

A Grounded Theory Based Approach for Integrating Asset Management with Total Quality Management in South African Food Industries

by

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of Master of Engineering Management in the Faculty of Engineering at
Stellenbosch University*



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Declaration

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Abstract

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In the quest to effectively apply a Total Quality Management System (TQMS) within South African food organisations, the integration of the Asset Management System (AMS) with the TQMS in the prevention of production and maintenance process challenges and to overcome the high competitive pressure of producing high-quality food products has become important. Given the potential for such collaborative improvements and the Asset Management (AM) prospect of extending the benefits of the TQMS as well as induced customer satisfaction, the integration of these two improvement programs deserved further exploration. The integration of the AMS with the TQMS remains unexplored within South African food industries. Furthermore, if integration is a possibility to consider, management will lack the understanding of, and the necessity for, integrating two managerial approaches to achieve collaborative results. Proper guidance to survive in the competitive environment of high-quality and customer demands is required. The purpose of this research study is, therefore, to develop a guideline for the implementation of an integrated approach to AM and Total Quality Management (TQM), which would improve product quality and subsequently support the food industry to strive for business excellence.

Owing to the qualitative complexity of this study, it was deemed necessary to engage and understand the context or settings in which management address a problem or an issue. This was done with a view to ultimately allow the voices of managers to be heard whilst generating possible solutions to their current situations. Hence, the grounded theory methodology was adopted to holistically portray the integrated approach grounded in management's input. All professional experiences of the senior managers in this study were described and interpreted as documented from in-depth interviews with nine such managers throughout eight distinct food organisations.

In accordance to the grounded theory methodology, the analysis has resulted into a theory that depicts the causal conditions to the phenomenon (named *Systems Integration*), the strategy developed in response to the phenomenon, the intervening conditions that influenced the strategy, and the outcomes or consequences of using the strategy. It is imminent that the theory has successfully portrayed all aspects grounded in senior management's inputs concerning AM integration with TQM. The developed theory was summarised and consolidated into a theoretical guideline for management. It served the purpose of assisting management to steer their focus and efforts on the practices that ensures the firms' ability to establish a holistic and competitive quality management capability. In the essence of integration, it is believed that the AMS incorporation will provide South African food organisations with a small step towards being the Best-in-Class; hence, it will improve the quality of the product, efficiency of the machines and productivity of the people. Further empirical evaluations are required to support and verify the findings from this study.

Uittreksel

‘n Gegronde Teorie-gebaseerde Benadering vir die Integrasië van Batebestuur met Totale Kwaliteitbestuur in Suid-Afrikaanse Voedsel Industrieë

(“A Grounded Theory Based Approach for Integrating Asset Management with Total Quality Management in South African Food Industries”)

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Te midde van die belangrikheid van die effektiewe toepassing van ‘n Totale Kwaliteit Bestuur Sisteem (TKBS) binne Suid-Afrikaanse voedselorganisasies, het die integrasië van die Bate Bestuur Sisteem (BBS) met die TKBS ‘n interessante konsep vir navorsing geword. Die rede hiervoor is dat die BBS kan help met die voorkoming van produksie proseskwessies asook om die hoë mededingende druk van die vervaardiging van hoë-gehalte voedsel produkte te oorwin. Aangesien die potensiaal vir gesamentlike verbeterings bestaan asook omdat Bate Bestuur (BB) moontlik uitgebreide voordele vir die TKBS kan bied en in so ‘n manier kliënt-tevredenheid sal verhoog, verdien die integrasië van hierdie twee verbeteringsprogramme verdere navorsing. Die integrasië van die BBS met die TKBS is steeds hoogs onbekend binne Suid-Afrikaanse voedselindustrieë. Indien integrasië as ‘n moontlikheid oorweeg sou word, sal die bestuur die begrip, en die noodsaaklikheid daarvan betwyfel asook heelmoontlik nie die integrasië van twee bestuursbenaderings van gesamentlike resultate suksesvol kan bereik nie. Om hierdie rede word behoorlike leiding vereis om te kan oorleef met die mededingende omgewing van hoë gehalte en kliëntediens-vereistes. Dus is die doel van hierdie navorsingstudie om ‘n riglyn van ‘n geïntegreerde benadering tot BB en Totale Kwaliteit Bestuur (TKB) wat as ‘n moontlike volgende stap om sake uitnemendheid te bereik, te ontwikkel vir implementering.

As gevolg van die hoë kwalitatiewe kompleksiteit van hierdie studie, was dit nodig geag om die konteks waarin bestuur probleme aanspreek te verstaan; asook om meer betrokke te raak ten doel om te verseker dat die stemme van bestuurdes gehoor sal word. Dus hierdeur, kan moontlike oplossings ge-genereer word vir hul huidige situasies en probleme. In reaksie tot dit is die gegronde teorie metodologie aangeneem

om holisties die geïntegreerde benadering (soos gegrond op die bestuur se insette) uit te beeld. Alle professionele ervarings van die bestuurders in hierdie studie is beskryf en geïnterpreteer soos gedokumenteer van in-diepte onderhoude met nege seniorbestuurders in agt afsonderlike voedselorganisasies.

In ooreenstemming met die gegronde teorie metodologie, het die ontleding gelei tot 'n teorie wat die volgende uitbeeld: die oorsaaklike toestande; die verskynsel wat oorsprong geneem het van die oorsaaklike toestande (genoem *Sisteem Integrasie*); die strategie soos ontwikkel in reaksie op die verskynsel; die tydelike voorwaardes wat die strategie beïnvloed het; en die uitkomste en gevolge van die gebruik van die strategie. Dit is dus vanselfsprekend dat die ontwikkelende teorie het suksesvol alle aspekte van die integrering van BB met TKB uitgebeeld. Die ontwikkelde teorie is opgesom en gekonsolideer in 'n teoretiese riglyn vir die gebruik deur bestuur. Dit mag ook beklemtoon word dat die ontwikkeling van die riglyn (gegrond op die insette van seniorbestuur) het uiteindelik die doel gedien om bestuur by te staan om al hul pogings te fokus op daardie areas wat die organisasie se vermoë om 'n holistiese en mededingende kwaliteitsbeheer te vestig. Daar word dus geglo dat die integrering van die BBS sal Suid-Afrikaanse voedselorganisasies bystaan om die Beste-in-Klas te word, maak nie saak hoe groot of klein die invloed is nie. As gevolg hiervan kan dit moontlik die kwaliteit van die produk, die doeltreffendheid van die masjinerie en die produktiwiteit van die mense verbeter. Verdere empiriese evaluering is wel nodig om hierdie studie se bevindings te beklemtoon.

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List of Acronyms

AM	Asset Management
AMS	Asset Management System
BRC	British Retail Consortium
BSI	British Standards Authority
BV	Bureau Veritas
CAPEX	Capital Expenditure
CEDAC	Cause-and-effect Diagram
CGCSA	Consumer Goods Council of South Africa
CIES	International Committee of Food Retail Chains
CMI	Certified Master Inspector
CVF	Competing Values Framework
EAM	Enterprise Asset Management
EAMS	Enterprise Asset Management System
EDM	Engineering Document Management
EFQM	European Foundation of Quality Management
EQA	European Quality Award
FCD	Fédération des Entreprises du Commerce et de la Distribution
FMCG	Fast Moving Consumer Goods
FMEA	Failure Mode and Effect Analysis
FSI	South African Food Safety Initiative

FSM	Food Safety Management
FSMS	Food Safety Management System
FSSC	Foundation for Food Safety Certification
GAP	Good Agricultural Practice
GDP	Good Distribution Practice
GFMAM	Global Forum for Maintenance and Asset Management
GFSI	Global Food Safety Initiative
GHP	Good Hygiene Practice
GMP	Good Manufacturing Practice
GPP	Good Production Practice
GTP	Good Training Practice
GVP	Good Veterinarian Practice
HACCP	Hazard Analysis and Critical Control Point
HDE	Handelsverband Deutschland
HR	Human Resource
IAM	Institute of Asset Management
ICT	Information and Communication Technology
IFS	International Food Standard
IMS	Integrated Management System
IPA	Individual Performance Appraisals
IRR	Internal Rate of Return
ISO	International Organisation for Standardisation
INVOCOMS	Employee Involvement through Communication for Commitment and Innovation
JIT	Just-in-Time
KPA	Key Performance Areas

KPI	Key Performance Indicators
MBNQA	Malcolm Baldrige National Quality Award
NPV	Net Present Value
NSF	National Sanitation Foundation
OE	Operational Excellence
OEE	Overall Equipment Effectiveness
PDCA	Plan-Do-Check-Act
PRP	Prerequisite Programme
QA	Quality Assurance
QC	Quality Control
QD	Quality Design
QFD	Quality Function Deployment
QI	Quality Improvement
QM	Quality Management
QMS	Quality Management System
QP	Quality Policy
RCM	Reliability Centered Maintenance
REC	Research Ethics Committee
ROA	Return on Assets
ROFA	Return On Fixed Assets
ROI	Return on Investments
SABS	South African Bureau of Standards
SAMP	Strategic Asset Management Plan
SANS	South African National Standards
SGS	Société Générale de Surveillance
SMART	Specific, Measurable, Achievable, Relevant, Time-bound

LIST OF ACRONYMS

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SOP	Standard Operating Procedure
SPC	Statistical Process Control
SQF	Safe Quality Food Standard
TPM	Total Productive Maintenance
TQC	Total Quality Control
TQM	Total Quality Management
TQMS	Total Quality Management System
TUV	Technical Inspection Association

Glossary

Asset Management (AM)

The coordinated activity of an organisation to realise value from assets (where realisation of value involves the balancing of costs, risks, opportunities and performance benefits).

Asset Management System (AMS)

Management system for AM whose function is to establish the AM policy and AM objectives. In this study, the International Organisation for Standardisation (ISO) 55000 standard represents as the AMS that provide guidance for effective AM.

Analytic Tools

Devices and techniques used by the researcher to facilitate the coding process.

Asking Questions

An analytic device used to open up the line of inquiry and direct theoretical sampling.

Asset

An item, thing or entity that has potential or actual value to an organisation.

Asset Problems

Known to the food industry as those issues related to people and physical assets. Asset problems are perceived as uneducated and/or uninformed people as well as negligence of physical asset and/or poor operation of it. More specifically, it is any causal problem that influence or deviates from the definition of assets.

Axial Coding

The process of cross-cutting or relating categories to each other, termed “axial” because coding occurs around the axis.

Axial Coding Paradigm

The visual representation of the theory in the form of a theoretical model.

CAPEX

CAPEX, or capital expenditure, represents as one basic category of business expenses. CAPEX are funds used by a company to acquire or upgrade physical assets such as property, buildings or equipment.

Categories

Concepts that stand for phenomena.

Causal Conditions

In axial coding, these are the categories of conditions identified in the database that cause or influence the central phenomenon to occur.

Coding

The analytic processes through which data are fractured, conceptualised, and integrated to form theory.

Concepts

The building blocks of theory.

Conceptual Saturation

The process of acquiring sufficient data to develop each category fully in terms of its properties and dimensions and to account for variation.

Conditional Matrix

An analytic device to stimulate researcher's thinking about the relationship between macro and micro conditions or consequences both to each other and to process (where macro is broad and micro is narrow in scope with possible impact).

Consequences

In axial coding, these are the outcomes of strategies taken by participants in the study. These outcomes may be positive, negative, or neutral.

Constant Comparison

An analytic process of comparing distinct pieces of data for similarities and differences. This process compares incident with incident, incident with participant's perceptions, and finally, participant's perceptions with other participant's perceptions. This allows the researcher to identify emerging categories and variations in the patterns found in data to achieve saturation, whilst it also provides a sense of verification for accuracy of emergent evidence, provide the ability to specify concepts under study to eliminate ambiguity or similarity, and to verify the developed theory.

Coping Strategy

The actions taken in response to the phenomenon, named *Systems Integration*, which describes how to cope with its emergence. To cope with its emergence, the AMS is referred to as the support system to Total Quality Management System (TQMS). The coping strategy of this study represents the process for *Systems Integration* implementation with two coping strategy activities: integrating on strategic level; and methodology for *Systems Integration*.

Customers

Represents either one or a combination of the following: clients; shareholders; stakeholders; retailers; buyers and consumers.

Diagrams

Visual devices that depict the relationships among analytic concepts derived from memo writing.

Dimensions

The range along which general properties of a category vary, giving specification to a category and variation to the theory.

Engineering Management

The engineering manager, representing as either the operations manager or maintenance manager, manages the every-day operation processes or maintenance programs within the food industry.

Food Industry

A collection of all activities that facilitate the consumption and supply of food products and services across the world. It involves processing of raw food materials, packaging, and distributing of it. This includes fresh, prepared foods as well as packaged foods, and alcoholic and non-alcoholic beverages. Any product meant for human consumption, aside from pharmaceuticals, are in the context of the food industry.

Grounded Theory

A design of inquiry from sociology in which the researcher derives a general, abstract theory of a process, action, or interaction grounded in the views of participants. This process involves multiple stages of data collection and the refinement and interrelationship of categories of information.

Intervening Conditions

In axial coding, these are the broader conditions within which the strategies occur. They are conditions that influence the strategies in response to the central phenomenon.

Leadership

Leadership is a process whereby a person influences others to accomplish a set of goals or objectives within an organisation. Participants of this study use the term *leadership* in context of the leader of the organisation, that represents the top manager. The top manager, also known as the executive, represent top management of the organisation.

Management System

One integrated system that contains a set of standards, which could either be certified or not, to establish policies, objectives and processes to achieve those objectives.

Memo

Written records of analysis, thoughts, interpretations, questions and direction for further data collection.

Objectivity

The ability to achieve a certain degree of distance from research materials and to represent them fairly; the ability to listen to words of respondents and to give them a voice independent of that of the researcher.

Open Coding

The analytic process through which concepts are identified and their properties and dimensions are discovered in data.

Phenomenon

Central idea in the data represented as concepts. This is an aspect of axial coding and the formation of the axial coding paradigm.

Properties

Characteristics of a category, the delineation of which defines and gives it meaning.

Propositions

Known as hypotheses or statements that describe the interrelationship between categories in the axial coding paradigm.

Selective Coding

The process of integrating and refining theory to generate propositions or statements that describe the interrelationships between categories.

Sensitivity

The ability to respond to the subtle nuances of, and cues to, meanings in data.

Strategies

In axial coding, these are the specific actions or interactions that occur as a result of the central phenomenon.

Substantive-level Theory

A low-level theory that is applicable to immediate situations which are closely related to the domain of practice and real-world situations. It is differentiated from theories of greater abstraction and applicability, called formal or general theory.

Systems Integration

The phenomenon of this study which are defined as the integration of the AMS with the TQMS in context to South African food industries.

Theoretical Comparisons

An analytic tool used to stimulate thinking about properties and dimensions of categories.

Theoretical Sampling

Sampling on the basis of emerging concepts, with the of exploring the dimensional range or varied conditions along with the properties of concepts vary. Often, this process begins with a homogeneous sample of individuals who are similar, and, as the data collection proceeds and the categories emerge, the researcher turns to a heterogeneous sample to see under what conditions the categories holds true.

Theoretical Saturation

During the process of the development of categories and data analysis the researcher identify instances that represent the category and continues to identify (alongside with interviewing) until new information no longer provide further insight into the category. It represent the point in category development at which no new properties, dimensions, or relationships emerge during analysis.

Theory

A set of well-developed concepts related through statements of relationship, which together constitute an integrated framework that can be used to explain or predict phenomena.

Total Quality Management (TQM)

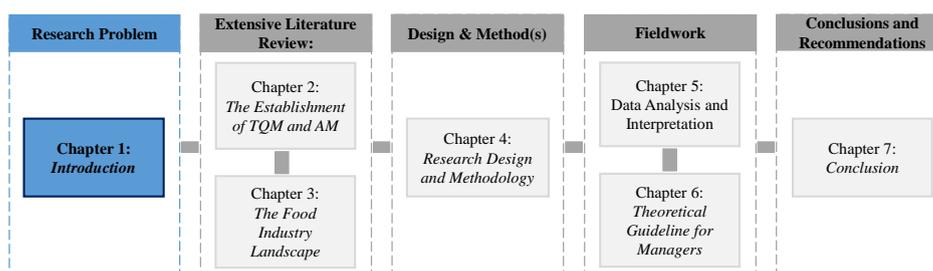
A holistic management philosophy and process of change that strives for incessant improvement of the integration of multiple functions and objectives of an organisation (including the improvement of quality, productivity, performance and competitiveness) to meet and exceed customer expectations.

Total Quality Management System

Management system for TQM whose function is to establish the TQM policy and TQM objectives. In this study, the TQMS consists of a set of multiple food standards which are selected according to customer demands and business objectives. The design of the TQMS will, therefore, differ between organisations.

Chapter 1

Introduction



It is evident that the collaborative utilisation of two management approaches, namely Total Quality Management (TQM) and Asset Management (AM), could induce synergic effects to South African food industries, mostly in the light of improving their quality outputs holistically. The purpose of this chapter is to provide a theoretical background with the aim of contextualising the need for integrating these distinct management approaches in the food industry. In addition, the research problem is stated while the research questions, objectives, design and methodology as well as the delimitations and limitations of the study are discussed. The chapter also provides a brief outline of the thesis.

1.1 Theoretical Background

The food industry¹ is widely known for its perishable goods, the existing variability within raw material quality, the consistent divergence of recipes and processing techniques, the effect of seasonality and varied harvesting conditions as well as the variability in batch volumes (Luning and Marcelis, 2006; Dora *et al.*, 2013a). In recent years food scientists or technologists and food producers have become more focused on the criticality and importance of quality, primarily due to intense market competition, governmental regulation, customer² demands and strict consumer expectation (Grunert, 2005; Lim *et al.*, 2014). Hence, over the last thirty years, quality has been identified as an important business driver in the international market (Bello-pintado and de Cerio, 2010; Islam and Haque, 2012). In turn, organisations have become more conscious of the competitive potential of quality and regard it as a powerful tool when competing in the current marketplace (Yusuf *et al.*, 2007). In response to these demands, the food industry are increasingly pursuing Quality Management (QM) practices that include powerful techniques such as Quality Control (QC) and quality improvement (Dora *et al.*, 2013a). International Organisation for Standardisation (ISO) 9000:2005 defines QM as (International Standard Organization, 2005):

“coordinated activities to direct and control an organisation with regard to quality”

This definition of QM is qualified by noting the following (International Standard Organization, 2005):

“Direction and control with regard to quality generally includes establishment of the quality policy and quality objectives, quality planning, QC, Quality Assurance (QA) and Quality Improvement (QI)”.

Luning *et al.* (2002) explicitly states that a QM system comprises of “the activities and decisions performed in an organisation to produce and maintain a product with the desired quality level against minimal costs”. Both the definitions provided by International Standard Organization (2005) and Luning *et al.* (2002) imply that QM relates to the responsibility of all participants (including all departments) within the organisation in order to achieve high-quality products at lower costs (Desai and Desai, 2006; Kaur *et al.*, 2012).

Quality has become a key factor to both the food and non-food manufacturing industries’ competitive strategy (Kaur *et al.*, 2012). Agus and Hassan (2011) explains that quality creates a higher value for money advantage over the competing

¹A collection of all activities that facilitate the consumption and supply of food products and services across the world. It involves processing of raw food materials, packaging, and distributing of it. This includes fresh, prepared foods as well as packaged foods, and alcoholic and non-alcoholic beverages. Any product meant for human consumption, aside from pharmaceuticals, are in the context of the food industry.

²A customer represents either one or more of the following: clients; shareholders; stakeholders; retailers; buyers and consumers.

organisation. Thus, a strategy that is concerned with high-quality will ultimately lead to a sustainable competitive advantage. Typically, organisations that compete with quality strive for an operational strategy that monitors, controls and continuously improves the quality of the product (Agus and Hassan, 2011). According to (McDonald *et al.*, 2002), the organisational quest for quality has emerged into a formal management function arising from the following principal trends:

- **Inspection** – quality (originally quantitatively conceptualised) slowly began to emphasise qualitative factors.
- **Assurance** – reactive function of inspection became a preventative function, known as the transformation from a reactive to a proactive vision.
- **Process management** – the notion of quality moderately transformed from focus on final products to quality of everyday tasks and processes.
- **Best practice** – the holistic perspective of quality emerged resulting from the increased integration of different functional aspects of quality.

McDonald *et al.* (2002) further observes that over the last four decades, quality related events have forced the transformation of QM from a functional focus to an integrated approach in the management of the organisation. Literature indicates that the implementation of QM is dependent on the following factors: size of the organisation; type of customers and suppliers; type of product produced; QA requirements; and top management commitment (Trienekens and Zuurbier, 2008). Since the food industry and its production process consists of factors (e.g. short shelf-life, heterogeneous raw materials, seasonality, varied harvesting conditions, etc.) that directly influence storage, conditioning, processing, packaging and quality control (Dora *et al.*, 2013a), the implementation of QM within the food industry is complicated when compared to the non-food manufacturing industry. Table 1.1 illustrates significant differences between the food sector and other manufacturing industries involved in batch and mass production.

Table 1.1: Differences between the food sector and non-food manufacturing industries (Adopted from Dora *et al.* (2013a))

Non-food manufacturing industry	Food manufacturing industry
<ul style="list-style-type: none"> • Mainly non-perishable products • Predominantly semi or automatic production line • Standardised raw materials • Large batches of products or components or fixtures made of materials of relatively uniform quality • Relatively limited number of designs 	<ul style="list-style-type: none"> • Perishable products • Manual or semi or very little automatic production line • Variation in quality of raw materials • Lower volume of batches • High variation of composition, recipes, products and processing techniques

Currently, the turbulent and market driven economy forces organisations to adopt management practices with supporting tools and techniques that are incessantly focussed on the continuous improvement of quality holistically, in order to become cost effective, responsive in operation and meet and exceed the demands of customers (Desai and Desai, 2006; Kedar *et al.*, 2008; Das *et al.*, 2011; Van Heerden and Vlok, 2015). Thus, the all-encompassing or holistic management philosophy, termed total quality management (TQM) (also known as an improvement program), has become of interest to wide-ranging sectors of the economy world-wide. TQM has also emerged as a critical trend for the management movement (Thiagaragan *et al.*, 2001; Desai and Desai, 2006; Kedar *et al.*, 2008; Das *et al.*, 2011; Van Heerden and Vlok, 2015) and world class performance. Contributing to this, Kaur *et al.* (2012) provided four reasons to adopt TQM, namely: (a) responding to pressure due to decreased profits; (b) inability to adapt to new markets; (c) intense organisational competition; and (d) quality consciousness of customers. As such, organisations interested in implementing TQM are able to create a vision for change from the current or traditional state to a new or innovative state that assists people in preparation of the adoption of change (Das *et al.*, 2011). It is imminent that organisations will have to undergo organisational changes in response to the rapidly changing global business arena, caused by the unprecedented competition, exponential technological development, customer expectations and governmental or international changes (Das *et al.*, 2011). However, competent leaders do not rashly respond to change, but proactively recognise when to implement, understand, and foster an environment of agility, learning, and strategic anticipation for, the change management process (Das *et al.*, 2011).

In addition to the customers' perception of quality of a product – shaped by consumers' behaviour to be more rigid and stringent toward food quality since food poisoning or microbiological outbreaks occurs regularly (Grunert, 2005) as well as the continued rejection of finished goods, product scrapping and product recalls that put the organisation's image at risk (Lim *et al.*, 2014) – the food industry had to urgently consider critical factors in the production and distribution processes as well as product-market systems as indicators of the holistic quality approach (Trienekens and Zuurbier, 2008; Lim *et al.*, 2014). This resulted into a trend for quality certifications among Western retailers, representing the industrialised countries, over the past decade. These quality certifications include: Hazard analysis and Critical Control Points (HACCP); International Organisation for Standardisation (ISO); British Retail Consortium (BRC); European Retail Good Agricultural Practices (EUREP-GAP); Foundation for Food Safety Certification (FSSC); and, Health and Safe Quality Food (Trienekens and Zuurbier, 2008; Progress Excellence, 2013; Lim *et al.*, 2014). These certificates are now a fundamental part of most food industries while TQM is adopted to encompass all these certificates and to integrate all relating concepts (e.g. QA, QI, QC, quality design (QD) and quality policy (QP)) (Coetzee, 2015) as well as all functions and processes (Kaur *et al.*, 2012) of quality.

Dora *et al.* (2013a) has conducted a thorough literature review regarding food QM and has found that the majority of food industries are aimed at quality assurance (e.g. HACCP, BRC, ISO, FSSC) and their primary objective is food safety. The

latter is a result of customers that become progressively concerned about quality and the safety of food (Trienekens and Zuurbier, 2008) when it became a topic of high dispute in the public debate, in food policy, in industry and in academic research over the past ten years (Grunert, 2005; Kneafsey *et al.*, 2013). Grunert (2005) finds that there are several factors driving this debate; among these are: varieties of food scarceness that have directed the public's attention to food safety issues; segments of the general public became interested and critical regarding the procedures of food production; and, consumers in developed countries became more demanding. However, food safety is just one part of the broad Quality Management System (QMS) (Dora *et al.*, 2013*a,b*), and should, therefore, not be the only focus to successful quality systems Dora *et al.* (2013*a*).

From an engineering perspective, the production process of food industries requires continuous operation of automated production line equipment (Tsarouhas, 2007). As such, product scrapping, product recalls (Lim *et al.*, 2014) and stopping a production line caused by equipment failure (Tsarouhas, 2007) will induce serious organisational financial implications, production rate variation as well as quality problems relating to the product. In the context of the non-food manufacturing industries, recent competitive trends have forced top management to reconsider both the impact and importance of inducing equipment availability and utilisation, resource utilisation, maintenance productivity as well as quality and responsiveness of maintenance services. These competitive trends originated to meet the global competition that is to manufacture high-quality products at lower costs (Kaur *et al.*, 2012).

South Africa is classified as one of the leading developing countries that matches and outperforms its peer countries such as Argentina, Brazil, China, India, Indonesia, Mexico and Turkey, in critical areas of national competency (Brand South Africa, 2002). This is an important indicator for South Africa to position their industrial business with those of the developed countries such as the United States of America, Europe and Japan, whom are considered the world class leaders. Reliability and productivity of capital assets are essential factors for the financial success of organisations. Thus, Van Heerden and Vlok (2015) suggests that the food industry may be defined as an capital asset intensive industry. However, it has also been established that the food industry, compared to other industries such as the automotive manufacturing and insurance industries, reported the lowest performance based on an assessment against the European Business Excellence Model (EBQM) (Mann *et al.*, 1999; Lim *et al.*, 2014). Therefore, the food industry should align itself with the development of manufacturing industries' drive to implement new manufacturing programmes and organisational structures in order to enhance their competitive position. An effective and holistic approach that is concerned with maintenance activities could significantly contribute to production efficiency, plant availability, reliability and profitability as well as equipment or resource availability to yield high levels of product quality (Kaur *et al.*, 2012).

Various manufacturing programmes related to process performance or maintenance strategies are available to, and are well researched within, the food industry. These include: TQM, Just-in-Time (JIT); Total Productive Maintenance (TPM);

Lean; Six-Sigma (Tsarouhas, 2007; Kedar *et al.*, 2008; Nabhani and Shokri, 2012; Lim *et al.*, 2014). Apart from these mentioned programmes, AM has become an important topic amongst many manufacturing industries who are striving for overall improvement and business excellence. Woodhouse (2001) refers to AM as a “set of disciplines, methods, procedures and tools to optimise the whole life business impact of costs, performance and risk exposures (associated with the availability, efficiency, quality, longevity and regulatory or safety or environmental compliance) of the company’s assets”. AM, thus, is a holistic management approach, similar to the TQM philosophy, which requires all participants to work in junction. AM is still a young discipline for many industry sectors (IAM, 2014) and its Asset Management System (AMS) – the ISO 55000 series of International Standards – has only been published in 2014. The concept of AM has globally been studied by numerous authors stressing its importance for achieving business excellence in the transport (McElroy, 1999), manufacturing (Campbell *et al.*, 2011), process (Schuman and Brent, 2005), construction (Vanier, 2001), chemical (Chopey and Fisher-Rosemount, 1999), irrigation (Malano *et al.*, 1999), service providers and finance industries (Mitchell, 2007; Campbell *et al.*, 2011) but none has yet explored its potential within the food industry. Since the food industry is identified as an asset intensive industry and limited literature exists on AM within the food industry, integrating this approach with the existing programmes (such as TQM) of food industries is of interest and deserves further exploration. Especially within South African food industries, since they are part of a leading developing country who are willing to match and outperform their peers. Moreover, since AM is focussed on asset health and other integrated processes (such as financial, operation, maintenance and engineering) in order to gain lifetime effectiveness, return on assets and utilisation while risks are considered (Schneider *et al.*, 2006; Woodhouse, 2013; Van Heerden and Vlok, 2015), it is inevitable that AM will assist with the turbulent and global competitiveness. With regard to integration, both TQM and AM are practices comprising of goal-orientated decision-making and production- as well as people-based systems to effectively and efficiently manage the expectations and delivery of quality. Both are applicable for the integration of other relevant management approaches (Yusuf *et al.*, 2007; Tsarouhas, 2007; Kristianto *et al.*, 2012; Schneider *et al.*, 2006; Woodhouse, 2006; IAM, 2014) and flexible to be manipulated as the organisation sees fit (Woodhouse, 2006; Yusuf *et al.*, 2007; Pinto *et al.*, 2013). However, whilst valuable research has been performed in TQM and AM as distinct management concepts, their effective and practical integrated application has been limited owing to the fact that its integration in the food industry has not yet been of interest. Thus, the correlation between the holistic disciplines, TQM and AM, could serve as a beneficial synergy for improvement within the food industry.

1.2 Problem Statement

Pursuant to implementing an effective and efficient Total Quality Management System (TQMS), in order to assist with the prevention of production issues and to overcome the competitive pressure of producing high-quality food products while satisfying customers, and the potential value to be gained by integrating an AMS into these improvement programmes the following problem arose:

There is no guideline or procedural framework available to the food industry for the integrated implementation of TQMS and AMS for realising the synergic benefits of these programmes.

To address this problem and the associated unexplored research field, this research study is conducted to develop a guideline for implementation of an integrated approach between TQM and AM which would contribute to the success of business excellence. By developing a deeper understanding of the relationship between TQM and AM, management can focus their efforts on the practices which ensure an organisation's ability to establish a competitive quality management capability. In turn, this would result in the induced effect of customer satisfaction.

1.3 Research Questions

Based upon background and the establishment of the problem statement, the primary question for this research is:

How can a guideline be constructed for explaining how managers can integrate AMS with their existing TQMS?

In support of the primary research question, the following sub-questions need to be investigated:

- a. What are the foundations of TQM and AM?
- b. How can these foundations be integrated into a guideline?
- c. On what basis can a guideline be constructed?
- d. How will the constructed guideline be consolidated to management?

1.4 Research Objectives

In order to respond to the research question(s) above, research objectives are formulated to guide the process. The primary objective of the study is:

Develop a guideline to assist management of food industries with the integrated implementation of incorporating TQM and AM.

This objective addresses the need for assistance as indicated in the research question. In attempt to achieve the primary objective, other manageable sub-objectives are formulated. Thus, the sub-objectives of the study are:

1. Establish the fundamental management principles in relevant fields of study:
 - a. Review the historical background of TQM and AM
 - b. Define TQM and AM

- c. Identify the fundamental management principles required for both TQM and AM implementation
2. Establish the holistic quality systems in South African food industry:
 - a. Review the historical background of relevant certificates and standards
 - b. Identify how quality is achieved holistically
 - c. Identify the a gap for AM in the existing TQM system
3. Construct a well-defined research methodology
4. Conceptualise the guideline
5. Develop the theoretical guideline for managers:
 - a. Align and incorporate the AMS with the TQMS
 - b. Consolidate alignment into a theoretical guideline for managers

This study seeks to achieve the above-mentioned objectives. The research process is guided by the objectives which will be discussed in section 1.7.

1.5 Research Design and Methodology Overview

The background of this study's field remains unexplored. Owing to the qualitative complexity of this study, a qualitative research paradigm is identified as suitable for this study. This research paradigm is deemed necessary for engaging with and understanding the context in which management address a problem or an issue. Its explorative nature allows the input from managers to generate possible solutions to their current situations. In respect of this, the study follows a pragmatic world-view, which is non-empirical in nature, and to which the grounded theory procedure is adopted as an appropriate research design. The research process follows the grounded theory approach employing the relevant tools and techniques to address the problem statement. The tools and techniques used are: interviewing; coding; memoing; and visual representation. In respect of grounded theory, the process of theory development involves multiple stages of data collection and the refinement and interrelationship of categories of information. This is commonly known as the *constant comparative method*, which is used as an analytic process throughout the research process. Another analytic device, called *asking questions*, was utilised during this research. This thesis is an exploration of the professional experiences of quality and food safety and engineering (i.e. maintenance or operation) managers³ in South African food organisations. In light of the grounded theory process, all professional experiences of the managers in this study are described and interpreted as documented from in-depth interviews with nine senior managers throughout eight distinct food organisations.

³Management participating within this study represents managers reporting to top managers, they are known as senior managers.

In summary, the following grounded theory procedure is used to guide the development process of the guideline for managers:

- a. Identification of the emerging categories during open coding.
- b. Identification of the emergent core phenomenon.
- c. Identification of the contextual and intervening conditions influencing the emergence of a phenomenon.
- d. Identification of strategies resulting from the phenomenon.
- e. Identification of the consequences of using these strategies.
- f. Determining how the phenomenon serve as a guidance for management.
- g. Identification of the propositions to which the theory holds.

The grounded theory process, thus, serves as the approach to developing the guideline for management to assist with the integrated implementation of TQM and AM.

1.6 Delimitations and Limitations

Since new areas of research are explored, it is imperative to state the scope, or boundaries, of this study to refine its focus. The previous sections outlined the theoretical position of this thesis. This section explicitly discusses both the delimitations and limitations of the study. Three primary boundaries are identified and should be addressed:

1. This study does not seek for an extensive level of analysis that considers empirical, quantifiable, generalisable and statistical significant outcomes into account. At this level of analysis the researcher can create a conditional matrix⁴, which is however optional. The researcher is not yet a trained sociologist, therefore, the researcher choose not to include the conditional matrix. Also, with quantifiable outcomes fixed constructs that describes the statistical significance between variables can be generated, however it does not have meaning within the context of this study. Fixed constructs are therefore not considered since this study does not seek for an extensive level of analysis. Thus, this study only claim towards the development of a substantive-level theory⁵

⁴“An analytic device to stimulate analysts’ thinking about the relationship between macro and micro conditions or consequences both to each other and to process (where macro is broad and micro is narrow in scope with possible impact)” (Strauss and Corbin, 1998).

⁵A low-level theory that is applicable to immediate situations which are closely related to the domain of practice and real-world situations. It is differentiated from theories of greater abstraction and applicability, called formal or general theory.

2. Considering the qualitative nature of this study and given the time-consuming data analysis and interpretation procedure associated with the grounded theory process, the time-frame of this study is limited. Thus, for the purpose of the guideline for managers, only one food standard (existent in the TQMS) will be selected to demonstrate the relevance of the selected standard with the ISO 55000 standard. It should be noted that all refinements are consistent with emerging evidence found in data and are based on expert opinions.
3. This thesis is essentially focussed on the exploration of AM within the context of South African food organisations' TQM environment. Furthermore, all aspects regarding the holistic achievement of quality, hence "total quality", will be explored. Whether or not other aspects outside of the holistic quality environment emerges, it will be addressed but will not be taken into account for present exploration.

The above-mentioned delimitations and limitations are considered during the execution of the research process. The outline of the thesis is further elaborated on in the next section.

1.7 Thesis Outline

In accordance to the qualitative research design, the thesis is structured to provide continuous flow of key concepts that emerged during the grounded theory process. Each chapter is presented in correspondence to the defined research objectives. Table 1.2 illustrates the road map and chapter sequence of the thesis. The thesis is presented in seven chapters.

Table 1.2: Summary of chapters and its corresponding objectives and questions

Chapter	Objective	Question
Chapter 2: The Establishment of TQM and AM	<i>1a; 1b; and 1c.</i>	<i>a.</i>
Chapter 3: The Food Industry Landscape	<i>2a; 2b; and 2c.</i>	<i>a.</i>
Chapter 4: Research Design and Methodology	<i>3.</i>	
Chapter 5: Data Analysis and Interpretation	<i>4.</i>	<i>b.; and c.</i>
Chapter 6: Theoretical Guideline for Managers	<i>5a; and 5b.</i>	<i>d.</i>

Chapter 1: Introduction

Chapter 1 introduces the research study. The chapter begins with a theoretical background which leads to the development of the problem statement and research questions. Thereupon, research objectives are stated and a brief overview of the research design and methodology is provided. Finally, the research delimitations and limitations are stated with the chapter concluding with the thesis outline.

Chapter 2: The Establishment of TQM and AM

Chapter 2 is the first part of the extensive literature analysis. The chapter establishes the historical background of, and fundamental management principles in, TQM and AM to provide the appropriate background and support for theory development according to the grounded theory approach. It serves as the preliminary to a holistic understanding of the emerging guideline for managers. The need for AM within food organisations is also elaborated, which ultimately serves as a baseline for a possible business case.

Chapter 3: The Food Industry Landscape

Chapter 3 concludes the extensive literature review with a holistic discussion of relevant frameworks, guidelines, standards and certifications required for achieving TQM in South African food organisations. This chapter also emphasises the possible gaps for incorporating AM into the existent TQMS, thus serving alongside chapter 2, as the foundation for the grounded theory analysis procedure.

Chapter 4: Research Design and Methodology

Chapter 4 depicts the research design and methodology where special attention is paid to the appropriateness of techniques used throughout the research process. The chapter begins by presenting the research approach that ultimately led to selecting an appropriate research design and methodology for this study. Upon this, the grounded theory approach as an interpretive research methodology and qualitative analytic framework is discussed. Considering the verification of research results, concepts of reliability, validity and trustworthiness is explained as well as the researcher's paradigm fit and researcher's role and impact on the study are elaborated. Finally, relevant ethical considerations are discussed.

Chapter 5: Data Analysis and Interpretation

Chapter 5 serves as the baseline for conceptualising the development of the theoretical guideline for managers documented in chapter 6. This chapter presents the grounded theory process in two consecutive phases. In the first phase (early data analysis and interpretation), emerging codes and categories are discussed. The second phase (theoretical development), confers the development of the core phenomenon which are discussed in accordance to the requirements of the grounded theory process. This chapter ends with a discursive set of theoretical propositions. All results are based on professional experiences of nine senior managers within eight South African food organisations. Relevant literature is cited to compare and confirm findings.

Chapter 6: Theoretical Guideline for Managers

Chapter 6 simultaneously summarises the findings from the grounded theory analysis procedure in chapter 5 and existing literature from chapter 2 and 3. Thus, contextual relevant literature is used to compare and confirm findings between literature and

theory. Ultimately, this chapter reports the theoretically developed guideline for managers to use when considering an integrated approach to TQM and AM.

Chapter 7: Conclusion

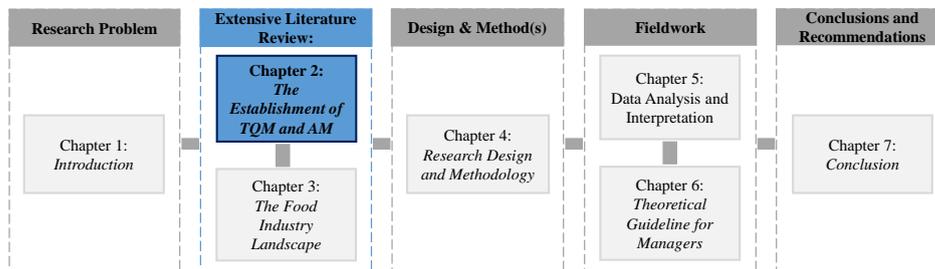
Chapter 7 provides the summary and conclusions of the key findings from conducting this study. Here also, a brief overview of the study is provided followed by a discussion of limitations, recommendations and future research opportunities. Finally, concluding remarks is given.

1.8 Chapter Conclusion

Chapter 1 provides the theoretical background of this study to which the problem statement was stated. Thereafter, the problem statement was consolidated into the primary research question and objective and its respective sub-questions and sub-objectives. The primary objective of this study is to develop a guideline that can assist management of food industries with the integrated implementation of AM and TQM. Owing to the high explorative nature of this study, the grounded theory methodology was selected as an appropriate qualitative design to explore the in-depth understanding of systems integration with expert opinions. This chapter further discusses the delimitations and limitations of the study and concludes with the thesis outline. In line with the thesis outline, the next chapter provides the fundamentals of TQM and AM in the context of the general food industry.

Chapter 2

The Establishment of TQM and AM



This chapter contextualises the research problem and highlights the need for research in the area of integrating Asset Management (AM) with Total Quality Management (TQM). This is done by portraying the holistic landscape of the two relevant management approaches. The fundamental management principles for TQM and AM implementation are introduced to provide appropriate background to the objective of the study. The chapter discusses the historical background of, definition of, and a detailed discussion of the implementation principles and concepts of, both TQM and AM. The need for AM incorporation to the food industry is also elaborated upon. The chapter ultimately serves as a preliminary to the holistic understanding of an emergent theoretical guideline for managers interested in integration.

2.1 Introduction to TQM

In order to provide a holistic understanding of TQM, essential concepts of the TQM philosophy will be discussed. These concepts are stated and discussed accordingly: history of TQM; the TQM philosophy; implementation principles of TQM; and concepts of TQM.

2.1.1 History of TQM

For centuries, the concepts of quality and Quality Management (QM) remained fundamentally unchanged. However, since the World War II, great changes occurred with regard to QM (Kanji, 1994). QM originated from simple inspection-based systems. As such, the use of inspection has been evident throughout the history of organised production. During the early years of manufacturing, inspections were traditionally used to examine, measure or test products while it was compared with a standard product to see if it met the requirements (Kanji, 1994). Although this approach was not done in a systematic manner, it corresponded well with low volume productions. Since the World War II, when aircraft technology became more complex and expensive, inspection-based systems for such military aircraft were seen as unacceptable. At the same time, organisations became larger, thus, more effective operations were demanded. In 1911, Frederick W. Taylor published “The Principles of Scientific Management”, which has provided people in industrial organisations with an effective framework that clearly defined tasks performed under standard conditions. Inspection was one of the tasks that created a movement, also known as the quality revolution, which led to the emergence of defect prevention. This change led to a system of Quality Control (QC) (Kanji, 1994).

The historical development of TQM began in the mid-1920s when statistical theory was first applied to product QC with a constricted focus on Statistical Process Control (SPC) (Martínez-Lorente *et al.*, 1998; Rahman, 2004). Despite being narrowly focused, SPC is based on scientific, philosophical and statistical foundation. It allows practitioners to understand the extent and variation types in systems, which also enables them to use this knowledge to continuously improve (Rahman, 2004). These aspects were further developed in Japan in the 1940s and became critical elements of Deming’s profound knowledge. In the late 1920s, Dr W Shewhart developed the application of statistical methods to the management of quality (ASQ, 1993; Martínez-Lorente *et al.*, 1998; Rahman, 2004). These methods referred to process control charts which served as a vehicle to understand variation and to develop strategies for improvement (Rahman, 2004). Shewhart’s philosophical foundations for continuous improvement process were later developed by Dr. E. Deming and other quality experts such as Dr. M.J. Juran, Dr. P.B. Crosby and Dr. A.V. Feigenbaum in the late 1940s. Deming captured the continuous improvement process in a diagram, which later became known as the Shewhart or Deming or Plan-Do-Check-Act (PDCA) cycle Rahman (2004). The PDCA cycle is shown in Figure 2.1.

After the War, Japanese industrial leaders recognised that their products are perceived as cheap and, therefore, aimed to produce innovative and high quality

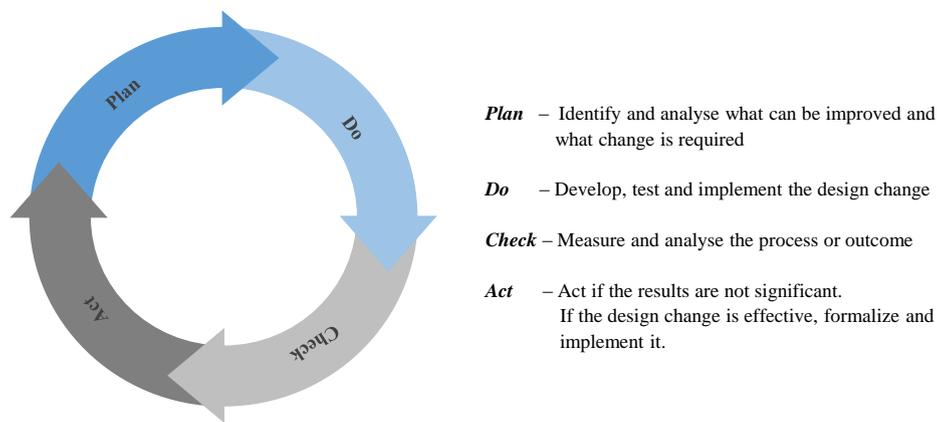


Figure 2.1: The Plan-Do-Check-Act Cycle (Adopted from Gould (1992); Best and Neuhauser (2006))

products. In response to their demand for change, in 1950, Deming was appointed as an advisor to the Japanese census. During this time, he obliged to help the JUSU (The Union of Japanese Scientists and Engineers) – who formed a committee of scholars, engineers, and government officials devoted to improving Japanese productivity as well as enhancing their post-war quality of life (Powell, 1995) – to help rebuild their industry (Kanji, 1990; Neave, 2012). With the Influence of Deming and Juran, the committee developed a course on statistical QC for Japanese engineers that were followed by extensive statistical training (Powell, 1995). Shortly after this, Deming’s knowledge regarding his quality philosophy was successfully disseminated among Japanese manufacturers from that time forward and had a profound impact on their management practices (Powell, 1995). In 1951, the Deming’s Prize for QC was established. However, during the early stages of the Japanese quality movement, they encountered various problems (such as the overemphasis on statistical tools and lack of top management commitment), which led to the presentation of Juran’s overall management perspective on quality (Krüger, 1999). In response to this, Deming also produced a list of 14 Points for Management in order to help people understand and implement his philosophy of quality during the early 1980s.

In the intervening period of the 1950s, Crosby’s initial venture into the quality field was in 1952 and only during the 2000s that he became widely renowned as a QM guru. He believed that the “zero defect” mentality is a realistic goal and stressed the importance of “doing it right the first time” which led to the outlay of Quality Improvement (QI) in his 14-step approach in 1979. Feigenbaum also contributed to the quality revolution as he was the first person who coined the term “total quality control” which is now known as TQM (Martínez-Lorente *et al.*, 1998; Anon, 2010). In his first book on Total Quality Control (TQC) entitled *Total Quality Control*, Feigenbaum termed TQC as “an effective system for integrating the quality-development, quality maintenance, and quality-improvement efforts of the various groups in an organisation so as to enable production and service at the most economical levels

which will allow for all customer satisfaction” (Martínez-Lorente *et al.*, 1998). His definition, however, did not include principles (e.g. people empowerment, teamwork and supplier relationship) that are now considered part of the TQM concept (Martínez-Lorente *et al.*, 1998). This has led Japanese companies, in cooperation with Prof. K Ishikawa, to develop and shape their own approach to TQC within their culture and operating environment (Martínez-Lorente *et al.*, 1998; ASQ, 1993).

However, with the use of Shewhart’s process control charts for understanding variation, Deming’s cycle for continuous improvement (also his 14 management points), Juran’s trilogy and Crosby’s 14 quality steps, the management of quality attained scientific, philosophical and statistical foundation (Rahman, 2004). See table 2.1 for a list of the most important TQM perspective promoted by Deming, Juran and Crosby.

Table 2.1: Standard perspectives of TQM (Adopted from Powell (1995))

Deming’s 14 points	The Juran Trilogy	Crosby’s 14 Quality Steps
<ul style="list-style-type: none"> • Constancy of purpose • The new philosophy • Cease dependence on inspection • End “lowest tender” contracts • Improve every process • Institute training on the job • Institute leadership • Drive out of fear • Break down barriers • Eliminate exhortations • Eliminate targets • Permit pride of workmanship • Encourage education • Top management 	<p><i>I Quality planning:</i></p> <ul style="list-style-type: none"> • Set goals • Identify customers and their needs • Develop products and processes <p><i>II Quality control:</i></p> <ul style="list-style-type: none"> • Evaluate performance • Compare to goals to adapt <p><i>III Quality improvement:</i></p> <ul style="list-style-type: none"> • Establish infrastructure • Identify projects and teams • Provide resources and training • Establish controls 	<ul style="list-style-type: none"> • Management commitment • Quality improvement teams • Quality measurement • Cost of quality evaluation • Quality awareness • Corrective action • Zero-defect committee • Supervisor training • Zero-defect day • Goal-setting • Error cause removal • Recognition • Quality councils • Do it over again

Since the 1980s, the new phase of QC and QM (known as TQM) began. During this period, the concept of TQM developed into a broad spectrum of quality-focused strategies, programmes and techniques. In addition, SPC methods and numerous other technical methods as well as behavioural concepts were combined to develop the term TQM (Rahman, 2004). During this development, the growing complexity

in products, services and processes led to the need for a broader approach to quality (Kanji, 1994; Mangelsdorf, 1999). In the mid 1980, the series of international standards for International Organisation for Standardisation (ISO) 9000 were launched and introduced the main principles of QM in all departments. The ISO 9000 series of standards narrowed their focus on the involvement of the management for quality on controlled processes of all key activities and on the continued improvement of all processes in the organisation (Mangelsdorf, 1999). Overtime, the focus of documentation and formalities at the initial phase of implementation changed towards management practices for process control as well as improvements in products or services, processes and in business management (Mangelsdorf, 1999). Thus, in the early and mid-1980s, the Malcolm Baldrige National Quality Award (MBNQA) in the United States was envisioned as a standard that helped the United States organisations to achieve world-class quality (Martínez-Lorente *et al.*, 1998; Mangelsdorf, 1999; BPIR, 2002). This created an insightful step forward in the QM movement (Mangelsdorf, 1999). The MBNQA model was presented as the first clearly defined and internationally recognised TQM model. A few years later (in the early 1990s), the European Foundation of Quality Management (EFQM) developed the European Quality Award (EQA), which had similar criteria as Baldrige (Mangelsdorf, 1999; BPIR, 2002). The EFQM Excellence Model is the framework for the European Quality Award. According to Mangelsdorf (1999), the adaptation and implementation of self-assessment based upon the quality award criteria was the first evolutionary step from quality assurance management (ISO accredited) towards TQM. More recently, the TQM model came to be referred to as the Business Excellence Models while TQM itself may also be termed “Business Excellence” (BPIR, 2002). The reason for this was the lack of a clearly defined framework for TQM implementation, as seen in the discussion above. Table 2.2 indicates the known perspectives of the MBNQA and EQA as well as the ISO 9000 series of international standards.

It is clear that TQM was the decisive beginning of integrating QM into business management in organisations world-wide. It also serves as the connection between the integrative management system and business excellence, which embraces and corresponds to all varieties of activities and programs within current businesses Mangelsdorf (1999).

As seen in the discussion above, the concept of TQM originated in the manufacturing sector. However, according to Gould (1992), Kanji (1994), and Powell (1995), it is inherent for managers to implement TQM in any organisation be it a manufacturing, service, food and beverage processing and production, non-profit or governmental organisation. They also commented that it is inevitable that TQM will generate improved products or services, reduces costs, and increment of satisfied customers and employees as well as bottom line financial performance within any type of organisation.

Table 2.2: Standard perspectives for the quality award criterion and ISO 9000 series (Adopted from International Standard Organization (2005); BPIR (2002))

Model Name	Model Design	Core Values and Concepts
QM standards (ISO 9000 series)	Generic management requirement stipulated by ISO 9001:2005: <ul style="list-style-type: none"> • Clause 4: Quality Management System • Clause 5: Management Responsibility • Clause 6: Resource Management • Clause 7: Product Realisation • Clause 8: Measurement, Analysis and Improvement 	<ul style="list-style-type: none"> • Customer Focus • Leadership • Involvement of People • Process Approach • Systems Approach to Management • Continual Improvement • Factual Approach to Decision-Making • Mutually Beneficial Supplier Relationship
Baldrige Award Criteria	<ul style="list-style-type: none"> • Leadership • Strategic Planning Responsibility • Customer and Market Focus • Measurement, Analysis and Knowledge Management • Workforce Focus • Operations focus • Business Results • Financial and Market Results 	<ul style="list-style-type: none"> • Visionary Leadership • Customer-driven Excellence • Organisational and Personal Learning • Valuing Employees and Partners • Agility • Focus on the future • Management by Fact • Social Responsibility • Focus on Results and Creating Value • Systems Perspective
European Quality Award Criteria	<ul style="list-style-type: none"> • Leadership • Policy and Strategy • People • Partnership and Resources • Processes, Products and Services • Customer Results • Perception measures • Performance measures • People Results • Society Results • Key Performance Results 	<ul style="list-style-type: none"> • Results Orientation • Customer Focus • Leadership and Constancy of Purpose • Management by Processes and Facts • People Development and Involvement • Continuous Learning, Innovation and Improvement • Partnership Development • Corporate Social Responsibility

2.1.2 The TQM Philosophy

Prior to stating the most appropriate definition for TQM, exhaustive theoretical and comprehensive literature are reviewed in great detail. Kaynak (2003) defines TQM as “a holistic management philosophy that strives for continuous improvement in all functions of an organisation, and it can be achieved only if the total quality concept is utilised from the acquisition of resources to customer service after the sale”. Supporting Kaynak’s definition Yusuf *et al.* (2007) states that “TQM is an approach for continuously improving quality of goods and services delivered through participation of individuals at all levels and functions of an organisation”; Kaur *et al.* (2012) confirms this by underpinning that “TQM is an approach that seeks to improve quality and performance which will meet and exceed customer expectations which can be achieved by integrating all quality-related functions and processes throughout the company”. Islam and Haque (2012) describes TQM as “both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organisation” as well as “the art of managing the whole to achieve excellence over product or service”. Contributing to this, Kristianto *et al.* (2012) also describes TQM as a strategy or a process, also known as a holistic approach, to integrate all organisational functions and objectives to fulfil the demands of customers. Gould (1992) and Yusuf *et al.* (2007) further mentioned that TQM can be defined by understanding the three words in TQM separately as follow:

Total – The word “total” refers to the participation of all people (e.g. employees, suppliers, stakeholders and customers) and departments (e.g. marketing, warehousing, production, maintenance, financial, etc.) involved. “Total” further implies the overall consideration of every activity accomplished within the organisation.

Quality – “Quality” represents the uniform level of product quality and service for which the organisation strives to meet the customers’ requirements and expectations with the understanding of constantly improving quality while remaining competitive.

Management – “Management” contributes to enabling all conditions required for “total quality”. It includes the creation of the most appropriate behaviour and workforce, which will be enforced on employees, equipment, machines, processes, suppliers, customers and the public.

These separate words are significant unto themselves. Whenever used in combination, however, they represent a management style, which may be used in the successful operation of a business for continued improvement (Gould, 1992). The TQM approach is a modern way of thinking, which enables organisations to achieve world-class status with gained competitive advantage concerning both quality and productivity (Gould, 1992; Yusof and Aspinwall, 2000). It is emphasised that the TQM philosophy express both customer requirements and business goals as inseparable, therefore, suggesting an integrated management approach based on a set of tools and techniques in order to achieve its objective (Yusuf *et al.*, 2007). It is, however important to consider that the TQM philosophy will only reach its full potential if the “total quality” concept is utilised from the acquisition of resources to post-sale

customer services (Kaynak, 2003).

The goal of TQM is to continuously seek competitive leadership and business excellence in order to satisfy the customers' expectations. As such, TQM's main driving force is customer satisfaction (Islam and Haque, 2012) as the customer defines and establishes the expected level of quality regarding all types of organisations (Gould, 1992). For this reason, the food industry (being studied here) has to develop and align their goals, strategic plans, and operational programs with the TQM philosophy to achieve the quality leadership (Gould, 1992). Another important aspect of TQM is its requirement for cooperation among every part and demands essential changes in all aspects of the organisation (Yusuf *et al.*, 2007). It also requires the continued improvement in products or services as well as in all operations and management for the creation of a sound organisational quality culture. Thus, achieving world-class status is an ongoing process of business performance and profitability (e.g. financial and market performance, quality performance, and inventory management performance), suggesting that the adoption of TQM is a long-term approach requiring determination, time and patience (Gould, 1992; Yusuf *et al.*, 2007; Islam and Haque, 2012).

Considering the preceding discussion, the following definition for TQM (as adopted from: Gould, 1992; Powell, 1995; Choi and Eboch, 1998; Kaynak, 2003; Yusuf *et al.*, 2007; Islam and Haque, 2012; Kaur *et al.*, 2012) are used for the purpose of this study:

A holistic management philosophy and process of change that strives for incessant improvement of the integration of multiple functions and objectives of an organisation (including the improvement of quality, productivity, performance and competitiveness) to meet and exceed customer expectations.

2.1.3 Implementation Principles of TQM

TQM is a well-established research field among numerous quality philosophers such as Drucker, Juran, Deming, Ishikawa, Crosby, Feigenbaum, Powell, Saraph *et al.*, Kanji, and many other individuals who have in due course studied organisational performance. Although it has been widely studied, the implementation of TQM is complex as it is dependent on product category, organisational settings, management philosophies and practices and varies between organisation types. There is, therefore, no existing universal approach or framework for its implementation (Hellsten and Klefsjö, 2000; Yusuf *et al.*, 2007; MSG, 2013). However, there are many implementation frameworks of TQM that an organisation could select and implement which are significant to their own organisation. These implementation frameworks include the following: Deming Application Prize; Malcolm Baldrige Criteria for Performance Excellence; European Foundation for Quality Management; ISO QM standards (ISO 9000 series) (Uysal, 2012). Refer to tables 2.1 and 2.2, section 2.1.1, for a summary of the known principles and core concepts of each implementation framework for TQM. See also appendix A for the illustration of each implementation framework

wherever applicable. The TQM implementation principles may be best described using the list of comprehensive actions depicted in the Malcolm Baldrige National Award or the European Quality award (Hellsten and Klefsjö, 2000). However, to prevent the confusion of contrasting core implementation principles, the implementation frameworks and literature are considered simultaneously.

Broadly speaking, although numerous authors emphasise different implementation principles and techniques and used distinct terminology for TQM, all share six common ideas for implementation principles (Powell, 1995; Kanji, 1998; Rahman, 2004; Yusuf *et al.*, 2007; Agus and Hassan, 2011; Islam and Haque, 2012). They are: quality; customer focus; planning process; process management; continuous process improvement; and total participation (See figure 2.2). Refer also to tables 2.3 and 2.4 for the identification of overlap and similarity among the principles of different frameworks found in exhaustive literature of TQM. Researchers argue that the integration of different management philosophies, implementation principles, techniques and processes as well as best practices to generate a suitable TQM framework for one's own organisation has been proven as an effective possibility, which, in turn, will contribute to organisational performance (Powell, 1995; Rahman, 2004). Furthermore, Hellsten and Klefsjö (2000) observes that most world-class organisations exhibit the majority of conducts that are typically identified with TQM.

Table 2.3: The overlap and similarity among the principles of different frameworks of TQM

Lee and Chang (2006)	Yusuf et al. (2007)	Das et al. (2011)	Agus and Hasan (2011)	Kaur et al. (2012)	Islam and Haque (2012)
Customer focus (Internal and external customers)	Leadership and commitment	Top management commitment	Supplier relations	Top management commitment	Creation of environment
Leadership (management role changes to active leadership)	Customer focus	Supplier QM	Benchmarking	Supplier QM	Development of teamwork
Teamwork (multi-disciplinary teams, include involvement of customers and suppliers)	Continuous improvement	Continuous improvement	Quality measurement	Continuous improvement	Practice of QC tools and techniques
Continuous improvement process	Get things right first time	Product innovation	Continuous process improvement	Product innovation	Focus on customer
Measurement (the improvement process based on quantitative and qualitative metrics)	JIT	Benchmarking		Benchmarking	Focus on supplier relationship
Benchmarking (a driver to improvement within competitive environment)	Competitive benchmarking	Employee involvement		Employee involvement	Benchmarking
	Cost of quality	Reward and recognition		Reward and recognition	Improvement of process
	Employee involvement	Education and training		Education and training	Involvement of employees
	Teamwork	Customer focus		Customer focus	
	Training	Product quality		Product quality	
	Communication and reward				

Table 2.4: The overlap and similarity among the principles of different frameworks of TQM, continued from table 2.3

	Flynn et al. (1994)	Powell (1995)	Kanji (1996, 1998)	Black and Porter (1996)	Thiagaragan et al. (2001)	Hansson and Klefsjö (2003)
Top support	management	Committed leadership	Quality culture	Corporate culture	Institute leadership	Committed leadership
Quality information	Adoption and communication of TQM	Adoption and communication of TQM	Leadership	Strategic QM	Maximise stakeholder's involvement	Improve continuously
Process management	Closer customer relationship	Closer customer relationship	Delight the customer	QI management systems	Manage by customer driven processes	Focus on customers
Product design	Closer supplier relationship	Closer supplier relationship	Management by fact (i.e. all work is process; measurement)	People and customer management	Adopt continuous improvement	Focus on processes
Workforce management	Benchmarking	People-based management	Operational planning	Operational quality		Base decisions on facts
Supplier involvement	Increased training	Continuous improvement	External interface management	Customer focus		Let everybody be committed
Customer involvement	Open organisation	Business excellence	Customer focus			Establish strategy for TQM
Employee empowerment	Employee empowerment		SPC usage			
	Zero-defect mentality					
	Flexible manufacturing			Suppliers and performance		
	Process improvement			Supplier performance		
	Measurement			Use of advanced manufacturing systems		
				Customer satisfaction orientation		
				Communication of improvement information		

Each of the six mentioned core principles may be used to drive the improvement process of TQM. To achieve this, the principles are translated into practice by using “soft” and “hard” concepts of management (Rahman, 2004; Islam and Haque, 2012; Psomas *et al.*, 2014). The concepts of TQM are discussed in the section that follows.

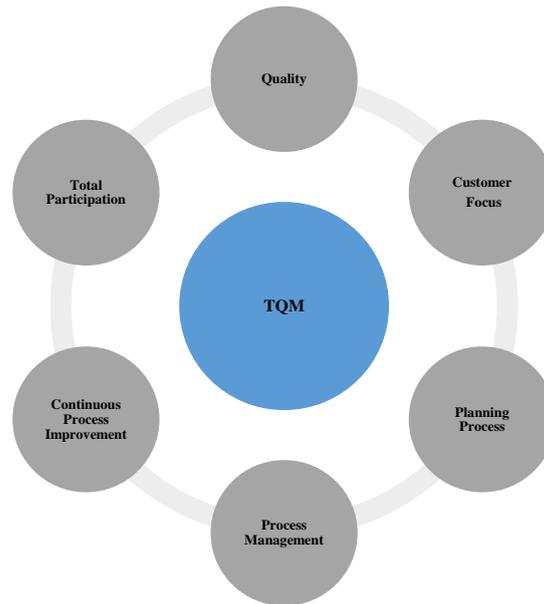


Figure 2.2: The TQM Model representing the most common implementation principles

2.1.4 Concepts of TQM

The implementation process of TQM involves clear definitions and deployment of several core principles which include both the “soft” (or “philosophical”) and “hard” (or “technical”) concepts of management. According to Beardsell and Dale (1999), the list of TQM characteristics and concepts identified in the food industry is similar to those in other industries (e.g. manufacturing industries). These are, therefore, identified and defined accordingly, as adapted by Islam and Haque (2012) as TQM pillars for TQM implementation and also the Kanji TQM pyramid (1994), Thiagaragan *et al.* (2001) and Agus and Hassan (2011) TQM practices, ISO 9001, Malcolm Baldrige’s framework as well as thorough review and synthesis of TQM literature ((Gould, 1992; Flynn *et al.*, 1994; Powell, 1995; Black and Porter, 1996; Beardsell and Dale, 1999; Hansson and Klefsjö, 2003; Rahman, 2004; Yusuf *et al.*, 2007; Psomas *et al.*, 2014).

The “soft” concepts of management include: culture; leadership and commitment; teamwork; customer focus; supplier relationship focus; employee involvement (empowerment, internal and external partnership, recognition and reward, and education and training), management by fact; and continuous improvement. In contrast,

the “hard” concepts of management includes: systems and improvement tools and techniques for the use of problem solving, statistical process or QC, and preventative management such as competitive benchmarking, prevention and cost of quality. Other “hard” concepts will briefly be discussed in section 2.1.4.8. This will be done in correlation to the “soft” concepts as they indirectly add value to the QM benefits of the TQM principles (Psomas *et al.*, 2014). Prior to implementing and achieving total quality successfully, the listed and integrated “soft” and “hard” aspects of management require sufficient attention.

2.1.4.1 Culture

One of the prime conditions for successful implementation of TQM is the application of an appropriate organisational culture (Prajogo and McDermott, 2005; Zu *et al.*, 2010). TQM may be described in terms of the culture, attitude and structure of an organisation that focuses on providing customers with high-quality products and services that satisfy their demands (Mohammad and Rad, 2006). Mohammad and Rad (2006) further explains that the culture oblige quality throughout all aspects of the organisation’s operations, while obtaining the mentality of “do things right the first time” and eliminating defects and wastes from operation. The latter will be discussed in sections 2.1.4.8 and 2.1.4.10 that follows. TQM may further be explained as the culture of an organisation committed to total customer satisfaction by the use of continuous improvement. Generally, within such a culture, resources, equipment, material and QM practices/principles are fully utilised and cost effectively implemented (Mohammad and Rad, 2006). It is clear, therefore, that effective leadership and commitment as well as many other principles for the TQM implementation are vital and need sufficient attention to attain a culture suitable for TQM. They will be discussed in succeeding sections.

Organisational culture represents the general pattern of mindsets, beliefs, norms, customs, concerns, practices and values that are understood, accepted and shared by members in an organisation (Prajogo and McDermott, 2005; Mohammad and Rad, 2006; Zu *et al.*, 2010). More specifically, these patterns of basic assumptions are usually invented, developed or discovered by a certain group of members which has learned to cope with problems of external adoption and internal integration. Once these members of the organisation accept these assumptions as valid, it may be taught to the new members as a pattern to perceive, to correspond to and act on solving problems in the correct manner (Mohammad and Rad, 2006; Zu *et al.*, 2010). Zu *et al.* (2010) states that the organisation’s cultural values shape the character of an organisation, suggesting that this culture allows employees to work in synchrony to define the understanding of reality and translate management strategies in a way that leads to the achievement of organisational goals (Zu *et al.*, 2010). In other words, organisational culture drives the structure and activities of an organisation. Stressing the importance of organisational culture, it may be viewed as an explanatory variable that differentiates one organisation from the other and which affects the operation of the organisation. Organisational culture plays a critical role in many facets within an organisation (Zu *et al.*, 2010).

Since the success of TQM is dependent on the organisational culture (Mohammad and Rad, 2006), the implementation program for TQM is more likely to succeed if the prevailing culture is aligned with the principles of the TQM discipline. Additionally, Powell (1995) argues that TQM principles have to be implemented within a suitable environment (e.g. culture) which exerts open communication. Therefore, authors suggests that organisations should define and manipulate their organisational culture prior to implementing TQM (Prajogo and McDermott, 2005; Zu *et al.*, 2010). A suitable framework for defining the organisational culture is the Competing Values Framework (CVF), developed by Quinn and his associates, to highlight the comprehensive nature of the TQM principles and to ensure that they are integrated in a TQM implementation framework for success (Denison and Spreitzer, 1991; Prajogo and McDermott, 2005; Zu *et al.*, 2010). The framework consists of two main dimensions representing a superordinate continuum as illustrated in figure 2.3¹.



Figure 2.3: The Competing Values Framework (CVF) of organisational culture (Adopted from Denison and Spreitzer (1991); Prajogo and McDermott (2005); Zu *et al.* (2010))

Research denote TQM as a unidimensional construct, also known as the “unitarist view”, that is generally focused on cultural characteristics that relate to people-oriented and flexible TQM principles (Prajogo and McDermott, 2005; Zu *et al.*, 2010). These principles are categorised into the “soft” concepts of management which

¹For further reading regarding the application of the CVF model (figure 2.3), consult Denison and Spreitzer (1991), Prajogo and McDermott (2005) and Zu *et al.* (2010).

emphasise the organisational and people side of TQM. Literature also suggests that TQM may be denoted as a multidimensional construct, known as the “pluralist view” that encompasses multiple practices or principles (Prajogo and McDermott, 2005; Zu *et al.*, 2010). These principles are categorised into the “hard” concepts of management that are concerned with the methodological and technical side of TQM to solve quality-related problems, including the use of product or service designs, quality information and process management (Prajogo and McDermott, 2005; Zu *et al.*, 2010). Thus, both Prajogo and McDermott (2005) and Zu *et al.* (2010) find that the functioning of a holistic, integrated system, which comprehends flexibility- and people-oriented cultural values (e.g. group culture and the development culture) as well as control- and external-oriented values (e.g. the rational culture) are required to obtain full benefits of implementing multiple TQM principles. Supporting to this observation, Prajogo and McDermott (2005) also emphasised that different practices are driven by and reflect multiple dimensions of organisational culture. Prajogo and McDermott (2005) stresses that adopting one culture is not the best approach for overall organisational effectiveness. This, therefore, highlights the idea of implementing dynamic capabilities that integrate the organisation’s ability for exploitation (emphasising control) and exploration (promoting flexibility) as mentioned by Benner and Tushman (2003). Thus, organisations have to develop systems that enable flexibility for adapting distinct management styles in order to accommodate divergent goals (Prajogo and McDermott, 2005). To accomplish this, organisations must attain the ability to transform comfortably from control and flexibility and from internal and external orientations (figure 2.3).

2.1.4.2 Leadership and Commitment – Creating the QM Environment

Leadership and corporate quality strategy resemble a united team which is committed to customer satisfaction while communicating the vision in a way that mobilises all employees towards its attainment (Thiagaragan *et al.*, 2001). Critical prerequisites to the development of the necessary commitment to TQM are the clear belief in tangible business and operating benefits of TQM as well as recognising that the traditional management system is no longer an option to stay competitive in the business environment (Thiagaragan *et al.*, 2001). Thus, in order to successfully implement the TQM philosophy, a QM environment has to firstly be created for all employees to identify and correct quality related problems (Prajogo and McDermott, 2005; Lee and Chang, 2006; Islam and Haque, 2012; Kristianto *et al.*, 2012). It is also essential, within any organisation, for top management (effective leadership) to develop a corporate Quality Policy (QP) which incorporates a statement of the mission and vision, goals and guiding principles or management strategy that are clearly defined and aligned with the quality movement of TQM and its implementation (Kanji *et al.*, 1992; Thiagaragan *et al.*, 2001; Yusuf *et al.*, 2007; Islam and Haque, 2012). Once the QP is established, its mission has to be communicated to all employees in the organisation for because TQM is an organisation-wide challenge which requires everyone’s participation (Thiagaragan *et al.*, 2001; Islam and Haque, 2012). Effective communication will ensure that all employees understand and are committed to the quality direction of the organisation. It is important to take note that any transformation towards the TQM philosophy will only be successful if the

awareness and need for improving quality of products and services are established and well understood amongst all role players (Thiagaragan *et al.*, 2001; Islam and Haque, 2012). The deployment and implementation of the quality goals at all levels will ensure correspondence of individual efforts and corporate expectations. It is, therefore, clear that competent leadership is essential in creation of the QM environment in order to achieve successful TQM implementation.

Leadership competencies relate to the possession and deployment of knowledge, skills, abilities and attributes that leaders should attain in order to perform their roles competently (Das *et al.*, 2011). Leaders have the important role of setting a direction, aligning, and motivating as well as inspiring people. According to (Kotter, 2001), competent leaders have a global mind-set as they continuously seek knowledge and expertise beyond boundaries. This implies that competent leaders have to be able to deal with high ambiguity and uncertainty, taking risk initiatives, experience new things and drive innovation as well as engage themselves in personal transformation (Das *et al.*, 2011). In addition, competent leaders have the responsibility of focussing on continual QI, obtain results and manage action strategies by stressing the critical necessity of achievement while they are motivating or influencing and or empowering them in order to extend their performance capabilities (Mumford *et al.*, 2000).

From the preceding discussion, it is clear that leadership and commitment are key factors in implementing TQM. Thus, the leaders (i.e. the executives, known as top management) of any organisation must consider the following (Thiagaragan *et al.*, 2001; Baldrige Performance Excellence Program, 2013):

- assume proactive responsibility for improving the existing management system and leading the quality drive;
- visibly show their commitment to quality and customer satisfaction;
- develop a comprehensive policy and effective deployment practices of goals;
- oblige to clear, consistent communication of mission statements and objectives which define the quality values, expectations and focus;
- ensure that all elements of the QM structure are in place to manage the new philosophy;
- help guide all organisational activities and decisions;
- inspire and encourage the workforce to contribute, to develop and learn, to be innovative and embrace meaningful change; and
- serve as role models through their ethical behaviour and their personal involvement in planning by providing a supportive environment.

2.1.4.3 Teamwork

Teamwork has become an increasingly prevalent factor to the implementation of TQM in many organisations. Researchers have acknowledged that one of the most important aspects of TQM is the use of practices that enable cross-functional problem solving and teamwork (Kanji, 1998; Yusuf *et al.*, 2007; Islam and Haque, 2012). General quality problems, such as performance, costs, and delivery of products and services, require teamwork throughout the entire organisation (Yusuf *et al.*, 2007). Teamwork underpins the success of managing change and implementing plans, solving related problems and creating involvement and empathy. Yusuf *et al.* (2007) further asserts that teamwork is an excellent way of building trust, developing interdependence and improving communication among participants.

The essence of teamwork is its valuable contribution to collaboration; which, in turn, entails many partnerships and non-organisational members. Yusuf *et al.* (2007) refers to this cooperative effort and contribution (collaboration) of all participants with a common goal as a “synergic partnership”. In order to realise the advantages of collaboration or the “synergic partnership”, teams have to facilitate the participation and involvement of all members, concentrate on solving actual work problems and overcome the hierarchical power differences (e.g. break down department barriers) (Islam and Haque, 2012). Another essence of teamwork is the empowerment and motivation of participants. TQM implementation requires the organisation to consider doing only quality work, establishing the quality climate and developing a team effort approach (Yusuf *et al.*, 2007). These prerequisites focus on enabling participants to feel, accept and liberate responsibility.

According to Islam and Haque (2012), teamwork offers four advantages regarding the implementation process:

- ***Enables flexibility*** – teamwork promotes the ease to assemble, deploy, refocus and disband. It also aids in enhancing permanent structure and processes.
- ***Enables commitment*** – TQM relies on participants from different cross-functional circles working together in order to develop a shared logic of direction.
- ***Enables synergistic response to challenge*** – teamwork enhances the ability to respond synergistically to challenges, changing events and demands due to a combination of experiences and skills.
- ***Enhance work*** – teamwork relates to overcoming barriers while establishing trust and confidence among team members.
- ***Creates focus*** – teamwork offers participants the ability to grow and change.

There exists two types of teams associated with QM, namely quality circles and QI teams. The quality circle is a group of people doing similar work who meet voluntarily and frequently to recommend solutions. The purpose of the quality circle is, therefore, to provide motivation for people to proactively engage on determining

their own actions (Yusuf *et al.*, 2007). QI teams contribute to content and process components which refer to certain tasks of quality projects and how to approach these tasks (Yusuf *et al.*, 2007). Such teams are typically involved throughout the entire production and operating system.

2.1.4.4 Customer Focus

In today's business and competitive environment, the essence of conforming to customer's requirements and expectations determines one's success. Those organisations that understand the demand of external customers and provide them with products or services to meet their requirements can advance their competitive advantage and profit (Yusuf *et al.*, 2007; Islam and Haque, 2012). TQM, therefore, demands that organisations should continually examine their quality systems with the aim of observing whether they are responsive to ever-changing customer requirements or not (Yusuf *et al.*, 2007; Islam and Haque, 2012). Apart from considering only those customers who are external to the business, TQM stipulates that internal customers must be regarded as equally important (Yusuf *et al.*, 2007). Internal customers are often referred to as internal stakeholders who represent middle management and non-management employees as well as those ranging from supplier to external customers (Thiagaragan *et al.*, 2001; Yusuf *et al.*, 2007). It is also the case that internal stakeholders directly or indirectly relate and cooperate with one another to establish a quality chain (Yusuf *et al.*, 2007). Thus, maximising internal stakeholders' support and involvement consist of assembling the entire workforce to achieve the quality goals of the organisation using buy-in, recognition and skills training (Thiagaragan *et al.*, 2001).

It is necessary for the organisation to realise and understand the relevance of all work activities to the entire quality chain. Thus, if this relevance is understood amongst all, Yusuf *et al.* (2007) states that a coordination of the entire organisation can be guaranteed and all internal effort will contribute to ultimately improving external customer satisfaction. To achieve this continuous improvement, the customers' requirements must be consistently measured and satisfied. Yusuf *et al.* (2007) argues that the organisation should be organised in such a way that one can obtain relevant information for the identification of customer requirements and to reliably and quickly obtain feedback of current product's or service's quality levels. The adoption of Quality Function Deployment (QFD), known to the food industry since 1987 (Costa *et al.*, 2001), is, therefore, suggested. The QFD is an innovative approach, which conveys quality (as demanded by customers) towards the product development process (Costa *et al.*, 2001). QFD is a set of planning tools that capture the voice of the customer in a series of matrices that facilitate the analysis of product or service quality characteristics, costs, reliability, and the application of new concepts and technologies for the fulfilment of customer requirements (Costa *et al.*, 2001; Islam and Haque, 2012). Other methods such as thorough market research, enquiring sales staff, and competitive benchmarking could be used to acquire useful information.

2.1.4.5 Supplier Relationship Focus

For the successful implementation of TQM, organisations should focus on the development of supplier partnership (Costa *et al.*, 2001; Agus and Hassan, 2011; Islam and Haque, 2012). Generally, supplier relation refers to the interactive relationship amongst parties involved in producing an output that need and input from another (Agus and Hassan, 2011). Production or manufacturing organisations are, therefore, obliged to build long-term relationships with its suppliers in order to prevent or eliminate any defects from all incoming raw materials while they ensure to provide inputs that conform to customer's end-use requirements (Thiagaragan *et al.*, 2001; Agus and Hassan, 2011). According to Islam and Haque (2012), there are three key partnering relationship elements, namely: long-term commitment; trust and shared vision.

It is important for the organisation to allow the purchasing department to analyse relevant information regarding suppliers in an attempt to thoroughly identify the most appropriate and qualified suppliers. Also, improved communication among departments is a necessity as all may contribute to the gain of information at some point in the chain. In order to develop tight supplier partnership – based upon trust and credibility – organisations should consider the application of appropriate tools, techniques and systems. Islam and Haque (2012) finds procurement systems, advanced planning and scheduling, as well as transportation planning systems are most useful.

2.1.4.6 Employee Involvement – Valuing the Workforce

The implementation of TQM emphasises the involvement of all employees (participants) in decision-making, problem-solving and the financial success of the organisation (Yusuf *et al.*, 2007; Islam and Haque, 2012). Regarding the food industry, people (employees) are essential aspects for the success of the food business (Gould, 1992); hence, TQM is suitable as it encourages all levels of people to refine their focus on the organisational goals and objectives (Yusuf *et al.*, 2007). In an attempt to achieve a company-wide TQM organisation, all participants are responsible for the production of quality goods and services while it constantly conforms to customer requirements. This implies that each participant is in control of their work and is allowed to partake in the business of the organisation (Yusuf *et al.*, 2007). The word “involvement” relates to the empowerment of employees, allowing them access to necessary information, giving them the opportunity to gain knowledge and rewarding them for quality performance (Gould, 1992; Yusuf *et al.*, 2007; Islam and Haque, 2012). Another important aspect of employee involvement is to understand that internal external-partnerships should be valued. Considering that people are such an important factor to organisational success, employee empowerment is briefly discussed. Internal and external partnership, recognition and reward as well as education and training are also discussed.

Employee Empowerment

Employee empowerment is considered a vital contributor to the success of any QI process which enables employees to make decisions regarding their own work and environment (Islam and Haque, 2012). Employee empowerment includes the following: the degree of freedom for cross-functional departments and teamwork; employee independence in decision-making; employee interaction with customers; and employee suggestion systems within the formulation of a strategy (Islam and Haque, 2012). An empowered employee is, therefore, confident and committed to be held fully responsible for accomplishing a work task or activity as they become the owner of the process to achieve organisational values and goals. In order to exert empowerment, change within the organisation's infrastructure is usually required. This suggests that top and senior management have to give up authority which implies that every part in the quality chain has its own contribution (Islam and Haque, 2012).

Internal and External Partnership

To accomplish employee and organisational goals, internal and external partnership should be formulated (Baldrige Performance Excellence Program, 2013). The internal partnership represent the cooperation between management and labour, as well as the creation of network relationships among organisational work units and locations or volunteers and employees to improve responsiveness, knowledge sharing and flexibility (Baldrige Performance Excellence Program, 2013) on the one hand. External partnership, on the other hand, include customers, suppliers, education or community groups which may contribute to the organisation when provided with complementary core competencies. These competencies often authorise the introduction to new markets, products or services (Baldrige Performance Excellence Program, 2013). Partnership is critical to organisations as it could be a source of strategic advantage when establishing effective alliances (Tidd and Bessant, 2013). An alliance is the collaboration to implement one organisation's core competencies or leadership capabilities with the other (partner) organisation's complementary capabilities and strengths (Tidd and Bessant, 2013).

In order to establish a successful internal and external partnership, it is important to develop long-term objectives, institute key requirements for success, and adopt approaches for adequate communication, progress evaluation, and management of change (Baldrige Performance Excellence Program, 2013). Typically, joint education and training is a cost-effective method and approach towards the development of an effective workforce.

Recognition and Reward

Recognition and reward are considered effective stimulators and motivators to achieve the desired organisational performance and employee satisfaction (Yusuf *et al.*, 2007), where the organisation publicly acknowledges the positive contributions of individuals responsible for organisational success (Yusuf *et al.*, 2007). In essence, they are key factors for positive reinforcement in allowing people to recognise their valuable contribution to the organisation (Gould, 1992; Yusuf *et al.*, 2007). Thus, recogni-

tion and reward are accepted and suggested for goal-oriented activities (Yusuf *et al.*, 2007). Yusuf *et al.* (2007) further emphasises that recognition and reward should only be used to encourage employees to work excellently, and not to force them to do so.

Recognition involves making employees to feel that they are appreciated, approved, and have peer recognition ((Gould, 1992; Yusuf *et al.*, 2007). Employees should be appraised for effort and quality results, for contributing suggestions and achievements, and for teams and individuals. Status or reward, beyond extra pay, should be given in a meaningful form of rank in position, promotion, and other visible benefits. Giving of rewards has to be appropriate for the situation by being rank-ordered – meaning, the higher the achievement, the higher the reward (Yusuf *et al.*, 2007). It is important to properly present the reward to enable employees to clearly understand what it exactly entails.

Education and Training

It has been continuously mentioned that people are the core of, and essential to, the TQM process of implementation. Researchers stress that the success of an organisation depends increasingly on an engaged workforce that benefits from clear organisational direction, meaningful work and accountability for performance (Yusuf *et al.*, 2007; Baldrige Performance Excellence Program, 2013). Usually, the successful organisation capitalises on the diverse knowledge skills, backgrounds, motivation and creativity of its workforce and partners. Within extensive TQM literature review, a well-established link between training and education and organisational performance exists (Powell, 1995; Kaynak, 2003; Prajogo and McDermott, 2005; Yusuf *et al.*, 2007).

Training denotes the acquisition of skills, competencies, and knowledge as a result of educating and teaching occupational or practical skills and knowledge that relate to specific competencies (Islam and Haque, 2012). Furthermore, training consists of the specific goals of improving people's capability, capacity, and performance. In terms of quality related tools and concepts, training is regarded as the fundamental factor in increasing employee's work capacity, their ability to obtain information and solve problems, and allowing employees to initiate their full potential to continuously improve quality (Yusuf *et al.*, 2007). Yusuf *et al.* (2007) further comments that training relates to changes; which include the diversity of business environment, stringent requirements of operations and levels of employees, and improvement of organisational performance. Although training will not change the behaviour of people, training in new skills and development is the first step towards conquering change (Yusuf *et al.*, 2007).

In order to implement effective training, it has to be systematically and objectively planned. Yusuf *et al.* (2007) suggests that training activities be introduced using an improvement cycle process, such as the PDCA-cycle (see figure 2.1). The steps of such a cycle may include the following four steps. Firstly, it is important to create awareness among all employees regarding what the training exactly entails by

collecting appropriate suggestions and feedback which will finally lead to acceptance. Secondly, the training objectives, which aim to achieve quality requirements, should be identified. It is senior management's responsibility to ensure that all objectives are clear and that all priorities are set. Thirdly, it is necessary to adopt what has been agreed upon; a training programme could include on-the-job- or off-the-job training, and formal- or informal training. Whichever training programme an organisation may decide on adopting, all participants must receive adequate training in quality awareness, safety, technical aspects and problem solving (Yusuf *et al.*, 2007). For the effective implementation of quality programmes, commitment of trainers and trainees is demanded. It is, therefore, the role and function of the senior manager to allocate responsibilities to training. For the final step, it is important to assess the results of the training programme to determine whether further training is necessary (Yusuf *et al.*, 2007).

2.1.4.7 Management by Fact

Being familiar with the current performance levels of products or services is key to attaining the ability to improve (Kanji, 1998). Kanji (1998) also states that providing people with useful information will help them base decisions upon facts rather than on extrasensory perception. This implies that decision-making is unbiased based on observed data and control is made impersonal (Gould, 1992); which, in turn, leads to continuous improvement. Thus, organisations are dependent on the measurement and analysis of performance (Baldrige Performance Excellence Program, 2013). According to Baldrige Performance Excellence Program (2013), measurement has to be derived from business requirements and strategy, and should provide critical information and data concerning processes, results, outcomes and outputs. In order to achieve performance management, organisations will require various types of information and data. This includes measurement of the following: product, customer and process performance; comparison of competitive, market and operational performance; partner, cost of quality, supplier, employee involvement (workforce), and financial performance; governance and compliance results; and successful execution of strategic objectives (Baldrige Performance Excellence Program, 2013).

To enable analysis, data must be segmented (e.g. product lines, markets, and workforce groups). The term analysis represents extracting greater meaning from information and data in support of evaluation, decision-making, innovation, and improvement (Baldrige Performance Excellence Program, 2013). It also entails using data to determine projections, trends, cause-and-effect relationships. The use of analysis will support a wide range of purposes, for instance, improving operations, undertaking management of change, planning, reviewing the organisation's overall performance, and comparing the organisation's performance with the best-practice benchmarks (competitors) (Baldrige Performance Excellence Program, 2013).

The selection and use of performance measures or indicators is an essential consideration in performance improvement. Thus, the measures or indicators an organisation should select are those that represent the factors leading to customer, financial, societal and operational performance. The Baldrige Performance Excel-

lence Program (2013) and Kanji (1998) remarks that a comprehensive set of measures or indicators that are connected to customer and organisational performance requirements offer a clear foundation for aligning all processes with an organisation's goals. In addition, any organisation may require measures and indicators to support decision-making within a rapidly changing environment. Thus, with the use of data analysis, an organisation can evaluate the measures or indicators and change them to better support organisational goals. See subsection 2.1.4.8 for the discussion of supporting tools and techniques.

2.1.4.8 Practice of Quality Control Tools and Techniques

It is prevalent that TQM places increased responsibility on all participants. In order for total quality participants to correctly identify quality related problems, appropriate tools and techniques should be applied (Islam and Haque, 2012). For this reason, Statistical Quality Control (SQC) and SPC are widely accepted technical tools to assist participants to make the control of quality and processes impersonal while providing them with unbiased decision-making based on observed data (Gould, 1992). Distinguishing between these two control techniques, SQC is typically used as a tool for collecting, analysing and monitoring data post the production process whereas SPC is a tool used to collect data during a production run to control and monitor the production process in order to detect any changes in process performance (Gould, 1992; Woodall and Montgomery, 1999). As mentioned in section 2.1.4.7, the key to success of any process is facts, i.e. participants have to learn to collect, analyse, and use data. Thus, the practice of QC tools and techniques are necessary.

According to Gould (1992) and Islam and Haque (2012), the tools of SQC and SPC, applicable to the TQM implementation process, are (a) those used to identify the root causes of the problems in the work environment, and (b) those used to control the process within established specification limits as well as (c) those used to improve process capability. These technical tools of TQM comprise eight basic techniques, namely: Check sheets; Brainstorming; Pareto charting; Process flow diagram; Cause-and-effect diagram (CEDAC); Histogram, frequency tables and probability plots; Control charts; Correlation or scatter diagrams. A summary of the corresponding tools and techniques for the process control analysis are shown in table 2.5.

Statistical control is essential to the change from detection to prevention (Gould, 1992). Prevention refers to the continual process of driving possible failures out of the system, which corresponds to developing a culture of continuous improvement over time (Kanji, 1994). Continuous improvement and prevention will be discussed in sections 2.1.4.9 and 2.1.4.10 respectively. In order to establish prevention, Failure Mode and Effect Analysis (FMEA) is an applicable, analytical technique that uses the combination of technology and experience of people in identifying foreseeable failure modes of a product or process as well as an action plan for elimination or mitigation of the failure (Islam and Haque, 2012). There are two distinct ways of approaching the FMEA technique; the first is to focus on the design of the product itself, and the second is to focus on the production process itself (Gould, 1992) The

Table 2.5: Process control analysis (Adopted from Gould (1992))

Process	Tools and Techniques
Identify the problem	Pareto Analysis, Check Sheets, QFD
Create and develop corresponding processes and alternatives	Flow diagrams
Analyse all probable causes	Brainstorming, CEDAC analysis /FMEA and Benchmarking
Collect and Analyse data	Histograms/Frequency Distributions, Run Charts, Scatter diagrams
Implement process corrective actions and establish parameters to monitor quality and control the process	Control Charts (i.e. X-Bar charts, R-Bar charts)

implementation of design FMEA aids with the establishment of priorities based upon expected failures and the severity of those failures. In addition, design FMEA helps with uncovering oversights, misjudgements and errors by decreasing the development time and cost of production process (Islam and Haque, 2012). Alternatively, process FMEA can identify potential process failure modes and aid with the establishment of priorities according to relative impact on internal and external customers (Islam and Haque, 2012). Therefore, with the use of the FMEA technique, the TQM target for continuous improvement and prevention is met by reducing its potential failures in its products and processes.

The optimal improvement of productivity by utilising resources such as machinery, men, and material has become an increased factor for the survival of organisations in the competitive environment (Tsarouhas, 2007; Kaur *et al.*, 2012). Thus, maintenance is considered fundamental to a productive production system. Within the food industry, Total Productive Maintenance (TPM) is a sound and innovative approach to maintenance that has been used successfully by many (Tsarouhas, 2007; Kaur *et al.*, 2012). TPM adds the following factors to maintenance: it optimises the effectiveness of equipment; it eliminates breakdowns; and it promotes an autonomous operator maintenance strategy that focusses on every-day activities involving the total workforce (Kaur *et al.*, 2012). Tsarouhas (2007) further comments that TPM may defined in terms of Overall Equipment Effectiveness (OEE), which can be considered as a combination of available resources, equipment management and operation maintenance. For these reasons, TPM aids with keeping the plant and equipment at its highest productive level through cooperation among all areas of the organisation while directing its focus towards eliminating equipment failures through planned maintenance schedules (Islam and Haque, 2012).

2.1.4.9 Continuous Improvement

Continuous improvement focuses on attaining levels of performance that are considerably higher than those of the current levels (Agus and Hassan, 2011). Continuous improvement is accomplished by employing emphasis on processes, rather than on events, which leads to the achievement of QI (Yusuf *et al.*, 2007; Agus and Hassan,

2011). This suggests that continuous improvements are based on habitual, incremental, and systematic improvements on processes, not on innovative progresses. The main focus of process improvement is to eliminate error, remove slack and reduce variation, which requires all participants (employees and departments) to work collaboratively to achieve quality (Yusuf *et al.*, 2007). Correspondingly, Agus and Hassan (2011) states that process improvement entails the exercise in optimising effectiveness and efficiency while improving process control as well as strengthening internal mechanisms in response to the ever-changing demands of customers. This proposes that the adoption of continuous improvement entails that every activity and process is aligned to the customer, which underlines continuous customer satisfaction Thiagaragan *et al.* (2001). It is important to set targets purposefully. In other words, an organisation should not set too ambitious targets for themselves as it is easy for participants to give up trying to achieve them. It is, thus, suggested by Yusuf *et al.* (2007) that target fulfilment should be “performed” rather than “achieved”.

Continuous improvement also implies that all participants should accept that improvement is available at all times and there is always a need for better means to accomplish achievements using their detailed knowledge (Yusuf *et al.*, 2007; Islam and Haque, 2012). Thus, the continuous process concentrates on the following aspects: creating process management responsibilities; continuously quantifying customer’s needs; frequently measuring employee performances; planning, control and problem-solving as well as identifying prospects for improvement (Yusuf *et al.*, 2007).

Thiagaragan *et al.* (2001) argues that there are three fundamental early initiatives that should be pursued in support of continuous improvement, namely: all steps taken for improvement are fact-based; teamwork is necessary to promote a bottom-up drive towards improvement; and the focus on delivering a synergistic enhancement of quality efforts.

For the successful implementation of the TQM philosophy, the continuous process for improvement may play a critical role. Numerous researchers have suggested that one of the most useful technique for process improvement in order to solve problems continuously is the PDCA cycle (Dahlgaard *et al.*, 1995; Kanji, 1996; Lee and Chang, 2006; Das *et al.*, 2011) – also known as the Deming’s Cycle. The PDCA cycle has successfully been used since 1950 by the Japanese to improve quality levels of products and services (Dahlgaard *et al.*, 1995). The PDCA cycle is a fundamental principle of TQM and is a useful and common tool to use in many other important aspects of the TQM philosophy (Gould, 1992) (see figure 2.1). Other tools and techniques such as benchmarking, self-assessment versus a quality or excellence model and cost of quality should be introduced at a later stage in time to initiate, monitor and control continuous improvements efforts (Thiagaragan *et al.*, 2001).

2.1.4.10 Prevention – “Get Things Right the First Time”

The traditional QC system emphasises supervision and inspections. TQM, however, undertakes a change from reactive (solving a problem only when it occurs) to proactive (preventing a problem from occurring) (Yusuf *et al.*, 2007). Many authors

supports the spirit of “zero defect” and the attitude of “get things right the first time” towards the quality program. This attitude, therefore, requires that all participants should acquire a “zero defect” or “right first time” mentality (Powell, 1995; Yusuf *et al.*, 2007; Islam and Haque, 2012). Such a mentality results in the emphasis on prevention with the attentive use of process controls and measurement as well as the data-driven elimination of waste and error. Doing things right the first time may be regarded as a performance standard that changes the traditional perception of the occurrence of a failure as normal in conventional work practices (Yusuf *et al.*, 2007). A management discipline to preclude the occurrence of defects in an organisation’s performance cycle is required to achieve prevention. This preventative management discipline would, therefore, contribute to fulfil high effectiveness and efficiency by allowing the process to be continuously reviewed and improved (Kanji, 1994; Yusuf *et al.*, 2007). This type of discipline also implies that wide communication, staff discussions, and problem-solving will become prevalent while replacing an inspect-in approach with a design-in approach.

In response to the requirement for preventative management discipline, the Just-in-Time (JIT) philosophy may be introduced as a suited approach. The JIT philosophy endorses the eliminations of waste by simplifying production processes in order to satisfy customers (Kannan and Tan, 2005; Yusuf *et al.*, 2007). The JIT approach enables reductions in setup times while controlling material flows and emphasising preventative maintenance, which, in turn, reduces or eliminate excess inventories and promotes induced efficiency of resources utilisation (Kannan and Tan, 2005; Yusuf *et al.*, 2007). In terms of total quality, JIT uses the minimal resources (e.g. materials, people, and facilities) to immediately and precisely respond to the demands of customers. Thus, the adoption of a JIT programme will allow organisations to get the process right before commencing of production; hence, it supports reducing the probability of defects (Yusuf *et al.*, 2007).

2.1.4.11 Competitive Benchmarking

Benchmarking entails thorough research and observation of best competitive practices to provide a guideline for rational performance goals, which will aid in forming the basic expectations for cost, reliability of products or services, time and delivery and many other factors (Agus and Hassan, 2011). It may formally be defined as: “A systematic and continuous measurement approach; a process of continuously comparing and measuring an organisation’s business processes against business leaders anywhere in the world to gain information which will help the organisation take action to improve its performance” (Yusuf *et al.*, 2007). According to many researchers, benchmarking is found to be one of the most important approaches to TQM, which is widely used amongst various organisations to achieve improvements in their field (Yusuf *et al.*, 2007; Agus and Hassan, 2011; Islam and Haque, 2012). The purpose of benchmarking is to study competitors and identify best practices to provide benchmarks (also known as targets) for the improvement of organisational performance in order to conquer superiority in the current market place (Yusuf *et al.*, 2007; Agus and Hassan, 2011). Improvement will accelerate when performance is measured and benchmarked against world-class performers. As a result of using competitive bench-

marking, effectiveness, productivity and performance will be augmented (Agus and Hassan, 2011).

The process of competitive benchmarking has the following five consecutive steps (Bank, 1992; Yusuf *et al.*, 2007; Agus and Hassan, 2011):

1. **Benchmark** – decide what is specifically going to be benchmarked. This usually concerns all departments and products or services in the organisation as well as external customers.
2. **Select** – select the most appropriate competitors with regard to what the specific organisation desires to measure.
3. **Measurement** – decide which measurement is the most appropriate to use and develop a strategy for the collection of data.
4. **Determine** – determine the strengths of the competitor's organisation and evaluate those strengths against one's organisation.
5. **Develop** – develop an action plan.

Participants related to this process should have the determination to learn from others as benchmarking directly focusses on identifying gaps, solving problems and continuous change. With regard to TQM, benchmarking is time and cost efficient (Islam and Haque, 2012) and will aid with the improvement of performance that are based on industry best practice, which oughts to contribute to conforming to customers' requirements (Agus and Hassan, 2011).

2.1.4.12 Cost of Quality

The cost of quality is defined as all business costs incurred in achieving a quality product or service (Gould, 1992; Yusuf *et al.*, 2007). In support of the known categories of cost of quality stated by Gould (1992), Yusuf *et al.* (2007) also suggests it includes the following: Prevention costs; Appraisal; Internal failure costs; External failure costs; costs of lost opportunities; and cost of exceeding customer requirements. They are summarised in table 2.6 below.

Gould (1992) recommends that an organisation should focus on improving quality as it can probably increase profits by five to 10% of its sales. Yusuf *et al.* (2007) observes that poor quality may result in costs exceeding sales by 20% in manufacturing or production organisations and 35% in service organisations. For this reason, TQM aims to continuously reduce these costs (table 2.6). In order to achieve a favourable Return On Investment (ROI) of materials, processes and people, the four categories of quality costs should be determined to establish benchmarks (or targets) to compare it with (table 2.6). Yusuf *et al.* (2007) finds that lower and more appropriate quality costs could identify opportunities for QI while establishing cost and price significances.

Table 2.6: Categories of quality costs (Adopted from Gould (1992); Yusuf *et al.* (2007))

Category I – Direct costs or costs of good quality	
<i>Prevention costs</i>	design reviews; pre-production runs; set-up adjustments; process control; purchasing QC; preventative maintenance; and cost of training
<i>Appraisal costs</i>	estimation of quality levels; and audits of the system
Category II – Indirect costs or costs of poor quality	
<i>Internal failure costs</i>	scrap; rework; material; and cost to reprocess or recoup
<i>External failure costs</i>	customer complaints; excess shipping charges; loss of customers; product liability suits; paper work; costs of lost opportunities; and cost of exceeding customer requirements

The reduction of all known as well as unknown quality costs through the prevention of errors and failures is an essential concept to TQM. If defect prevention is exerted, it may positively influence internal failure costs (e.g. to correct defect products or services that do not meet the required quality standards pre-delivery) and affect external failure costs (e.g. to correct defect products or services that do not meet the required quality standards post-delivery) (Yusuf *et al.*, 2007). Once a high level of prevention is attained, appraisal costs (e.g. to determine conformance to quality standards) may confidently be decreased. This suggests that a quality cost programme to collect and report information, analyse relative costs in comparison with other organisations is required in command of developing a QI strategy (Yusuf *et al.*, 2007). Thus, it is necessary for organisations to invest in implementing the right prevention activities, continuously evaluate and redirect the prevention effort, and use problem-solving to decrease failure costs.

With regard to decreasing the costs of exceeding requirements and the cost of

lost opportunities, an organisation should consider coordinating its participants and departments. TQM may contribute to minimising the cost of poor quality as it involves all participants to improve the quality in their work. Moreover, TQM also provides a synergistic framework of Good Manufacturing Practice's (GMP) (Yusuf *et al.*, 2007). Once the financial impact of the costs of quality is clearly identified and communicated in pursuit of a common goal in the organisation, the four categories of costs may be reduced due to high understanding, responsibility and cooperation (Gould, 1992; Yusuf *et al.*, 2007).

2.2 Introduction to AM

In light of providing a holistic understanding of AM, essential concepts of the AM will be discussed. These concepts are stated and discussed in the sections that follow. They are: history of AM; defining AM; implementation principles of AM; Subject groups and description. The need for AM in the food industry is also discussed.

2.2.1 History of AM

Over the past decades, the term "Asset Management" (AM) has caused obscurity among many practitioners. As the discipline matured, practitioners became insightful and recently more and more understand that AM refers to the use of "assets" to deliver value and achieve explicit organisational purposes rather than the mere thought of "doing things to assets" (IAM, 2014). Once the term AM is understood, it translates the essential aims of an organisation into the practical implications (or principles) to choose, to acquire (or create), to utilise (or operate), and to take care (or maintain) of applicable assets as it attempt to deliver the aims (IAM, 2014). The translation is accomplished using the best total value approach which also refers to the optimal combination of costs, risks, performance and sustainability, as mentioned by IAM (2014). However, some of the reasons that caused this obscurity are professional and educational specialisations which caused various disciplines involved in the management of assets to become isolated, as well as the significantly similar use of AM across numerous industries (Amadi-Echendu *et al.*, 2007; Hastings, 2015). This has led to many qualifying uses and interpretations for the term; Mitchell (2007) and Woodhouse (1993) established six different uses, of which the first applies to this research:

1. The *financial service* sector – AM refers to the management of stock and shares or investment portfolios in order to obtain the best assortment of capital security (or growth) and interest rates (or revenues).
2. The *financial board directors* (and *company analysts*) – this group refers to AM in relation to mergers and acquisitions. Examples of this include buying and selling companies, re-organising companies, divesting low value elements and inducing capital value.
3. The *equipment maintainers* – they adopted AM as a preferred term over maintenance management in order to advance credibility and visibility for their activities.

4. **Software vendors** – aligning themselves with equipment maintainers, software vendors (known for selling of asset information management systems) relabelled their products as (Enterprise Asset Management Systems) EAMS.
5. **Information systems** – a sub-domain of the information systems field interprets AM as the bar-coding of computers and peripherals as well as the tracking and tracing of its location.
6. **Infrastructure or plant owners and operators** – they perceive AM as playing an essential role towards their company which describe the combination of caring for and sustained use of its physical plant, infrastructure and its supplementary facilities.

The cumulative recognition of good AM has evolved from three primary origins, they are: the financial service sector; the North Sea oil and gas industry; and the public sector (IAM, 2014). For over 100 years, the financial service sector used the term AM to describe the act of optimising risk, yield, short and long term security obtained from an assortment of cash, stocks and shares or investment portfolios. Alongside the financial service sector, the Australian and New Zealand public sector forced a radical change towards the establishment of better strategic planning, prioritising and value-for-money activities resultant to the public outcry faced by economic pressure (IAM, 2014).

Contributing to this, the Oil and Gas industry in the European North Sea adopted the term AM after the Piper Alpha disaster in the late 1980s as well as the oil price crash, market globalisation and Lord Cullen's recommendations on risk or safety management (Woodhouse, 1993; IAM, 2014; Jooste, 2013). This forced organisations to a radical reassessment of their business practices and models; which, in turn, has led to the discovery that smaller, more dynamic and multi-disciplined organisations, that are focussed on a full lifecycle view of assets, ensued a higher operational efficiency than those of the big organisations (Woodhouse, 1993; IAM, 2014). This, therefore, steered the direction towards the development of dynamic business units and profit-centred organisations, in which performance accountability and investment or asset care responsibility are intertwined when using small, multi-disciplined teams (Woodhouse, 2006). During this period of change, the "Asset Management Model" emerged which proved that it contains both radical and an assembly of common sense (Woodhouse, 2006).

Since the emergence of AM, scholars argued that the AM field requires an interdisciplinary approach and agreed that this approach is no longer confined to maintenance aspects only, but rather to drive their focus towards the whole life-cycle management of assets (Woodhouse, 2001; McGlynn and Knowlton, 2011; Jooste, 2013). Upon this agreement, scholars from distinct industries stated that the case of AM has begun to increasingly be researched in the electrical and water utilities, transport (i.e. road and rail) systems, mining, construction, process and manufacturing industries (McElroy, 1999; Hoskins *et al.*, 1998; Morton, 1999; Vanier, 2001; Kostic, 2003; IAM, 2014). The realisation of the advances and benefits obtained from AM application in developed countries became apparent, which has led to the

widespread acceptance among industries that great opportunities associate with a joint approach to management of assets (IAM, 2014).

In the early 2000s, a general agreement towards a holistic view of AM became prevalent among engineering circles, which emphasised on lifecycle AM, the strategic planning of an AM strategy, asset risk management and optimisation as well as other factors of AM such as the human, safety and environmental factors (Schuman and Brent, 2005; Jooste, 2013). This has led many cooperating organisations and individuals to the realisation that the integration and optimisation challenges require clarity and structured guidance (Woodhouse, 2006). In response to this demand, the United Kingdom Institute of Asset Management (IAM) and the national British Standard Institution (BSI) developed and launched the first Publicly Available Specification (or PAS 55) for a holistic, optimised and sustainable management of physical assets, referring to AM, in 2004 (Woodhouse, 2006). In collaboration with the IAM and BSI, the cooperating organisations and individuals (which includes over 50 participating organisations from 15 different industry sectors in 10 distinct countries) contributed to substantial revision from the original 2004 version in order to create the publication of PAS 55:2008 (British Standards Institution, 2008, i). Based upon the widespread adoption and acceptance of PAS 55 as the most appropriate AM standard, in 2014, the International Standards Organisation (ISO) released the ISO 55000 series of international standards for AM.

In the interim, the Global Forum for Maintenance and Asset Management (GFMAM) was established in 2010 mainly focussing on aligning advances of, and collaborating to the development of a collective view of AM to share knowledge in support of the maintenance and AM community worldwide. Thus, in attempt to achieve this ambition, the GFMAM published the first edition of the GFMAM Asset Management Landscape in 2011. During this time, it was agreed upon that the Landscape will be reviewed in 2014 contrary to the release of the ISO 55000 series to incorporate developments. Upon this agreement, the second edition of the Landscape was released in 2014, which includes Subjects and fundamentals that describe the AM discipline (GFMAM, 2014, 4). In 2014, the IAM additionally published their second issue of Asset Management – Anatomy in alignment to IAM projects, the GFMAM landscape version 2 and the ISO series of standards for the benefit of maintenance and AM members as well as the general public (IAM, 2014, i).

It has been recently anticipated by many maintenance and AM members that the 39 AM Subjects represented by IAM, in collaborative use of the ISO 55000 series of standards' practical guidelines, has a significantly important role in understanding the holistic concept of the AM discipline. However, it is important to understand the distinct objectives of ISO 55000, PAS 55 and the 39 Subject, which IAM (2011, 2014) describes as follows:

“The 39 Subjects describe the body of Asset Management knowledge as a whole, whereas ISO 55001 (and PAS 55) specify the requirements for and organisation’s management system – to direct, control and continually refine Asset Management. Note that familiarity with the man-

agement system standard alone does not constitute knowledge and competence across the whole discipline of Asset Management! For anyone wanting to master the discipline, knowledge of the ISO 55000 series is important but not the whole picture – you really need to learn the whole discipline as represented by the 39 Subjects, albeit to different levels and degrees depending upon your area of responsibility or operational environment”.

2.2.2 Defining AM

Prior to clearly defining AM, it is essential to clarify the following underlying concepts first: the realisation of value from assets; the meaning of lifecycle activities; optimised decision-making; management strategy; and alignment (or line of sight). These underpinning concepts are, therefore, briefly discussed in section 2.2.2.1, from which the most appropriate definition for AM is depicted as seen in section 2.2.2.2.

2.2.2.1 Underpinning Concepts of AM

In terms of AM, the term “asset” is commonly used to refer to things that have actual value or potential value from which AM attempts to achieve the realisation of that value. The constitution of value will vary between different organisations and stakeholders and will depend on how they perceive it. Apart from how it is perceived, IAM (2014) finds that it is important that value reflect the combination of stakeholders and their expectations and it may frequently consist of an assortment of tangible and intangible benefits of risks. IAM (2014) further mentions that assets are characterised in different levels of granularity, thus, it is essential for organisations to understand inputs, costs and risks at discrete intervention and asset unit levels at different stages of their asset lifecycles.

To be more specific with understanding what an asset exactly entails, PAS 55 defines physical assets as (British Standards Institution, 2008):

“plant, machinery, property, buildings, vehicles and other items that have a distinct value to the organisation”.

Contributing to this, the more recent authority (ISO 55000 series of standards) define an asset more broadly as (International Standard Organization, 2014a):

“item, thing or entity that has potential or actual value to an organisation”.

The definition of asset is supported by noting the following (International Standard Organization, 2014a):

1. *Value can be tangible or intangible, financial or non-financial, and includes consideration of risks and liabilities. It can be positive or negative at different stages of the asset life.*

2. *Physical assets usually refer to equipment, inventory and properties owned by the organisation. Physical assets are the opposite of intangible assets, which are non-physical assets such as leases, brands, digital assets, use rights, licences, intellectual property rights, reputation or agreements.*
3. *A grouping of assets referred to as an asset system could also be considered as an asset.*

Assets may be defined at many levels of the organisational system and this has caused many to misinterpret the nature and priorities of AM (IAM, 2011). This is critical to consider when introducing AM to the food industry. British Standards Institution, 2008 and IAM (2014) seeks to clarify the need for layered integration of what is required during the implementation of AM. This ranges from the lifecycle optimisation of discrete component or equipment items to the “value-for-money” sustained using the organisation’s holistic portfolio of information, people, systems, networks, etc. Figure 2.4 illustrates this concept.

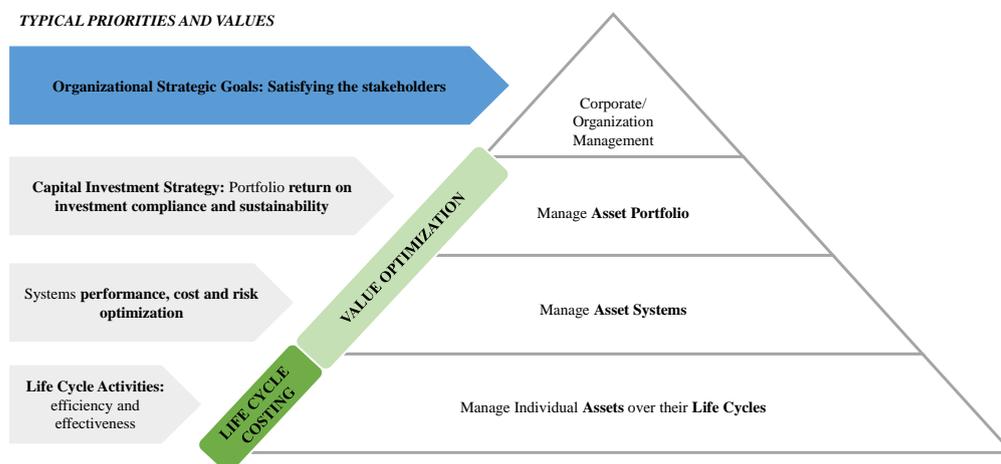


Figure 2.4: Hierarchy of assets within an integrated management system (Adopted from (IAM, 2014))

Although each layer increases with system complexity and perceive problems and goals differently (figure 2.4), underpinning challenges of optimising the elements of costs, risks, sustainability and performance exists. Therefore, it should be stressed that the expectations of good AM must include the awareness of such systems integration, and require those interested in implementing AM to manage assets at the most appropriate level of “granularity” to add value contribution or business criticality.

Assets are, therefore, categorised into different classes. Figure 2.5 presents the different types of assets in relation to the PAS 55. PAS 55 focuses on a holistic management perspective of the assets' contribution to AM and states that the physical assets are represented as the only asset type that are acquired to be managed holistically to achieve the organisational strategic plan (British Standards Institution, 2008). However, it also recognises the importance of other interface asset types such as human, information, financial and intangible assets (e.g. morale, property, reputation, etc.) which should be considered to optimise all conflicting elements (i.e. cost, risk, and performance) to deliver value within the business context. Figure 2.5 clearly illustrates the importance of the interfaces and interdependencies which, once again, reinforce the essential requirement of a systems integration view (as adopted from British Standards Institution (2008)). Conferring to ISO 55000 series of standards, ISO 55000 classify asset type as such (International Standard Organization, 2014a): "the grouping of assets that interact or are interrelated", which are supported with an example: "Physical assets, information assets, critical assets, enabling assets, linear assets, Information and Communication Technology (ICT) assets, infrastructure assets, moveable assets".

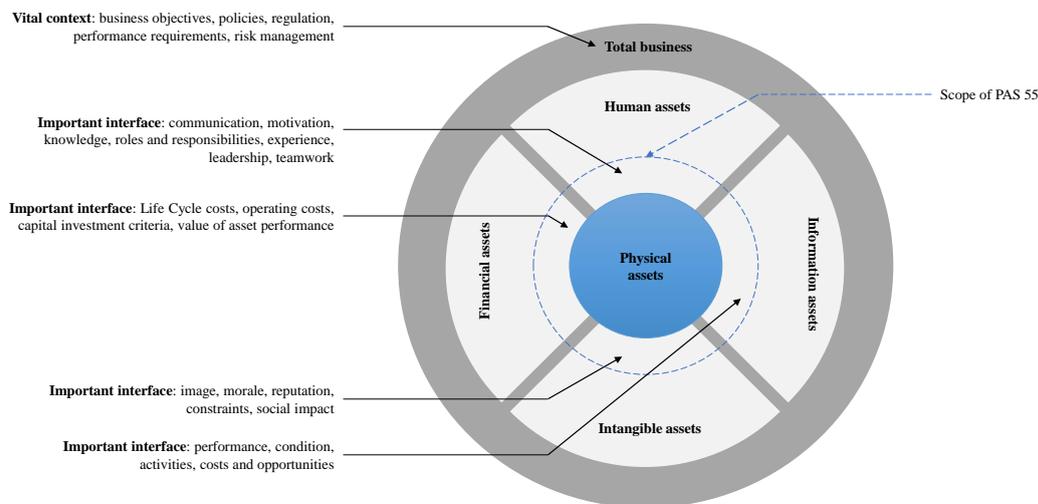


Figure 2.5: The focus and business context of PAS 55 in relation to the other categories of assets (Adopted from British Standards Institution (2008))

The concept of lifecycle is important towards understanding AM (British Standards Institution, 2008; McGlynn and Knowlton, 2011; International Standard Organization, 2014a; IAM, 2014; Hastings, 2015). According to the International Standard Organization (2014a) the asset life represent "the period from the creation of an asset to the end of its life". At the lowest levels of asset granularity (e.g. physical equipment components), the concept of lifecycle activities may be more easily understood, nevertheless, assets are only capable of contributing value within the

context of a system. The increased complexity of systems will strain the identification of lifecycle phases which will, therefore, require the consideration of maintenance strategies, asset replacements, modifications, recycling and changing functional demands during the asset's life (IAM, 2014). Furthermore, value realisation periods, lifecycle activity planning and lifecycle costs should be established to avoid the tendency to act on short-term benefits without considering the future effects and false economies (IAM, 2014). The asset lifecycle consists of several reciprocal stages, as illustrated in figure 2.6.

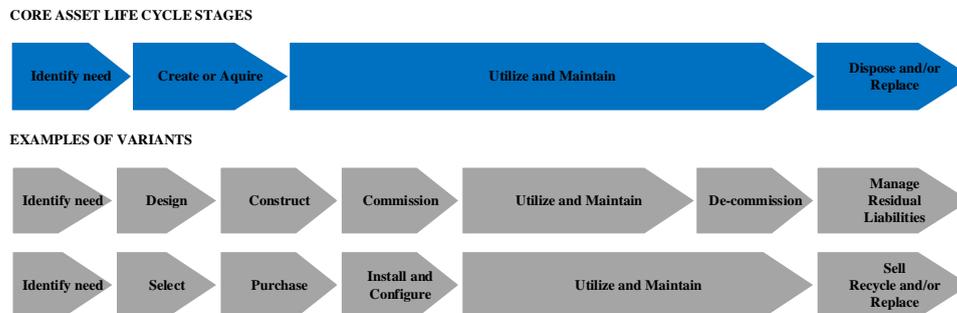


Figure 2.6: The core asset lifecycle stages and examples of variations (Adopted from IAM (2014))

Optimisation, or optimised decision-making is essential for the achievement of successful AM (Woodhouse, 2006; IAM, 2014). It involves the ability to identify the best compromise between conflicting objectives or influences, such as asset care (i.e. maintenance, investments, and risk management) and asset exploitation (i.e. asset utilisation to meet corporate objectives and to achieve performance benefit, operating expenditures, and sustainability). More practically stated by (IAM, 2014), “optimisations involves the adjustment of inputs subject to constraints in order to minimise or maximise an objective function”. Normally this combination represents the lowest arrangement of business impact (i.e. costs, risks, performance losses, or maximisation of net value) across the asset lifecycle. Decision-making for AM varies in complexity and criticality, thus it is important to be proportionate and to not apply equality in context of sophistication to all decisions (IAM, 2014). Making AM decisions is constrained with factors (e.g. budget, resources and regulation constraints) which causes the inability to apply the optimum solution. It is, therefore, important for the manager responsible for assets to understand the constraints in order to obtain the balance point of optimisation. See an illustration of optimised decision-making in figure 2.7.

One should consider optimisation of AM plans at several levels of decision-making. IAM (2011) suggest those interested in implementing AM should build a transparently justified total programme that minimises rework and as previously

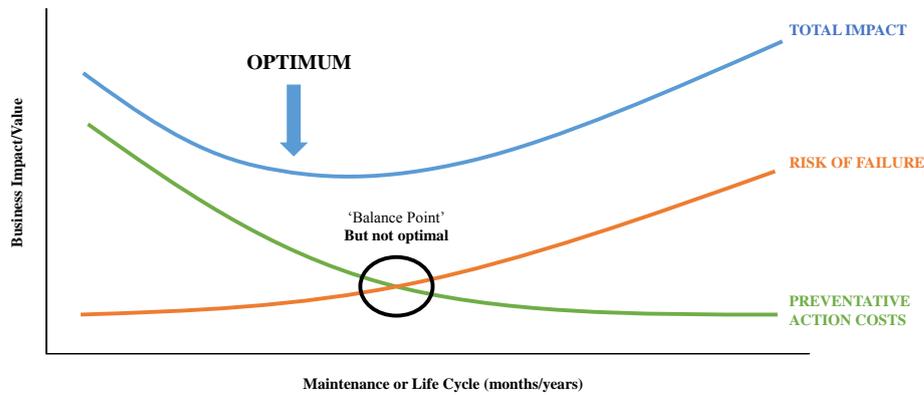


Figure 2.7: Optimum value achieved by optimising cost, risk, and performance impact (Adopted from IAM (2014))

mentioned, they should consider an integrated system approach. According to IAM (2011), this programme has to reflect on the following three levels of optimisation:

1. Individual interventions should be optimised for cost, risk, benefit and timing (e.g. decision-making regarding the cost or benefit and optimal timing for a particular investment, maintenance or inspection task, mitigation or modification project or renewal of a specific asset)
2. Optimisation should consider the best combination of different activities performed on the same asset over its entire lifecycle (e.g. this may include the planning of contingency scenarios to explore different combinations of capital investment, operating strategies, maintenance and economic lifecycles)
3. Optimisation of delivery activities which include the best work programming, task building, resourcing and efficient delivery of multiple tasks across multiple assets (e.g. such refinements of the AM plan has to consider the cost and risk impact of performing task prematurely or beyond their optimal timing to obtain enhanced benefits of system access or downtime, logistics or overheads, and other resource efficiencies).

In order to organise the various facets of AM, a system to provide a sense of direction and control is advised. In the context of both PAS 55 and ISO 55000, an Asset Management System (AMS) is suggested which is accompanied with standard requirements and instructions to establish a clear policy and strategic direction, AM plans, operational controls and activities for continuous improvements (IAM, 2014). It is important to note that not all aspects of AM (e.g. leadership, culture, motivation, behaviour, etc. which can significantly influence AM) can be formalised within the AMS. These aspects may however be managed outside the AMS, using supportive tools, techniques and deliverables such as TQM, JIT, FMEA, Reliability Centered Maintenance (RCM), six-sigma etc. (Woodhouse, 2006), which can significantly contribute to lifecycle and optimised AM (International Standard Organization, 2014a). Moreover, (Woodall and Montgomery, 1999) also confirmed that

TPM and TQM aid with AM's intangible responsibilities – referring to the attitude, motivation and performance of the workforce. The liaison between core AM terms are shown in figure 2.8.

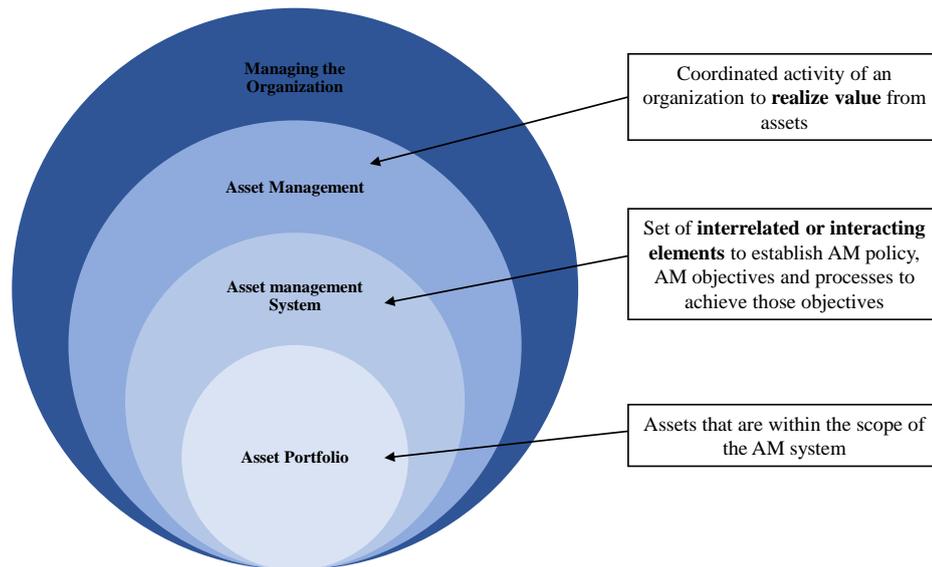


Figure 2.8: Liaison between core terms (Adopted from International Standard Organization (2014a, 4))

The philosophy of AM does not always require a systematic approach, that consists of documented business procedures, standards and policies. However, for those organisations that wish to comply with the ISO 55000 series, it is inevitable that rigour in management of documents and records would be required (Gaarenstroom, 2014; IAM, 2014). The aim of this system is to ensure appropriate documentation in order to add value.

According to IAM (2014), a clear connection between the strategic organisational plan, known as the business plan, and everyday activities of individual departments (e.g. engineering, procurement, maintenance, operation, planning, performance management, etc.) is essential in the attainment of a good AMS. This connection is generally referred to as the alignment (or line of sight) since participants have to have a clear understanding of what their activities exactly entail. This type of alignment is known for achieving the following benefits: prioritisation and coordination; stimulating employee's ability in creativity and innovation; and aligning top management decisions and corporate strategies with fact-based realities (IAM, 2014).

2.2.2.2 Definition of AM

Many scholars define AM as a strategic and integrated set of comprehensive processes (e.g. financial management, operating management, risk management, maintenance management, engineering, etc.) that operate a group of assets throughout its entire lifecycle in order to guarantee lifetime effectiveness, utilisation that is concerned with risks, and return from assets (Schneider *et al.*, 2006; Pinto *et al.*, 2013). The focus of AM is mainly on managing assets more effectively to deliver value (e.g. lower costs than those of the competing organisations and higher return on fixed assets (ROFA) to their shareholders or stakeholders) and to achieve the clear purpose of the organisation (Anon, 2006; IAM, 2014).

In an attempt to define AM more specifically, Both PAS and the ISO 55000 series enables convergence to the simplicity of the term “AM” within the international expert community (British Standards Institution, 2008; International Standard Organization, 2014a).

PAS 55 – defines AM as the “systematic and coordinated activities and practices through which an organisation optimally and sustainably manages its assets and asset systems, their associated performance, risks and expenditures over their lifecycle for the purpose of achieving its organisation strategic plan” (British Standards Institution, 2008).

ISO 55000 – views AM as the “coordinated activity of an organisation to realise value from assets” (International Standard Organization, 2014a).

The definition by ISO 55000, is intentionally constructed in its most simplistic and general form to allow organisations the freedom to decide for themselves how to manage the common use of assets in order to derive the best value (IAM, 2014). Supportive to the definition of AM, ISO 55000 qualifies the definitions with three important notes (International Standard Organization, 2014a):

1. Realisation of value will normally involve a balancing of costs, risks, opportunities and performance benefits.
2. Activity can also refer to the application of the elements of the AMS.
3. The term “activity” has a broad meaning and can include, for example, the approach, the planning, the plans and their implementation.

For the purpose of this research, the ISO 55000 definition for AM is preferred since it is the more recent authority.

2.2.3 Implementation Principles of AM

Over the last 10 years, the understanding of the implementation principles of AM has significantly matured and more recently, various approaches, standards and business models have been developed globally and aligned to the AM philosophy (IAM, 2014).

According to IAM (2014) and Woodhouse (2006), it is more appropriate to refer to AM as an integration framework that enables organisations to attain their explicit aims in a structured approach. This implies that AM may incorporate methodologies from other management approaches (e.g. TQM, QM, Lean, Six-sigma, TPM) that are aligned with delivering value, to acquire the most appropriate combination of tools and techniques to achieve their organisational aims.

Tools, techniques and technologies are essential to AM. However, the engagement of the workforce, effective leadership, cooperation between different departments and functions are the most vital contributing factors to an AM organisation (Mitchell, 2007; IAM, 2014). Therefore, a suitable AM culture (that considers the competence, knowledge, motivation and teamwork of people) is critical to implementing a good AM philosophy.

As previously mentioned in section 2.2.1, the principles of AM may be translated into 39 Subjects that form the core of the AM Landscape. AM is a holistic discipline (IAM, 2014), therefore, it is necessary for organisations to consider the complete scope of AM as described in the 39 AM Subjects, developed by IAM and their international partners within the GFMAM. As such, any person or organisation interested to become demonstrably competent or expert in the AM field, needs to understand the importance and knowledge of each Subject. The 39 AM Subjects are categorised into six AM Subject Groups which are reflected in figure 2.9.

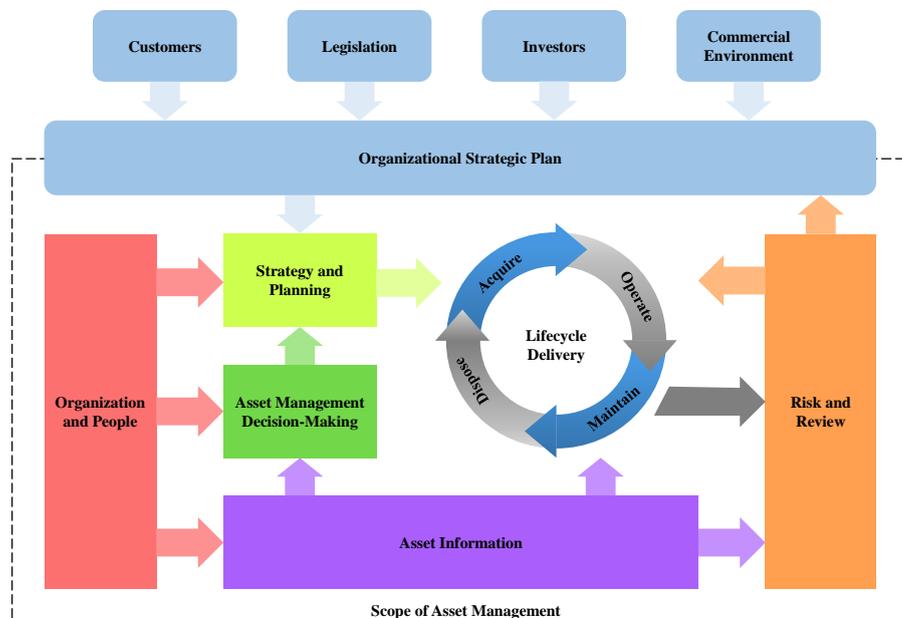


Figure 2.9: The IAM conceptual model for AM representing its Subject Groups (Adopted from IAM (2014))

The conceptual model is designed by the IAM to describe and illustrate the AM Landscape as well as to define the high-level groups of activities that are aligned with the discipline (IAM, 2014). Moreover, this model reflects the natural transition point between the coordination and direction for a wider range of assets (e.g. human resources, financial assets, reputation) and those primarily focused on the lifecycle of physical assets or infrastructure. This model, therefore, illustrates the integration of the six groups of activities, which stresses the importance of implementing all activities holistically (figure 2.9). Additionally, this model emphasises the critical issue of aligning all AM activities correspondingly to the organisation's goals.

Each Subject Group as well as each corresponding Subject is described in more detail in section 2.2.4.

2.2.4 Subject Groups and Description

Even though these Subjects are described and discussed individually (seen in sections 2.2.4.1 to 2.2.4.6), it is important to consider them as not discrete. The correlation between the Subject and its contribution to the organisation's capability for AM is a critical aspect to the AM Landscape and should, therefore, be approached holistically.

2.2.4.1 Strategy and Planning

The strategy and planning Subject Group encompass critical AM activities that are necessary in the development, implementation and improvement of the AM approach within an organisation while considering organisational and business objectives, provided that it includes all changing demands over a certain period of time (IAM, 2014). The AM strategy will contain documented information that stipulate how AM objectives are aligned with organisational objectives. In support of achieving the AM objectives successfully, IAM (2014) states that the AM Strategy must also contain the approach attained to develop the AM plan as well as a clearly defined prophecy to the AM Strategy. In addition, the AM plan typically explains what the organisation does with its assets in order to achieve their objectives that are related to required resources and time-scales in respect of lifecycle activities (e.g. acquisition, maintenance, operation and disposal). More specifically, the ISO 55000 series define a Strategic Asset Management Plan (SAMP) as follows (International Standard Organization, 2014a, 14):

“documented information that specifies how organisational objectives are to be converted into asset management objectives, the approach for developing asset management plans, and the role of the asset management system in supporting achievement of the asset management objectives”.

The definition is qualified with the following two notes (International Standard Organization, 2014a, 14):

1. *A strategic asset management plan is derived from the organisational plan.*

2. *A strategic asset management plan may be contained in, or may be a subsidiary plan of, the organisational plan.*

During strategy and planning, it is necessary for organisations to consider the outputs from assets and the available possibilities for developing these outputs to determine the holistic, optimum life costs. Therefore, the consideration of an AM strategy over long-term time frames is required to guarantee that the enduring inferences of AM decision-making are understood (IAM, 2014). As a result, IAM (2014) suggests that strategy and planning should be integrated with AM decision-making activities, as will be discussed in the section that follows. Prior to achieving long-term planning, strategy and planning, organisations should consider uncertainties. In respect to long-term planning, typical uncertainties include: future demands; service change; asset deterioration rates; risk change over time; innovative technology; changes of legislation and regulation; and changes of economic business environment (IAM, 2014). The understanding of these uncertainties and its implications should consider the likelihood of cost, risk and level of service impact.

The AM strategy is mostly focused on long-term strategic requirements of physical assets while providing guidance and direction toward the establishment of an investment and maintenance plan. This is a necessity for the attainment of relevant resources, including finances, that are used to consistently manage assets in order to obtain desired outcomes (IAM, 2014). Moreover, the development of the AM strategy has to be aligned, and consistent with the delivery of maintenance plans (e.g. improvement of business processes) which are also expected to correlate with other strategic plans (IAM, 2014) concerned with enablers for integration and sustainability (Woodhouse, 2013). These enablers include: leadership; consultation; information management; training; human resources; communication; competency development; etc.

The AM Subjects that are interrelated to the strategy and planning Group include the AM policy, AMS and objectives; demand analysis, strategic planning and AM planning. These Subjects are summarised in appendix A.2.1 for further in-depth reading.

2.2.4.2 AM Decision-Making

It is essential for organisations determined to attain good AM decisions to acquire appropriate knowledge and to apply this knowledge within a robust framework for decision-making. Once the AM strategy, derived from, and aligned with, the AM policy are consistent, the AM strategy and objectives will provide a stable framework that allows mutual AM decision-making (IAM, 2014). According to IAM (2014), the overarching principles constructed by the AM policy support the production and implementation of the AM strategy and objectives and AM plan(s). The criteria established by the AM strategy is, therefore, used to drive and optimise AM decision-making.

Another critical element to AM decision-making is to acquire the appropriate asset knowledge required for specific assets grouping outline below (IAM, 2014):

1. **Strengths and weaknesses** – to understand the critical state and condition of the asset.
2. **Opportunities** – in order to improve AM capability, opportunities refer to those actions attained to improve the asset condition as well as the adoption of new skills and technology.
3. **Threats** – to identify possible risks that affect performance capability and to understand how to manage these risks by implementing mitigation plans.

AM decision-making is important to all stages and elements of the asset lifecycle (IAM, 2014), therefore it is critical to align decision-making with the lifecycle to optimise the holistic value given that it considers any constraints, regulatory obligations or constitutional legislations. Furthermore, AM decision-making is normally undertaken at the same time as strategic planning which are essential for the development of an optimised AM plan(s). It may be used for specific once-off decision-making (e.g. optimising an investment scheme) as well as for non-specific decision-making (e.g. finding the optimal renewal policy for assets to use extensively). Referring to non-specific decisions, AM decision-making are only allowed to initiate after it is embodied into asset specific policies. Once these policies are generated, they are combined with asset knowledge prior to developing costs and work volumes and tasks for the asset portfolio within the AM plan(s) (IAM, 2014). It is critical to continually review the outputs obtained from the application of these policies to ensure that they are aligned with the process(s) of AM decision-making (IAM, 2014).

The AM decision-making Group consists of the following Subjects: capital investment decision-making; operations and maintenance decision-making; lifecycle value realisation; resourcing strategy; shutdowns and outage storage. A summary of each of these Subjects is outlined in appendix A.2.2.

2.2.4.3 Lifecycle Delivery

The lifecycle delivery Group is confined with the majority of incurred expenditures. The application of good AM in lifecycle delivery activities (i.e. acquire, operate, maintain, dispose) enables significant opportunities to identify efficiencies. If these activities are not managed effectively, it would provoke risks within opportunities for the identification of efficiencies (IAM, 2014). As seen in figure 2.9, it is prevalent that lifecycle delivery activities should not be encountered individually as these activities are interdependent. According to IAM (2014), operations and maintenance is concert to the lifecycle delivery activities of which many other operations and maintenance cycles may occur before the final disposal of an asset.

It is important for organisation to understand that the full lifecycle approach to lifecycle delivery activities should be adopted. The approach normally requires organisations to consider the maintenance delivery phase at the asset creation and

acquisition and systems engineering phases of the asset lifecycle in order to ensure that maintenance issues are included into the design. The asset disposal phase at the asset creation as well as the acquisition and systems engineering phases of the asset lifecycle may also have an effect on disposal costs through the engineering design, construction procedures or material assortment (IAM, 2014). It is, therefore, important to continuously improve the design of assets and systems by acquiring knowledge from the fact that maintenance delivery and operations generate feedback to the asset creation as well as acquisition and systems engineering activities.

The AM Subjects that correspond to the lifecycle delivery activities Group include: technical standards and legislations; asset creation and acquisition; systems engineering; configuration management; maintenance delivery; reliability engineering; asset operations; resource management; shutdown and outage management; fault and incident response; and asset decommissioning and disposal (refer to appendix A.2.3, for a summary of these Subjects).

2.2.4.4 Asset Information

Asset intensive organisations, which refer to those organisations concerned with reliability and productivity of capital assets (McMullan, 2004; Van Heerden and Vlok, 2015), typically rely on four underlying enablers when implementing both strategic AM activities and operational activities, namely: asset data; information; knowledge; and wisdom (IAM, 2014). Data and information can be approved by using a management approach that depict an overall asset information strategy, which generally defines the activities used by the organisation to ensure that asset information requirements are met (IAM, 2014).

The asset information guidelines, established by the IAM in response to the high demand from the AM community for guidance to properly execute and manage asset information, explicitly define asset information as (IAM, 2009):

“Asset information is a combination of data about physical assets used to inform decisions about how they are managed”

The guideline further comments that good asset information enables asset managers to make better decisions (e.g. to determine the optimal asset maintenance or renewal frequency of assets). In the context of AM, these decisions may be based upon information that typically include the following (IAM, 2009, 2014):

- asset inventory or asset register (e.g. records of asset existence);
- attributes of assets (e.g. age, capacity, etc.);
- attributes of asset system (e.g. capability);
- asset location, spatial information, dependencies, connectivity information;
- asset performance information (e.g. asset reliability and condition, etc.);

- access requirements (e.g. permits, safety, requests);
- historical records of assets;
- documentation, model designs and visual illustration of assets;
- consequence and probability of asset failure;
- work option specifications and costs;
- constraints (e.g. resource availability); and
- business priorities (e.g. regulatory requirements).

The nature of asset information varies and intersect extensively. For this reason, asset intensive industries should clearly understand what information is necessary to obtain within the field of AM, how it should be obtained, documented and analysed, and how it should continuously be improved upon (IAM, 2009). Both PAS 55 and ISO 55000 identifies and clarifies the requirements for asset information and AM systems; thus, the reader is advised to refer to these publications whilst reading this discussion. Asset information standards² are developed to clearly define the landscape for data and information in order to ensure that asset information is collected, categorised and it provides the link between data and its meaning (IAM, 2014).

Asset information systems are known as the collection of technology, processes and applications to collect, store, process and analyse asset information. These systems are used to automate AM processes while enabling reliable and consistent decision support analysis (IAM, 2014). These systems are generally integrated with a register of all assets within the organisation to allow effective integrated planning and operation of activities (IAM, 2014). IAM (2014) further states that it is critical to assess, understand and manage the quality of data and information to effectively provide support to business decision-making and processes. As such, asset intensive organisations does not always have the capability to obtain all asset information as required and those that are obtained do not necessarily meet the required quality for data and information. Therefore, it is required that organisations assess and prioritise data collecting and cleaning in order to focus on those regions that are beneficial (IAM, 2014).

The asset information Group consists of the following AM Subjects: asset information and strategy; asset information and management; asset information systems; and data and information (refer to Appendix A.2.4, which summarises the mentioned Subjects for in-depth understanding).

²The ISO 8000 series of international standards provide useful guidance regarding the management of asset information and is therefore important to refer to that standard if one wants to understand it in greater detail.

2.2.4.5 Organisation and People

According to IAM (2014), AM may be thought of as “a way of thinking that puts a new light on everything an organisation does”. Generally, this “way of thinking” about AM depicts traditional activities, existing structures, roles and responsibilities as well as predetermined relationships which are translated over generations (IAM, 2014). This is known as the AM culture.

The organisation and people Group consists of Subjects that are substantially interrelated and strongly influence the organisation’s ability to successfully adopt and implement AM. These Subjects include: procurement and supply chain management; AM leadership; organisational structure; organisational culture; and competence management. The main purpose of enabling these Subjects is to yield performance and establish the behaviours that are required to deliver the AM strategy and objectives discussed in section 2.2.4.1. Each individual Subject has interrelated implication which need to explicitly be defined, risk assessed and actively managed in order to achieve a successful AM strategy. These Subjects are important principles to deliver high level business integration that exemplifies the capability of mature AM (IAM, 2014). Each Subject is briefly discussed below (refer to appendix A.2.5, for a detailed summary of these Subjects).

Typically, organisations that implement effective AM are clear on what activities to outsource and what should remain internal (IAM, 2014). This type of organisation’s procurement and supply chain management approach is concerned with quality, cost, risk, and performance management. These type of organisations are required to develop and manage both contractor and supplier relationships and capabilities while considering long-term AM goals (IAM, 2014). Effective AM leadership is required to ensure that all AM activities, strategies and plans are communicated, understood and properly implemented by all participants, ranging from different departments to professional functions or work groups, in order to attain the best value from assets. Furthermore, it is important to note that the organisational structure should be aligned with, and compliment, the AM strategy (IAM, 2014). It is, therefore, the responsibility of top or senior management responsibility to: clearly depict what the asset responsibilities are; determine the communication network and report system; clearly establish what the roles and responsibilities of AM participants are to ensure that they are contributing to information sharing; establish cross-functional and multidisciplinary teamwork; and other features of good AM behaviours.

Another important Subject is organisational culture as it has an effect on people’s perception of, behaviour towards, commitment to and feeling towards good AM (Mitchell, 2007; IAM, 2014). Here, the top management is obliged to proactively shape the organisational culture and climate that are aligned with the AM culture and their organisation’s specific AM goals. Top management has to consider the following best practice principles to decide on an appropriate organisation structure and culture when implementing AM (IAM, 2014):

- be explicit about the purpose of the organisation;

- ensure consistency across the entire organisation;
- ensure that all employees understand the benchmarks of their responsibilities and accountabilities;
- create employee empowerment;
- ensure that all employees are clear about the chain of command and how issues escalates;
- create a clear understanding regarding the organisation's communication channels and how information is transferred, which includes: top-down; bottom-up; and side-ways communication;
- ensure that communication is acted upon; and
- ensure visible support and engagement from top management for any AM changes or improvements.

The last Subject to classify as important, is competence management. This type of management approach enables the organisation to identify and assign enough competent employees to establish employee empowerment and effective team working. According to IAM (2014), the “systematic approach to defining competence and behavioural requirements, selecting and developing them and managing their work are hallmarks of best practice AM organisations”.

As seen in the discussion above, various responsibilities for top management is required. In summary, top management has the responsibility to:

- create an AM culture;
- acquire effective leadership;
- create the AM strategy which is complementary to the organisational structure;
- proactively shape the organisational culture and climate conducive to AM goals and AM culture; and
- establish competent management to create competency throughout the entire workforce.

Leadership has been identified as a critical factor to implementing sound management approaches by various authors (Das *et al.*, 2011; Ahire *et al.*, 1996), therefore, leadership should be elaborated upon in the context of AM. For this reasons, adequate leaders should be capable of the following (IAM, 2014):

- **Create a vision** – drive a sense of direction within the organisation, function or team. In context to AM, leaders should establish a clear vision for optimising its assets and how they will benefit from it. Also, it is their responsibility to explicitly articulate and communicate the vision in a practical but persuasive manner.

- **Decision-making** – leaders should be able to make difficult AM decisions. It includes those decisions that are not properly defined and non-routine as well as those decisions that requires tough choices to be made which may influence individuals or the entire organisation.
- **Inspire** – leaders must be able to inspire all employees to achieve organisational goals.
- **Create confidence** – it is leaders' responsibility to establish confidence to stakeholders towards the direction of, purpose of, and benefits achieved from implementing AM.

2.2.4.6 Risk and Review

Risk and review is an essential requirement for a sustainable AM system. As mentioned earlier in section 2.2.4.2, AM decision-making facilitates the incessant trade-off between performance, cost and risks whilst providing feedback and review of mechanisms to assist with the adoption of objectives and understanding of asset criticality to finally deliver business aims (IAM, 2014).

Stressing the importance of risk, it is required of organisations that they clearly understand their tolerance to risk in terms of finance, safety, environment, reputation and performance, in order to appropriately define criticality and inform the decision-making process (IAM, 2014). It is of fundamental significance to continuously develop and manage Stakeholder Engagement as it is their responsibility to face the risks of the organisation; therefore, a clear understanding of, description of, and communication channel for, tolerance to risk is required (IAM, 2014).

The AM Subject Group risk and review is also a critical factor for organisations in preparation for significant events such as accidents, incidents or the impact of climate change. Risk and review, therefore, ensures that the organisation has suitable contingency planning in place and consists of the most appropriate tools and techniques to assure business continuity or sustainability (IAM, 2014). Once the tolerance to risk and the criticality of assets to business decision-making is understood amongst all employees, the organisation has to ensure that appropriate feedback and review activities are available to monitor the risk profile in terms of risk limits (IAM, 2014). Towards the appreciation and development of criticality and risk measurement, a robust understanding of asset health and performance has to become insightful to all participants within the organisation. Thus, this structure facilitates informed and appropriate change request which can be controlled with a suitable change management process (IAM, 2014).

IAM (2014) suggests that organisations should adopt standard accounting prac-

tices to provide assurance³ and auditing⁴ processes. Using these controls in conjunction will provide additional feedback to report the evolution of all AM processes throughout the entire business (IAM, 2014).

The AM Subjects that correlate with the risk and review AM Subject Group include: risk assessment and management; contingency planning and resilience analysis; sustainable development; management of change; asset performance and health monitoring; management review, audit and assurance; asset costing and valuation; and stakeholder engagement (see appendix A.2.6 for a in-depth summary of the mentioned Subjects).

2.3 The need for AM in the Food Industry

In context of the food industry, it became apparent to discuss the relevance and need for AM. In this section, therefore, the AMS, requirements, objectives and alignment, competitive advantage and the benefits of implementing AM are discussed. The section may also serve as a preliminary to a possible business case.

2.3.1 The AMS – ISO 55000

In context to the research study, the ISO 55000 series of International Standards are referred to as the AMS to provide guidance for effective AM. ISO 55000 is applicable for an integrated approach to any relevant sectors, other than manufacturing, or the combined use with asset type-specific AM standards and technical specifications (International Standard Organization, 2014a; IAM, 2014; Pragma, 2015). As such, the ISO 55000 series is compatible for incorporation into food quality and food safety systems since most systems require similar management processes.

The ISO 55000 series consists of three interrelated documents, namely the ISO 55000 Asset Management, ISO 55001 Asset Management and ISO 55002 Asset Management. The first document, ISO 55000, is an introduction to AM which consists the following sections: overview; principles; and terminology. The ISO 55001 represents the main standard, that specifies and describes the requirements for the AM system whereas the ISO 55002 document describes the necessary guidelines for the application of ISO 55001. ISO 55002 also provides advice on how to interpret and implement the standard.

International Standard Organization specifies that the ISO 55000 series are primarily intended for those organisations interested in improving the realisation of

³ Assurance is those evaluation methods which are employed to assess the performance of an organisation. It includes the communication of the results of the process to add credibility for users. It may also be used to refer to the outcome of this process in which users or stakeholders feel “assured” and can therefore take decisions based on the information provided with confidence (Iansen-Rogers, 2010).

⁴ Auditing is a procedure in which an independent third party systematically examines the evidence of adherence of some practice to a set of norms or standards for that practice and issues a professional opinion (Auditing, 2005).

value from their asset base. Moreover, this series of standards is also applicable to those organisations who are involved in establishing, implementing, maintaining and improving an AMS or those involved in establishing, designing, implementing and reviewing of the AM activities. Apart from what is its intended use, adopting the ISO 55000 series will enable organisations to achieve their objectives by effectively and efficiently managing their assets (Van Heerden and Vlok, 2015). According to (International Standard Organization, 2014a), with the application of an AMS, organisations can be assure that their asset related objectives will continuously be achieved and sustained over time.

In order to establish, implement, maintain and incessantly improve AM, four influencing factors have to be considered (International Standard Organization, 2014a). These include (International Standard Organization, 2014a):

- the nature and purpose of organisation;
- its operating context;
- its financial constraints and regulatory requirements;
- the needs and expectations of the organisation and its stakeholders

Additionally, the effective control and governance of assets are essential in the realisation of value through managing risks and opportunities (International Standard Organization, 2014a). These factors are critical for achieving the optimum balancing point of conflicting elements, known as cost, risk, and performance. The food industry operates within an increasingly challenging regulatory and legislative environment (Desai and Desai, 2006; Trienekens and Zuurbier, 2008) from which its characteristic risks, that many assets present, are continuously evolving. A framework for AM is, thus, suggested to the food industry.

Provided that the fundamental principles for achieving a holistic AM strategy are obtained in the food industry, obtaining tangible benefits and leveraging opportunities may be expected. Furthermore, the ISO 55000 series explains that implementing AM will enable the organisation to realise the value form its assets by achieving the organisational objectives while it balances the environmental, financial and social costs, quality of products or service and performance. (International Standard Organization, 2014a) stipulates the following benefits from achieving AM holistically:

- improving Return on Investments (ROA) by reducing costs, while supporting asset value without sacrificing organisational objectives;
- improving asset investment decisions by enabling the organisation to improve decision making procedures and balancing costs, risks, opportunities and performance;
- managing risk through reducing financial losses, good will and reputation, improving health and safety, minimising social and environmental impact and finally reducing liabilities;

- improving the organisation's ability to demonstrate social responsibility;
- enhancing the organisation's reputation through improving customer satisfaction, stakeholder awareness and confidence;
- improving the organisation's sustainability by effectively managing short and long-term effects, expenses and performance which can improve sustaining operation and the organisation;
- demonstrating compliance by conforming to legal, statutory and regulatory requirements as well as adhering to the AM standards, processes and policies; and
- improving efficiency and effectiveness through reviewing and improving processes, procedures and asset performance.

Numerous researchers have confirmed that the international cooperation during the preparation of the ISO 55000 series allows general practices to be applied to a broad base of assets in a broad range of industries across a variety of distinct cultures (Woodhouse, 2013). It is, therefore, believed that the AM supporting ISO series of international standards are applicable to provide a positive contribution to the food industry's competitiveness.

2.3.2 Requirements, Objectives and Alignment

In order for the food industry to become competitive with the leading manufacturing sectors, they will have to first be capable of delivering optimal manufacturing results (Anon, 2006). The latter may also be termed Operational Excellence (OE) (Anon, 2006). AM is measured with OEE⁵ productivity and profits, but when comparing with world-class performers, AM is measured with OE (Anon, 2006)⁶. With the incorporation of a holistic AM strategy in the food industry's business system, OE results will be achieved, which will increase success delivery. This implies that those organisations that incorporates a business-wide, lifecycle system for reliability will succeed in OE (Van Heerden and Vlok, 2015). Figure 2.10 illustrates the value contribution of activities towards attaining OE.

International Standard Organization (2014c, 2) states that if the intended AMS is established or reviewed, it is critical to ensure that the approach is consistent and aligned with both the internal and external context of the organisations. This is important since it may influence the scope and design of the AMS. Van Heerden and Vlok (2015) therefore has suggested that the food industry should consider the following implementation objectives:

⁵OEE is calculated by multiplying three ratios: availability ratio (time available/calendar period), quality ratio (total quality product produced/total product produced), performance ratio (rate of production divided by capacity of machine to produced) (Anon, 2006).

⁶OE is calculated by multiplying QM with plant maintenance and (operations monitoring/world class manufacturing) (Anon, 2006).

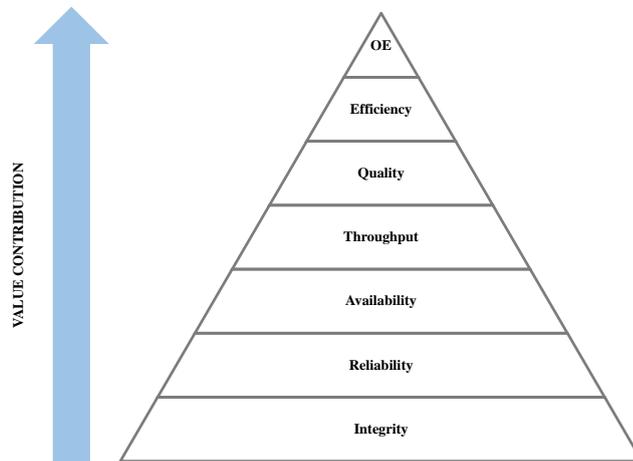


Figure 2.10: The value hierarchy of achieving OE (Adopted from Gaussian Engineering (2014))

- **Creating value:** The ISO 55000 series identifies that managing the asset will create value to the organisation. Thus, organisations should state clearly how the AM objectives will align with the organisation as well as establish a decision-making process that reflects stakeholder need and define value.
- **Creating alignments:** It is proposed that AM related decisions (technical, financial and operational) will enable the organisation to achieve its objective. Thus, organisations should implement a risk-based, information-driven, decision-making and planning process to transform the organisational objectives into AM plans. Also, organisations must strive to integrate the AM processes with the functional management ones.
- **Establishing leadership:** Leadership and a constructive workplace culture contribute to realising the value. Thus, organisations should establish leadership and commitment from all managerial levels to successfully establish, operate and improve AM within the organisation. Therefore, the roles, responsibilities and authorities must be defined, the employees must be informed and empowered, training as well as consultation with employees and stakeholders will be required.
- **Assuring that asset will perform optimally:** It is proposed by the ISO 55000 series of standards that AM will assure that assets fulfil their required purpose. Thus organisations should develop and implement processes to connect the performance and purpose of assets to the organisational objectives. They should also implement these processes to assure capability across the life-cycle of assets, providing monitoring and continuous improvement while providing necessary resources and competent personnel to demonstrate assurance by commissioning AM activities and operating the AM strategy.

2.3.3 Competitive advantage

From an engineering perspective, the approach of aligning the holistic AM Strategy with its supporting ISO 55000 series of international standards will help the food industry to attain a proactive nature, which will force them to move away from the break-fix approach and mentality (Van Heerden and Vlok, 2015). This proactive approach of AM will enable the organisation to gain real-time visibility into equipment failures before they occur (Anon, 2008). However, for the food industry to achieve this holistic approach, they will have to first consider and strive to become a top performer, the Best-in-Class.

According to Shah (2009), Best-in-Class organisations gain competitive advantage when compared to the Industry Average and Laggard organisations. Thus, the food industry has to compare themselves with those defined as Best-in-Class. Table 2.7 provides a clear indication of the average performance of a Best-in-Class organisation compared to the Industry Average and Laggard organisations. These statistical figures are based on respondent organisations from which the Aberdeen Group surveyed more than 160 manufacturing executives (Anon, 2008; Shah, 2009).

Table 2.7: Top performers earn Best-in-Class status (Adopted from Anon (2008))

Definition of Maturity class	Mean Class Performance
Best-in-Class: Top 20% of aggregate performance scorers	93% OEE
	2% unscheduled asset downtime
	99% production compliance
	12% reduction in maintenance costs
	+24% Return on Assets vs. Plan
Industry Average: Middle 50% of aggregate performance scorers	86% OEE
	6% unscheduled asset downtime
	97% production compliance
	17% reduction in maintenance costs
	+6% Return on Assets vs. Plan
Laggard: Bottom 30% of aggregate performance scorers	6% OEE
	13% unscheduled asset downtime
	85% production compliance
	2% increase in maintenance costs
	-5% Return on Assets vs. Plan

Table 2.7 clearly depicts the three important criteria for the measurement and classification of organisations. These criteria are measure as follows (Shah, 2009):

- OEE is a measure of asset performance, measured as a percentage by multiplying availability times performance times quality;
- asset downtime measured as the amount of time the asset is off-line against total asset availability;
- production compliance measured as a percentage of products produced that were in compliance to processes against the total products produced;
- ROA measured as the percentage of return on assets (new income/total asset) goal achieved versus corporate goal; and
- maintenance cost measured as year over year reduction in total maintenance costs.

As seen in table 2.7, Best-in-Class organisations overall have higher asset performance scores than the Industry Average and Laggards. It is also clear that Best-in-Class organisations outperform the other classes since they have a higher production compliance and lower unscheduled asset downtime. Concerning unscheduled asset downtime, the lower it is, the lower the significance for the occurrence of product losses (which are worth millions of rands) will become for asset intensive organisations (table 2.7). According to Van Heerden and Vlok (2015), the food industry is an asset intensive organisations; therefore, production losses and its criticality for cost of quality is extremely risky in terms of finances if they under-perform. It is, therefore, advised that the food industry should notice the intense difference between the maturity classes of AM since it directly contributes to the need for implementing the holistic AM strategy to ultimately gain the competitive advantage while benefiting from ROA and improving its profitability (Van Heerden and Vlok, 2015).

The Best-in-Class organisations practice a combination of strategic actions, organisational capabilities and business process capabilities to achieve their competitive advantage. They commonly implement a framework, called the Best-in-Class PACE (pressures, actions, capabilities, enablers) framework to achieve its status. This has previously been discussed in sections 2.2.3 and 2.2.4, however, table 2.8 serves as a good summary of AM related activities to which the food industry should strive for.

Van Heerden and Vlok (2015) further observes that benchmarking the Best-in-Class framework serves as the foundation for the holistic AM implementation, it can be expected that the food industry would achieve continuous improvement, OE, minimising costs and receive ROA (see table 2.8).

Table 2.8: The Best-in-Class PACE framework (Adopted from Anon (2006, 2008))

Pressures	Actions	Capabilities	Enablers
Maximise ROA	Optimise asset utilisation;	Executive ownership and sponsorship for AM strategies throughout the entire organisation;	Reliability Centered Maintenance (RCM);
	Executive focus on creating continuous improvement initiatives for AM;	Using AM data to analyse, predict, plan and schedule maintenance activities;	Predictive maintenance;
	Improve the visibility of asset performance into production;	Standardised processes for reliability and maintenance; The AMS is combined with predictive failure data analysis;	Manufacturing analysis; Risk management; Corrective and Preventative Actions (CAPA)
Maximise production capacity, availability, flexibility	Preventive and preventative maintenance programs	Real-time monitoring;	CMMS with integrated analytic tools;
		Calculation and alerts of OEE (KPIs)	The ability to monitor equipment in real-time
Product quality	Implement continuous improvement programs as well as condition monitoring technologies	Technological capability to collect and monitor SPC and other data; Facilitate root cause analysis	CMMS integrated to either MES or SPC-ability to detect and diagnose issues in real time
Align assets in response to market dynamics	RCM (reliability Centered Maintenance Program)	Monitor equipment performance;	Condition monitoring;
		Develop plans to avoid probable failures and loss of performance	Diagnostic solutions such as analytics services and diagnostic instruments
Asset reliability and longevity	Develop long-term asset strategy focused on reliability lifecycle and health needs	Maintain asset history, configuration and documentation	EDM (engineering document management); Configuration and data exchange for capital projects

2.3.4 Benefits of Implementing AM

It has been proven by various industries that are currently implementing AM and AM related environments that extensive benefits will be obtained through the improved management of assets by continuously focussing on the holistic lifecycle value realisations (Woodhouse, 2013). It is also prevalent that an effective work environment, where all departments function inter-dependently and efficiently, are accomplished using the holistic AM Strategy. With this application, it is evident that an increase in organisational profitability while meeting and exceeding customer expectations may be expected (Van Heerden and Vlok, 2015).

With the implementation of AM and its supporting use of the ISO 5500 series of international standards while obtaining the Best-in-Class status will reap significantly higher levels of benefits in comparison to the Industry Averages or Laggards. Such benefits include the following:

- substantial improvement of asset reliability;
- lower costs of servicing assets;
- greater uptime and availability;
- less downtimes and outages; and
- higher return on assets as well as in invested capital.

Moreover, the implementation procedure of AM will force the food industry to adhere to the following objectives (International Standard Organization, 2014b, 5):

- The organisation will be able to develop cross-functional teams, consisting of operators, maintainers, engineers and managers which directly add value to employee ownership and performance as well as equipment performances.
- The organisation will be able to be proactive in the dynamic market and move away from the break-fix approach
- The organisation will be able to successfully manage risks, improve services and outputs, make informed asset investment decisions, improve its financial performance and demonstrate its social responsibility as well as compliance.
- The organisation will be able to sustain OE over time while improving their reputation.
- The process of creating a holistic AMS will bring new perspectives to the organisation and new ideas on value creation from the use of assets. These perspectives will stimulate improvement in other organisational functions (e.g. purchasing, finance, information technology and human resource).
- Top management will be able to recognise the need to improve communication and interaction across functions, which will ensure that assets are managed in an integrated manner. Thus, the asset value is said to be improved.

- Management will be able to communicate with employees, suppliers and contracted service providers, which will increase the improvements on quality of asset information and create asset awareness amongst individuals.
- The organisation will be aware of robust financial information, which is based on integrated processes between the AM and finance functions. Therefore, this will allow the organisation to improve assessment of financial position and funding requirements in relation to assets.

Anon (2006) explains that manufacturers or producers, who aim to implement the holistic AM approach are in a better position to proactively react to market dynamics, increasingly stringent regulatory requirements and pressures as well as demanding shareholders.

With regard to the discussion for the need of AM, it is evident that the AM approach will aid with establishing a constructive work environment while achieving quality driven success, overall performance and financial success. Encompassing all benefits regarding AM, it will partake in a small contributory step towards attaining success of business excellence. The food industry, therefore, should invest in this approach.

2.4 Chapter Conclusion

Chapter 2 discusses the fundamental requirements for establishing effective TQM and AM. This it does by providing an overview of the topic under scrutiny and deliberating key aspects regarding the successful achievement of each management approach. This chapter also discussed the need for AM, hence, the requirements, objectives and alignment of its AMS (the ISO 55000 series of international standards) were depicted as well as its competitive advantage and benefits of implementing its system in context of the food industry.

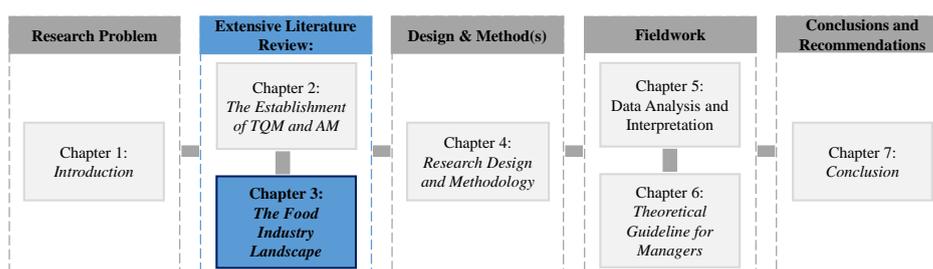
Evidently, this chapter contributes towards achieving the first objective and answers the first sub-question of this study. Sequentially, the following sub-objectives were addressed and established (refer to section 1.4):

- The historical background of TQM and AM was reviewed;
- Both TQM and AM were defined; and
- The fundamental management principles required for both TQM and AM implementation were identified.

The chapter (the first part of the extensive literature review) served the purpose for providing the appropriate and supporting background for theory development. Consecutively, it served as a preliminary to the holistic understanding of the emerging guideline for managers. The following chapter, chapter 3, concludes the extensive literature review.

Chapter 3

The Food Industry Landscape



This chapter serves as the second part of the extensive literature analysis. This chapter aims to shape the South African food industry by identifying essential frameworks, guidelines, standards and certifications required for achieving quality holistically, known as Total Quality Management (TQM). Furthermore, possible gaps for Asset Management (AM) incorporation to the existent Total Quality Management System (TQMS) are deliberated. In accordance with chapter 2, this chapter also serves as the foundation for the grounded theory analysis procedure, which will be discussed in the succeeding chapter.

3.1 Management Systems and Certification History

Certification provides accreditation that a product complies with specific international standards (NFS, 2015). It enables food organisations to ascertain assurance that the food they produce has been manufactured and handled in accordance to the recognised standard. More specifically, the Global Food Safety Initiative (GFSI) certification provides independent certification of the most common standards used throughout all food industry types. Certification is critical to the food industry as it demonstrates a commitment to quality processes and continuous improvement, which in turn, authorises access to the leading retailers (NFS, 2015). If organisations attain certification to GFSI benchmarked standards, it is possible to increase brand protection and to minimise risks (NFS, 2015). Apart from this, being certified (or even GFSI approved) may reveal a food manufacturing organisation's robust commitment to safe manufacturing materials and processes. Thus, certification may be viewed as critical since it separates industry leaders from industry followers. The evolution of certification will now be discussed.

The International Organisation for Standardisation (ISO) 9000 family of standards has been developed to assist all sizes and types of organisations to implement and operate effective Quality Management Systems (QMS) (International Standard Organization, 2005, v). Simultaneous implementation of the ISO 9000 family (i.e. the ISO 9000, ISO 9001, ISO 9004 and ISO 19011) form a coherent set of QMS standards facilitating mutual understanding in national and international trades (International Standard Organization, 2005, v). The South African National Standard (SANS) 9000:2005 is the identical implementation of ISO 9000:2005, which are adopted for organisational use with the permission of the ISO.

The food industry, however, realised that implementing ISO 9001 and focussing on quality in solitaire was no longer sufficient. The global concern of food safety emerged for the following reasons (Progress Excellence, 2013): (a) it is important for the public health; and (b) it has a great impact on international trade.

Thus, during the 1960s, the Hazard Analysis and Critical Control Point (HACCP) principles, which form the basis of many Food Safety Management Systems (FSMS), were created (later published as Dutch HACCP) in accordance to the high demand for hazard and critical control within the food industry caused by globalisation of food production and procurement (Progress Excellence, 2013). A few years later, HACCP (1991), as part of European regulations, and the Safe Quality Food Standard (SQF) (1995), known as a comprehensive HACCP-based food safety and Quality Management (QM) certification system for all sectors of the food industry (NFS, 2015), were published. In 1996, the HACCP standard in South Africa was released and in 1998, the British Retail Consortium (BRC) food Standard, to help promote consistency across the supply chain for food and ingredient manufacturers, wholesalers and distributors (NFS, 2015), was issued.

Moreover, the increased demands of customers, increased legal requirements and product supply globalisation forced food organisations to attain a uniform quality as-

insurance and food safety Standard. This led to the development of the International Food Standard (IFS) by the Handelsverband Deutschland (HDE) and its French counterpart, Fédération des Entreprises du Commerce et de la Distribution (FCD), in 2003. In 2004, the IFS was launched for the first time while version 6 was published in 2012 (Foundation for Food Safety Certification, 2013).

Parallel to the global concern for food safety, globalisation of food production and procurement has increased the complexity of food chains, which significantly induced the risk of food safety and quality incidents (Foundation for Food Safety Certification, 2013). Corresponding to this, the food industry argued that implementing both ISO 9001 and HACCP has become tedious and, therefore, FoodDrinkEurope attempted to develop an integrated standard, which consists benefits of both. Thus, the ISO 22000 standard for Food Safety Management (FSM) which applies to all organisations in the food chain (Foundation for Food Safety Certification, 2013) was launched in 2005.

Corresponding to the development of the ISO 22000, an increased requirement for harmonised certification of the food safety systems to ensure that all measures are taken that certify food safety throughout the food chain arose (Foundation for Food Safety Certification, 2013). The ISO 22000 was, therefore, at first not approved by the GFSI since it lacked the necessary requirements for Prerequisite Programs (PRP). Responding to the demand for sound PRP's, the British Standard Institution (BSI) issued BSI-PAS 220 (a technical specification also currently known as ISO/TS 22002-1:2009) in 2008, which contains requirements for good practice in food manufacturing that specifically meets the demands of customers (Foundation for Food Safety Certification, 2013).

Ultimately, the food industry demanded a certification scheme for food safety systems of an organisation in the food chain that incorporates both BSI-PAS 220 and ISO 22000. The Foundation for Food Safety Certification (FSSC) 22000 was, therefore, issued and approved by the GFSI as a recognised certification scheme in 2010. The scheme was re-benchmarked and recognised by the GFSI in 2013 for approval against the GFSI Guidance Document version 6 (Foundation for Food Safety Certification, 2013). It is important to note that in order to achieve FSSC 22000 certification, ISO 22000:2005, ISO/TS 22002-1:2009 and additional FSSC requirements (such as guidance on the application of ISO 22000) should be implemented in combination to successfully implement the certification requirements and to ensure trustworthy food safety certificates (Foundation for Food Safety Certification, 2013).

Management systems developed overtime in response to market demands. More specifically, ISO standards developed in response to the request from industry or other stakeholders such as consumer groups. The development of standards is based on global expert opinion and proceeds with a multi-stakeholder processes (ISO, 2013). The development of ISO standards is a consensus-based approach to which valuable comments from stakeholders are taken into account at all times. Standards provide a framework to follow when setting up and operating a management system (ISO, 2013). As such, all ISO management systems standards consists of a significant

similar structure, text and common terms and definitions. The analogous systems structure ensures consistency among future and revised management system standards and also eases the possibility of the integrated process if deemed necessary (ISO, 2013). Thus, a management system is referred to as one integrated system that contains a combination of standards which could either be certified or not.

3.2 Global and Local Forums and Bodies

In this section, both global and local forums bodies is discussed in sections 3.2.1 and 3.2.2 respectively.

3.2.1 CIES and GFSI

During the 1990s, a series of high-profile international food safety crises (including dioxin, listeria and BSE) occurred. This led to the growing audit fatigue within the food industry since retailers and brand manufacturers audited factories against their countless in-house standards, which were developed in isolation and with no consideration of convergence (GFSI, 2000). This resulted in low consumer and food industry confidence. In response to this, the International Committee of Food Retail Chains (CIES)¹ – an international network of businesses active in the food industry known as the Consumer Goods Forum (CGF) – agreed to take collaborative action (GFSI, 2000). In 2000, the GFSI, a non-profit foundation, was founded by the CIES forum (Progress Excellence, 2013). The GFSI is an industry-driven initiative which provides thought leadership and guidance in context to FSMS required to ensure safety along the supply chain (GFSI, 2000; Progress Excellence, 2013). The GFSI align themselves with the slogan “certified once, accepted everywhere”.

According to Progress Excellence (2013), the existence of several international standards resulted into GFSI’s attempt to start benchmarking various standards to achieve a worldwide confidence in the delivery of safe food to consumers. GFSI recognised five to-date standards that are considered equal, namely (GFSI, 2000; Progress Excellence, 2013; NFS, 2015):

- BRC – Global standard for food safety (Issue 6);
- IFS (Version 6);
- SQF;
- FSSC 22000; and
- Dutch HACCP-based food safety system.

¹CIES groups approximately 400 retailers in 150 countries and an equivalent number of retailers and their manufacturers, e.g. Waitrose, Marks and Spenser, Tesco, British American Tobacco, SAB Miller (UK), Coca Cola (USA), Click, Shoprite Checkers (RSA), Coop, Migros (Switzerland), Danone (France) (Progress Excellence, 2013)

3.2.2 CGCSA and FSI

In 2002, the Consumer Goods Council of South Africa (CGCSA) was established as a neutral, non-profit standards and services organisation (Progress Excellence, 2013). The CGCSA facilitates engagement between stakeholders in the industry and also represent the interests of the industry to the government and other relevant parties. Thus, this organisation deals directly with best practices, standards, legal and regulatory issues in retail, wholesale and manufacturing industry as well as service providers in the consumer goods industry (Progress Excellence, 2013).

The South African Food Safety Initiative (FSI) operates under the supervision of CGCSA as a division. FSI is obliged to ensure that those food products that are produced, distributed and marketed in South Africa conform to the highest standards of food safety and nutrition and comply with legal requirements or recognised codes for good practice (Progress Excellence, 2013).

3.3 Food Safety and Quality

In the light of the discussion in sections 3.1 and 3.2, FSM serves as the building blocks for achieving a successful QMS. However, an effective food safety system is firmly based on PRP's (Progress Excellence, 2013). Therefore, food businesses must operate entrenched PRP's prior to implementation of HACCP (Progress Excellence, 2013). (Fuller, 2007) observes that "HACCP is not a 'stand-alone' system, however, it forms part of the overall TQMS of an establishment". By encompassing the elements of PRP's and HACCP holistically, the TQMS will be achieved. The holistic system and its relevant standards, whether certified or not, are placed in perspective in figure 3.1.

There are many benefits associated with the implementation of an effective FSMS (e.g. HACCP). These include (Progress Excellence, 2008):

- providing a preventative approach;
- helping identify process improvements with the involvement of maintenance;
- reducing the need for, and costs of, final product testing;
- complementing the QMS's (such as ISO 9001);
- providing evidence of due diligence;
- reducing product scrapping, losses and wastage;
- reducing the likelihood of product recalls and bad publicity;
- advancing customer satisfaction by reducing dissatisfaction;
- facilitating improved understanding and awareness of food safety issues throughout the entire organisation;

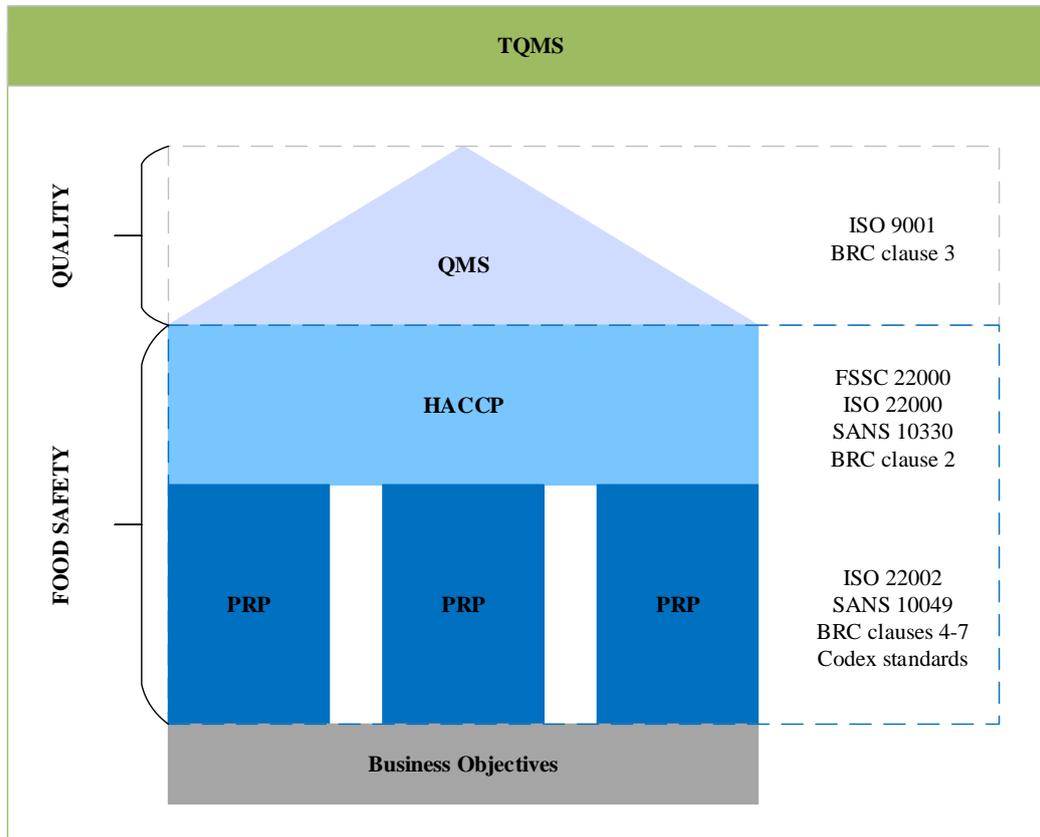


Figure 3.1: The holistic system towards achieving the TQMS

- establishing a cleaner working environment which leads to improved staff morale and motivation; and
- conforming to relevant regulatory authority.

3.4 Business objectives

Numerous standards are available to the food industry, ranging from private to public standards, national to international standards (Progress Excellence, 2013). Moreover, depending on countries and where the food products are mainly going to be used and recognised, the standards may vary. A summary of the different standards and their availability is depicted in table 3.1

As previously mentioned in section 1.1, food industries and their way of manufacturing are complex since they produce seasonal and non-seasonal food products of various varieties. Also, food organisations have to comply with specific standards in response to rigorous customer-defined quality thresholds as well as stringent regulatory and legislative requirements (Desai and Desai, 2006; Trienekens and Zuurbier,

Table 3.1: Summary for relevant standards (Adopted from Progress Excellence (2013))

Standard	Focus			Private, national or international	Country	GFSI ap- proved
	PRP	Quality	Food Safety			
BRC Global Standard for Food Safety	X	X	X	Private	United Kingdom	Yes
IFS	X	X	X	Private	Europe	Yes
Dutch HACCP-based food system	X		X	National	Europe	Yes
SQF	X		X	Private	America	Yes
ISO9001		X		International	World-wide	No
FSSC 22000	X		X	Private	World-wide	Yes
ISO 22000	X		X	International	World-wide	No
SANS 10330	X		X	National	South Africa	No
AIB (American Institute of bakers)	X		X	Private	America	No
ISO/TS 22002	X			Public	World-wide	No
SANS 10049	X			Public	South Africa	No

2008). Responding to these criteria, it is critical to properly define the business objectives when selecting a standard. Therefore, the organisations need to consider and define their vision in terms of (Progress Excellence, 2013):

- focus of their organisation (e.g. food safety, quality, environmental issues, health and safety);
- market for their products (e.g. local, international, relevant export countries); and
- acceptance of standards

Once the business objectives, and its vision are considered, the standard that aligns to the business objectives may be chosen.

Progress Excellence (2013) finds that it is important to take note of the following:

- If more than one applicable standard is identified, it is essential that those standards are implemented in an integrated manner. Therefore, one management system should include certification to different standards where relevant.
- The purpose of the management system should be to improve the business by complying with regulatory requirements of standards, and not for the sake of satisfying the auditor.

3.5 Prerequisite Programs

This section discusses essential elements of PRP's. It provides a brief overview of PRP's, control measures of PRP's, food legislations concerned with PRP's as well as the responsibilities related to PRP's (see sections 3.5.1 to 3.5.4).

3.5.1 Overview of PRP's

Food recalls, food scrapping and reworking are the result of negligence and non-compliance to PRP's (Progress Excellence, 2013). It is therefore essential for an organisation to maintain relevant PRP's since they form part of the basic control measures relating to food safety hazards (Progress Excellence, 2013). Progress Excellence (2013) states that the PRP's must be appropriate to the organisations objective in context to food safety. Thus, prior to implementing the most appropriate PRP, the size and type of the operation and the nature of the products being manufactured should be taken into consideration (Progress Excellence, 2013). Additionally, an organisation should consult various sources of information when selecting the relevant PRP's, among them are: statutory and regulatory requirements; customer requirements; recognised guidelines; Codex Alimentarius² codes of practice; and national, international or sector standards.

More specifically, Progress Excellence (2013) defines PRP's as:

“the basic conditions and activities which are necessary to maintain a hygienic environment throughout the food chain suitable for production, handling and provision of safe end products and safe food for human consumption”.

PRP's typically depend on the segment of the food chain from which the organisation wish to operate as well as the type of organisation. Other terms equivalent to PRP's exists (depending on the type of organisation), they include: Good Agricultural Practice (GAP); Good Veterinarian Practice (GVP); Good Distribution Practice (GDP); Good Manufacturing Practice (GMP); Good Hygiene Practice (GHP); Good Training Practice (GTP); and Good Production Practice (GPP) (Progress Excellence, 2013).

²The Codex Alimentarius is a collection of internationally recognised standards, codes of practice, guidelines and other recommendations relating to foods, food production and food safety (Codex Alimentarius, 2015).

The FSMS consists of a concrete foundation of PRP's. There are various documents available which describe the PRP's in great detail. The different documents confined with PRP's are listed in table 3.1 seen in section 3.4.

3.5.2 Control Measures

In order to successfully achieve PRP's, the handling and management of location, design, construction and maintenance of buildings and equipment should be properly executed. The latter may be referred to as "assets" in context to the food industry. Therefore, PRP's – classified into two different categories: structural requirements; and policy and programme requirements – should holistically be considered and implemented according to requirements stipulated in each document. A list of each category, found in different PRP documents, such as South African Bureau of Standards (SABS) 049:2001, SANS 10330, SANS 10049:2011, ISO/TS 22002, is summarised in table 3.2.

It is clear from table 3.2 that various structural requirements and policies and procedures exist. All of them are critical to ensure that possible hazards remain under control. Thus, it is necessary to establish and maintain schedules that address the defined policies and procedures (Progress Excellence, 2013) as listed in table 3.2.

3.5.3 Food Legislation

It is critical to consider that all documents related to PRP's refer to a requirement to comply with legislation. (Progress Excellence, 2013) stipulates that: "All applicable laws (national and international), by-laws, regulations and compulsory specifications shall be complied with. If a product is exported, the relevant legislation of the country of destination shall be complied with". In the South African context, the national departments responsible for food legislation are shown in table 3.3.

3.5.4 Responsibilities related to PRP's

The responsibility of top management is critical to successful implementation of management approaches and guiding frameworks. In the case of PRP's, various responsibilities are also allocated to top management in relevant Standards explaining PRP's in detail (Progress Excellence, 2013). In summary, it is the responsibility of top management to ensure that:

- relevant statutory, regulatory and customer food safety requirements are determined, recorded and met, and the promotion awareness thereof must be evident;
- all outsourced processes adhere to the relevant PRP's;
- responsibilities and authorities are clearly defined and communicated within the organisation to ensure effective operation and maintenance of the PRP's;
- policies, organisational objectives and customer satisfaction requirements are met;

Table 3.2: A brief summary of items and policies and programs related to various PRP documents (Adopted from Progress Excellence (2008))

Structural requirements	Policies and Programs
Grounds	Cleaning and Disinfection Programme
Roofs and Outside Structures	Maintenance Programme
Walls	Pest Control Programme
Floors	Personal Hygiene Programme
Drains	Control of Foreign Matter
Ceilings and Overheads	Allergen Management Programme
Doors and Windows	Product Recall, Traceability and Withdrawal Programme
Storage and Blending Vessels	Supplier Quality Assurance
Pipes	Training Programme
Equipment and Utensils	Service Needed for Production (e.g. air, water)
Change-rooms, Toilets and Ablution Facilities	Staff and Product flow
Canteens	External Areas to Facility
High Risk Areas	Labelling and Packaging
Lights	Construction of Equipment
Waste	Building Structure, Ablution Facilities, Production, Distribution and Storage
Ventilation and Air Quality	Management of Purchased Materials, Supplies, Disposals and Handling of Products
Compressed Air and Gasses	Measures for the Prevention of Cross Contamination
Water	Other Aspects as Required
Steam	

- the required resources for PRP are assessed and documented (documents include: time, competent staff, suitable and adequate infrastructure and work environment, equipment and funding) to provide appropriate resources for the establishment, implementation, maintenance and improvement of the PRP;
- all staff members are adequately trained and competent in context to PRP's; and
- a management representative (whom are part of, or report to, top management) is appointed to ensure that PRP is established, implemented, maintained and continually improved in accordance to the relevant Standards

Table 3.3: Food legislation acts determined by the national departments (Adopted from Progress Excellence (2008, 2013))

Department of Agriculture	Department of Health	Department of Trade and Industry	Department of Labour
Agricultural Product Standard Act, 1990 (Act No. 119 of 1990)	Foodstuffs, Cosmetic and Disinfectants Act, 1972 (Act No. 54 of 1972)	Product Standards Act, 1993 (Act No. 29 of 1993)	Employment Equity Act, 1998 (Act No. 55 of 1998)
	Hazardous Substances Act, 1973 (Act No. 15 of 1973)		Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)
	International Health Act, 1974 (Act No. 28 of 1974)		
	National Health Act, 2003 (Act No. 61 of 2003)		

3.6 Gap Identification

As mentioned in section 3.1, certification is extremely important to the food industry's global concern for food quality and safety in order to produce high-quality food products. Food industries mainly focus on achieving high-quality products that are safe for consumption. Hence, appropriate certifications are adopted responding to their focus. In an informal interview with food management systems expert, (Coetzee, 2015) explained that food industries are more concerned with attaining certification to satisfy their customers and have the mentality of implementing only those standards that would directly benefit the organisation in terms of increased client base and profitability (Personal communication, July 3, 2015). This statement is essential and should be considered when approaching the food industry in an attempt to explore the possibility of integrating AM within their already existing TQMS. This has led to a question that should not be ignored, that is:

Would the ISO 55000 series of international standards be relevant to the existing TQMS and would it satisfy the food industry's need for improved client base and profitability?

Although the need for AM and the benefits of the Asset Management System (AMS), the ISO 55000 series, has been theoretically discussed in section 2.3, its practical and extending benefits in the context of the food industry remains unknown. Hence, there exists a need to explore this state of affairs with management within food organisations.

From an engineering point of view, the importance of AM and its focus on effective utilisation of machines (or any other type of assets), considering risks throughout the asset lifecycle, and the performance of assets are as important as achieving qual-

ity as seen from the food manufacturers point of view. Thus, it is believed that AM could extend the benefits of existing food standards and its certification by introducing the ISO 55000 standard. The latter is possible since the structure of ISO 55000 is significantly similar to those of food standards, as mentioned in section 3.1.

Considering chapter 2 and 3 holistically, the need for two distinct departments, engineering and quality and food safety, to collaborate exists, since a desire for food industries to compete with the non-food manufacturing industry exists as well as the high demand for achieving quality products at lower production and market costs has been identified. It was also mentioned before that management principles are required for establishing sound management systems. Within the scope of this study and the high complexity and explorative nature of the topic under scrutiny, three questions arose from literature, these are:

1. *Does poor communication between quality and engineering departments exist?*
2. *Could AM possibly benefit the food industry's competitive advantage?*
3. *Is it necessary to address managerial principles prior to implementing an effective integrated management system?*

In consideration to the discussion above and the listed questions, an exploration for the elements of the integration of two supportive management approaches, TQM and AM, is proposed since it is believed that synergistic effects will provide benefits to the food industry. Thus, a detailed qualitative analysis is required to determine and confirm the appropriate relationship between AM and TQM on a strategic level which is parallel to the South African food industry's existing food management systems. Holistically, the concept of integration will be explored and all elements will be considered in accordance to professional opinions. Hence, the participants' inputs should ultimately lead to a guideline that is appropriate for use by management when experiencing the need for integration.

3.7 Chapter Conclusion

Chapter 3 is continuous to chapter 2 and therefore concluded the extensive literature analysis. In this chapter, the South African food industry landscape, in context to achieving quality holistically, was portrayed. The chapter started with a discussion of management systems and the history of certifications relevant to the food industry. Other important topics consistent with achieving TQM were discussed. For instance, an overview of the Global and Local Forums and Bodies that provides thought leadership and guidance in context to FSMS and certification to ascertain food safety and food quality along the supply chain was provided. The latter continued with a discussion regarding food quality and food safety as well as the influence of business objectives on standard selections and the importance of PRP's was elaborated upon. The chapter ends with a discussion identifying a possible gap for AM incorporation in the existing TQMS to which a proposition and three questions arose. These questions and proposition ultimately act as a starting point for further qualitative

exploration.

Primarily, the extensive literature analysis followed an explorative nature to provide a holistic, comprehensive and theoretical view of the problem stated in chapter 1. Considering the spirit of the grounded theory process, it is critical to note that chapter 2 and 3 are used sparingly throughout the succeeding chapters. Thus, these chapters are only used as a supplementary and affirmation source in attempt to reflect on results and to establish the domain to which the study findings can be confirmed for significances. Moreover, the extensive literature analysis will only be consulted once the data collection and analysis process commenced.

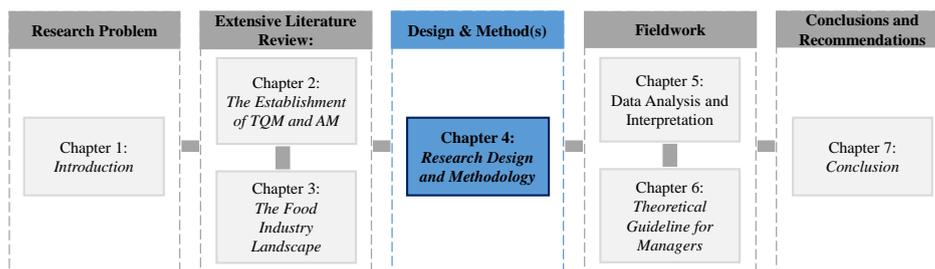
This chapter contributed to achieving the second objective and answered the first sub-questions, as defined in section 1.4, of this study. Consecutively, the following sub-objectives were addressed and established:

- The historical background of relevant certificates and standards were reviewed;
- It was identified how quality is achieved holistically; and
- A possible gap for AM in the existing TQMS was identified.

The following chapter discussed the choice of research design and constructs a well-defined research methodology that supports the topic under investigation.

Chapter 4

Research Design and Methodology



The previous chapters introduced the integration of Asset Management (AM) with Total Quality Management (TQM), described the conceptual framework of the study, and highlighted the need for research in the area of integrating AM with TQM to support management. This chapter outlines the methodology chosen for this research where special attention is paid to the appropriateness of techniques to the research topic under investigation. The chapter begins by presenting the research approach that ultimately led to selecting an appropriate research design and methodology for this study. Thereafter, the grounded theory approach as an interpretive research methodology and qualitative analytic framework is discussed. Also explained is how reliability and validity are verified throughout the research process to which the researcher's paradigm fit is further elaborated. Finally, relevant ethical considerations are discussed.

4.1 Research Approach

The research approach is defined as a structured strategy to develop the research. Creswell (2014) suggests three universal approaches to research, namely qualitative, quantitative, and mixed methods. In an attempt to select the appropriate research approach, Creswell (2014) comments that three components should be considered, which are: philosophical assumptions, research design and specific methods or procedures translating the approach to practice. Other important factors to consider prior to selecting an approach is the research problem, the personal experiences of the researcher and the targeted audience(s) for the research study (Creswell, 2014). The interaction of the three components are illustrated in figure 4.1, which serves as a framework from which the appropriate approach is selected.

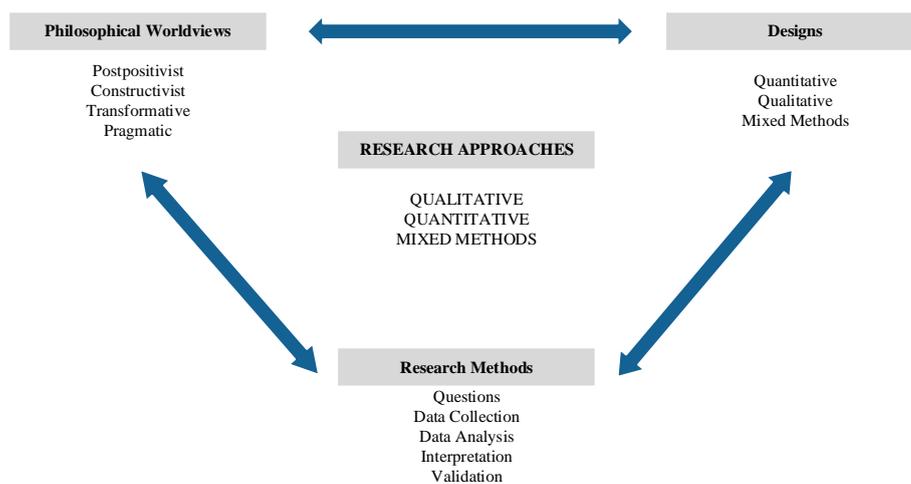


Figure 4.1: A research framework (Adopted from Creswell (2014))

The succeeding sections discuss the three components in an attempt to present the research approach.

4.1.1 Philosophical Assumptions

In search of an appropriate research method, two factors primarily guided the decision. Firstly, the focal area of this research study is unexplored which indicates the need for exploratory research paradigm. Secondly, the complexity of the issue at hand needed to be captured without reducing it to a fixed set of quantifiable constructs that have little meaning outside of the researcher's own statistical context. Thus, the qualitative research paradigm is deemed appropriate.

Strauss and Corbin (1998) and Creswell advocate the use of exploratory studies when researchers attempt to yield new insights into a research topic and to explore a

problem. Typically, qualitative research is chosen to establish a complex and detailed understanding of the issue (Creswell, 2007). Qualitative methods can either be used to explore areas about which little is known or which much is known to gain novel understanding Strauss and Corbin (1998). The purpose of this study is ultimately to develop new insights into the strategic integration of management systems which may, in turn, guide management in achieving high-quality products. Although it could be possible to hypothesise constructs for building a guiding framework appropriate to management and to explore each variable until a statistical correlation is found, there exists no better way to provide detailed understanding of the issue than the participants themselves. Creswell (2007) asserts that qualitative research is conducted in order to “understand the context or settings in which participants in a study address a problem or issue”. Thus, qualitative research enables researchers to study a phenomena as it emerges from real life situations without any manipulations (Creswell, 2007).

Furthermore, qualitative research is not confined with creating fixed sets of information patterns of human behaviours, instead, it is focused on making sense of human experiences in the context of their experiences with the phenomenon under investigation. Through this, qualitative research allows the researcher to understand the phenomenon within its context while uncovering links between concepts and behaviours (Bradley *et al.*, 2007). Ultimately, it leads to generating and refining theory.

These characteristics of qualitative research are deemed important for the purpose of this study, since it allow the researcher to engage in managers’ real life situations and to uncover what their professional experiences are. It also allow the voices of managers to be heard in the generation of possible solutions to their current situations and construct a holistic picture grounded in their input.

Considering the research study and the qualitative research characteristics, the research area does not consist of fixed sets of information and the discussions with participants are likely to result in complex discursive replies. A methodology that is focused on the latter complexities, rather than to pursue forcing information into preconceived hypothesis is necessary. Thus, a methodology that advances capitalising the uniqueness of individuals in the study and the contradiction upon them is deemed appropriate.

Philosophical assumptions help define, characterise and reflect a particular stance that researchers make when choosing qualitative research (Creswell, 2007, 2014). These assumptions further shape the research by incorporating it into the inquiry’s world-view (Creswell, 2007) (see section 4.1.2). However, five basic philosophical assumptions exist, namely the ontological, the epistemological, the axiological, the rhetorical the and methodological assumptions.

In terms of ontology, the researcher assumes the nature of reality and its characteristics. Ontology provides evidence of multiple realities in which multiple quotes based on actual words of different individuals presenting different perspectives is allowed (Creswell, 2007). Epistemology also reflects in this study since it depicts

the general view of the social world where perspectives of individuals are directly involved with the events under investigation. The researcher, therefore, deemed it necessary to interact directly with individuals to understand and interpret their insight into the phenomenon while focusing on the outcomes of the research, which are the actions, situations, and consequences of inquiry. Hence, the researcher admits the value-laden nature of the study and often will report values and biases as well as the value obtained during data collection (Creswell, 2007). The latter refers to axiology, therefore, the researcher assumes to conform to axiology. Axiology will allow the researcher to include personal interpretations in conjunction with the interpretation of participants (Creswell, 2007).

Throughout the remainder of the investigation, inductive logic dominates the analytical process. According to Creswell (2014), the inductive process illustrates working back and forth between the database and its categories until a comprehensive set of categories is established. However, deductive logic is also assumed. The data is analysed deductively to determine whether additional evidence is required to support the categories. If additional evidence is required, supplementary information is gathered. Therefore, in the process of inductively analysing data, deductive thinking will also play a critical role in the analysis process (Creswell, 2014). This research does not follow *a priori* and a tightly prescribed nature, instead the research process is emergent. To conform to the inductive and emergent process, literature is used sparsely at the beginning of the research process. Only in chapter 5 and 6, contextual relevant literature is explored in order to compare and confirm findings with existing literature and theory (Charmaz, 1990; Strauss and Corbin, 1998). The general order of the qualitative design does not follow a prescribed order with distinct phases of data collection and data analysis. The collection and analysis of data is consolidated to introduce new data from which immediate analysis proceeds again. Therefore, data collection, analysis and theory development stand in close relationship to one another (Strauss and Corbin, 1998).

4.1.2 Philosophical World-view

World-view refers to “a basic set of beliefs that guide action” which may also be called paradigms, epistemologies, ontologies (Creswell, 2014), broadly conceived methodologies, and alternative knowledge claims (Creswell, 2007). A world-view may be perceived as a general philosophical orientation concerning the research’s world and nature which the researcher convey to a study (Creswell, 2014). There exists four widely discussed world-views, namely: post-positivism; constructivism; transformative or interactionism; and pragmatism.

Pragmatism originated from the pragmatists Pierce, James, Mead and Dewey (Creswell, 2014) during the first three decades of the twentieth century (Creswell, 2007). Pragmatism as a world-view emerges from actions, situations, and consequences of inquiry rather than precedent conditions which are known conditions for post-positivism (Creswell, 2014). In the case of pragmatism, researchers emphasise the research problem in collaboration with all approaches available to understand the problem instead of typically focusing on methods (Creswell, 2014). This sug-

gests that pragmatism is not devoted to any one system of philosophy, inferring that this world-view allows the researcher to use multiple methods of data collection to best answer the research question and focus on the practical implications of the research as well as emphasise the importance of conducting research that best address the research problem (Cherryholmes, 1992; Creswell, 2007, 2014).

Corbin and Strauss (2008) describes the nature of the pragmatism world as follows:

“We are confronting a universe marked by tremendous fluidity; it won’t and can’t stand still. It is a universe where fragmentation, splintering, and disappearance are the mirror images of appearance, emergence, and coalescence. This universe where nothing is strictly determined. Its phenomena should be partly determinable via naturalistic analysis, including the phenomenon of men [and women] participating in the construction of the structure which shape their lives.”

Qualitative research ultimately serves the purpose for theory development as perceived in the social world (Creswell, 2007, 2014). In order to develop a theory that fit the nature of the pragmatism world-view, Corbin and Strauss (2008) has suggested considering the following theory:

“A world that is complex, often ambiguous, evincing change as well as periods of permanence; where action itself although routine today may be problematic tomorrow; where answers become questionable and questions ultimately produces answers.”

The essence of this study is liable to be subjected to the pragmatic world-view. The complexity of the research problem direct the researcher to examine problematic as well as routine situations and events. Thus, the varieties of human action, interaction, and emotional responses that people have to the events and problems they encounter is critical to this study. In line to what Corbin and Strauss (2008) advocates, the nature of human responses within this study creates conditions that impact upon, restrict, limit, and contribute towards re-orientating the variety of action that are well-known to the social world. The theory may also shape the institutions of those humans by creating and changing their environment. The latter discussion also conforms to the transformitive world-view since this world-view contains “an action agenda for reform that may change lives of the participants, the institutions in which individuals work or live, and the researcher’s life” (Creswell, 2014). Thus, to some extent, the transformative world-view is used in combination with the pragmatism world-view.

4.1.3 Research Design

Research designs are known strategies of inquiry within qualitative, quantitative, and mixed methods approaches. The defined strategy of inquiry provides an explicit direction for procedures in a research design (Creswell, 2014) that outlines the action

plan in order to achieve the research objectives.

In the midst of this research study and the discussion from the previous section, it is evident that the design of qualitative methods is used. In response to the high complexity of the problem under investigation as well as its pragmatic nature, the grounded theory approach is identified as the most appropriate method for inquiry. In support of this statement, Creswell (2014) defines grounded theory accordingly:

“Grounded theory is a design of inquiry from sociology in which the researcher derives a general, abstract theory of a process, action, or interaction grounded in the views of participants. This process involves multiple stages of data collection and the refinement and interrelationship of categories of information.”

Considering the quoted definition above and in support of the pragmatic nature of the research problem, grounded theory will be used as the qualitative research inquiry approach. Grounded theory is specifically chosen as suitable for this study since the theory, that is drawn from data, are likely to offer insight, enhance understanding and provide a meaningful guide to action (Strauss and Corbin, 1998). The methodology, in alignment and consistent with the systematic procedures described by Corbin and Strauss (2008), for inquiry and analysis is discussed in detail in the following section.

4.1.4 Research Methodology

The research methodology is depicted in five interrelated sections, which are: the method of inquiry; the grounded theory process; participant identification; data collection; and data analysis and interpretation. These are elaborated in the sections that follow.

4.1.4.1 The Method of Inquiry: Grounded Theory

The method employed is one of thematic extraction drawing on the premises of a grounded theory. In general, grounded theory is an inductive research methodology and a data analysis technique which focusses on a systematic set of procedures in doing qualitative research (Corbin and Strauss, 2008). Grounded theory aims to generate or discover a theory, known as an abstract analytical schema of a process, action or interaction grounded in the views of participants (Creswell, 2007). According to Creswell (2007), “this process involves using multiple stages of data collection and the refinement and interrelationship of categories of information”. In order to achieve this, the grounded theory methodology uses an analytical procedure, called *constant comparison*, which is the coding of data and comparing the codes for relationships to develop categories.

The methodology further uses a combination of coding procedures, memoing and diagram procedures and theory development from the analysis of themes, common categories, and patterns which are discovered in raw data (Corbin and Strauss, 2008). These is discussed in greater detail in section 4.1.4.5. Barney Glaser and Anselm Strauss are the founders for discovering grounded theory as a methodology (Strauss

and Corbin, 1998). Many other social science scholars have antecedently refined and developed the methodology to what it is known for today.

According to Creswell (2007), there exists two approaches to grounded theory, one being the systematic procedures of Corbin and Strauss (2008) and the other being the constructivists approach of Charmaz (2014). Choosing between these approaches is dependant on the approach the researcher prefers. At this point, the systematic approach of Corbin and Strauss (2008) is identified as appropriate and necessary for this study. Hence, the theory will be derived from data that are systematically gathered and analysed throughout the research process (Strauss and Corbin, 1998). Prior to beginning the process of developing theory, the term “theory” should be defined. Strauss and Corbin (1998) defines a “theory” as:

“A set of well-developed concepts related through statements of relationship, which together constitute an integrated framework that can be used to explain or predict phenomena.”

Grounded theory is chosen for this study as it is mostly used by researchers when further exploration of theoretical information and knowledge is required to explain a problem or a phenomenon (Creswell, 2007). Additionally, Leonard and McAdam (2004) affirm that grounded theory uses abstract concepts to describe and analyse a series of phenomena that are based on practical experience. According to them, it is this link to practical experience that makes grounded theory attractive to theory forming within the practice of TQM. The highly recursive theory-building process from literature and theory allows the opportunity for coherent TQM theories to be developed (Leonard and McAdam, 2004), which in turn, should lead to more informed organisational applications.

In the case of this study, the benefits that the alignment between TQM and AM present to the food industry exists. It is, however, incomplete as it does not address potentially valuable areas of interests. Thus, in order to find the most appropriate link between AM and TQM in the context of the food industry, further explorative research is required to contextualise the understanding of the problem enabling a holistic result. It is, therefore, necessary to explore within the environment of the industry to gain knowledge from experts in order to build on and confirm the theoretical background analysed using literature analysis. This description fits very well with the context of grounded theory because of its explorative nature as well as its interaction with individuals, and engagement in a process when responding to a phenomenon. Grounded theory, therefore, allows this study to reveal a social phenomenon that reflects professional experiences.

For these reasons, grounded theory supported the structure of this study by providing an ideal framework for it. Consequently, its methodology and data analysis techniques are adopted. The grounded theory process is discussed in the next section.

4.1.4.2 The Grounded Theory Process

Grounded theory represents the process whereby a theory is allowed to emerge. It involves a cyclic process of identifying the phenomenon, data collection, analysis and data interpretation. At first, the researcher expresses an interest in a social process or phenomenon. In order for the researcher to pragmatically facilitate a study of this area, it is critical to define the parameters of the process or phenomenon specifically enough to drive the focus of the study, but generally enough to allow for the emergence of unanticipated factors Corbin and Strauss (2008). Data collection ensues via various data collecting tools, such as: in-depth interviews; questionnaires; focus groups; observation and a holistic review of literature as well as other relevant documents (Creswell, 2014). In-depth interviewing is used during the data collection process, discussed in section 4.1.4.4. The focus of data collection is to explore and gather enough information to generate and develop a theory rather than focussing on representivity. Following data collection, the analysis and interpretation of data proceeds in stages (Creswell, 2007) of *open-coding*, *axial coding* and *selective coding*. Finally a conditional matrix, defined as “an analytic device to stimulate analysts’ thinking about the relationship between macro and micro conditions or consequences both to each other and to the process” (Strauss and Corbin, 1998), is visually portrayed. The conditional matrix elucidates the social, historical, and economic conditions influencing the central phenomenon. Using the conditional matrix is however optional (Creswell, 2007), thus, the researcher has excluded it from the research process. This research study, therefore, seeks to develop a substantive-level theory, also known as a low-level theory (Creswell, 2007), and not a formal, or general, theory. In order to comprehend the differences between these two theories, Glaser and Strauss (1967) states the following:

“By substantive theory, we mean that developed for a substantive, or empirical, area of sociological inquiry, such as patient care, race relations, professional education, delinquency, or research organisations. By formal theory, we mean that developed for a formal, or conceptual area of sociological inquiry, such as stigma, deviant behaviour, formal organisation, socialisation, status congruency, authority and power, reward systems or social mobility.”

Substantive theory proceeds prior to generating a formal theory and is closely related to the domain of practice and the real-world situations. In contrast, the formal theory deals with a more general domain of social science (Strauss and Corbin, 1998). Substantive theory can provide a link to a more formal theory if it is empirically analysed to develop conceptual categories at higher levels of abstraction and generality. An extensive level of analysis is required to achieve this, therefore, this study only claims for a substantive-level theory.

Corbin and Strauss (2008) proposed that there are certain strategies, or analytical tools, that could be considered in an attempt to ensure methodological rigour within the grounded theory process. Strauss and Corbin (1998) suggests that analytical tools are important “devices and techniques” that can be used by the analysts “to

facilitate the coding process”. The primary analytical tool to use is the *constant comparative method*. The *constant comparative method* is known as the analytic process of comparing distinct pieces of data for similarities and differences Creswell (2007); Corbin and Strauss (2008). Corbin and Strauss (2008) depicts this process as comparing incident with incident, incident with participant’s perceptions, and finally, participant’s perceptions with other participant’s perceptions. Constant comparison, therefore, allows the researcher to identify emerging categories and variations in the patterns found in data (Strauss and Corbin, 1998) to ultimately distinguish one category from another while identifying properties and dimensions specific to that category. Properties are defined as attributes or characteristics of categories and dimensions as variations within properties that give specificity and range to categories (Strauss and Corbin, 1998). Constant comparison further provides a sense of verification for accuracy of emergent evidence and provides the ability to specify concepts under study in order to eliminate ambiguity or similarity and to verify the theory that has been developed (Corbin and Strauss, 1990). The constant identification of variations in data induces the effect of maintaining objectivity (Strauss and Corbin, 1998) and developing researcher sensitivity (Corbin and Strauss, 2008); which, in turn, improves the ability to respond to the subtle nuances of, and cues to, meaning of data (Strauss and Corbin, 1998). The *constant comparative method* proceeds with a process of systematic coding, memo writing, classification and formulation of categories and visualising (Creswell, 2007). The process of research, guided by the researcher’s *theoretical sensitivity*, therefore, continues in a cyclic process while utilising *theoretical sampling* until *theoretical saturation* is reached. Theoretical sampling and theoretical saturation is discussed in sections 4.1.4.3 and 4.1.4.5 respectively.

Another equally important analytical tool used in this study is *asking questions*. It is defined as “an analytical device used to open up the line of inquiry and direct theoretical sampling” (Strauss and Corbin, 1998). *Asking questions* allow the researcher to enhance the discovery of new knowledge Corbin and Strauss (2008) as well as the development of the evolving theory (Strauss and Corbin, 1998). It further enables the researcher to probe, develop provisional answers, think outside the box, and become acquainted with the data (Corbin and Strauss, 2008). *Asking questions* is useful at every stage of analysis, but the type of questions the researcher asks change over the course of the research process. Normally at the early stages of research, questions are open ended, then it may later become more focused and refined as the research process progresses Corbin and Strauss (2008). No matter what the type of question, questions becomes a stimuli for thinking concerning what to ask interviewees or where to do theoretical sampling. Evidently, *asking questions* allow the researcher to realise that there is in fact much more to learn about the concept or category that is being analysed (Strauss and Corbin, 1998). The use of *asking questions* during data analysis and interpretation is described in section 4.1.4.5.

4.1.4.3 Participant Identification

Qualitative samples tend to be purposive rather than random (Creswell, 2007). For this reason, purposeful sampling of individuals is used to intentionally sample a group of people that could best inform the researcher about the research problem

under examination and to be more pragmatic. More specifically, grounded theory emphasises *theoretical sampling* (Creswell, 2007). *Theoretical sampling* is a data development method where sampling is done on the basis of emerging concepts to ask theoretical based questions that lead the researcher to further data collection. Strauss and Corbin (1998) defines *theoretical sampling* as follows:

“Sampling on the basis of emerging concepts, with the aim being to explore the dimensional range or varied conditions along which the properties of concepts vary.”

The goal of sampling within this paradigm is to include those persons, places, concepts and situations that will provide insightful understanding towards gathering the most relevant data about the phenomenon under investigation (Creswell, 2007). However, within the complex and pragmatic paradigm, the manageability of this study requires certain parameters and boundaries within the sampling process. This is done by holistically investigating the research problem, as seen in chapter 2 and 3, without being too rigid.

In alignment to the grounded theory methodology, *theoretical sampling* is used to select individuals from a homogeneous sample containing food experts within the field of system management and senior management¹ focused on quality systems in South Africa, Western Cape area. Thus, the choice of participants is driven by a conceptually defined topic under investigation, not by a concern for representivity, since the present study is theoretically driven. The food experts are selected from a network of contacts and acquaintances made by the researcher during industry training and visits as a preliminary to the undergraduate course. At first, one respondent is selected and invited to participate from which the respondent agreed to participate. As part of the concluding questions in the interview, the *snowball sampling* strategy is used to further identify other members (e.g. acquaintances or friends) from the same population for inclusion in the sample if more information should be required. Allowing the initial participants to contribute to the sample structure is deemed necessary by the researcher to reflect on the spirit of the grounded theory in that the initial participants contributes to both the constructs available for discussion and the selection of sources of data. Ultimately, the homogeneous sample (n=7) contributes to the development of the theory through building the opening and axial coding of the theory.

Once the initial development of the theory is established, the researcher selects and study the heterogeneous sample (n=2). The rationale for studying this heterogeneous sample is to confirm or dis-confirm the conditions, both contextual and intervening, and consequences under which the theoretical model, also known as the *axial coding paradigm*, holds. The heterogeneous sample contains engineering experts within the field of system management and senior management focused on maintenance and operation systems within the food sector. This sample is selected to confirm or dis-confirm the conditions of the developed framework. The latter

¹Management participating within this study represents managers reporting to top managers, they are known as senior managers.

individuals are selected from a network of contacts and acquaintances made by a former employee of an AM service provider. Two experts are identified and invited to participate in the research and both agreed to participate. Thus, the heterogeneous sample provides additional details required for the integration of AM with TQM in an attempt to close gaps.

The nature of purposive sampling allows the choice of which participants to include and which to exclude. This creates a position for the researcher to manipulate the outcomes. Here, the researcher explicitly framed only the views of those participants selected and acknowledges her subjective role in the nature of this study. This did not lessen the trustworthiness of the findings, instead it is used to improve the investigation process.

In total, 17 semi-structured in-depth interviews were conducted at eight different organisations. These interviews proceeded within a period of two and a half months (from 3rd August to 15th October 2015) where each participant was interviewed once, some at least two times, for one to two hours. There was also follow-up telephone and e-mail calls to some of the participants. The participants were promised feedback reports if they should request it.

Although grounded theory primarily uses interviews with 20 to 30 participants to achieve detail in the theory (Creswell, 2007), another equally viable approach is the idea of *theoretical saturation* (Creswell, 2014). Thus, this study is firmly based on the idea of saturation, implying that data collection is stopped as soon as the themes are saturated (Creswell, 2014) and therefore the researcher only deemed it necessary to work with a sample size of nine ($n=9$).

Demographic information of all participants is listed in table 4.1. The participants are categorised in order of the interview schedules; their job description, responsibility and sample type is also listed. The identity of the participants remains confidential as stipulated in the ethics policy of the University of Stellenbosch, thus pseudonyms are used (refer to appendices B.1 and B.2 for the approval letter and letter of consent which address participants' anonymity). The managers in this study are given the pseudonyms: Laura; Garry; Renee; Alec; Ian; Sam; Ella; Fred; and Jim.

4.1.4.4 Data collection

In order to proactively collect qualitative data, in-depth semi-structured interviewing is employed as the data collecting instrument of this study. Interviewing, in general, is one of the most direct ways to access participants' views and to investigate a phenomenon. Semi-structured interviewing is found useful for data analysis and interpretation since it is typically used by researchers to (a) compare the participants' responses while at the same time (b) exploring and understanding their unique experiences (Welman *et al.*, 2005). Since semi-structured interviewing reside within the continuum of structured and unstructured interviewing, it considers varying themes and questions that should be covered but it also allows the researcher to

Table 4.1: Demographic information of participants

Reference Code	Occupation and Responsibilities	Sample type
Laura	Technical Manager: Oversees two divisions of the organisation and sets its direction; ensure that quality and food safety systems are in place and health, safety and environmental requirements are met.	Homogeneous
Garry	Divisional Manager: Oversees three divisions of the organisation and sets its direction; plan, organise, allocate resources and direct the day-to-day operations of the division.	Homogeneous
Renee	Quality Manager: Oversee the overall quality and safety of the organisation's blending products; ensures that food products meet standards set by both their organisation and regulatory authorities; develop and review quality and safety policies; manage audits by third-party inspectors.	Homogeneous
Alec	Quality Manager: Oversee the overall quality and safety of the organisation's food products; ensures that food products meet standards set by both their organisation and regulatory authorities; develop and review quality and safety policies and manage audits by third-party inspectors.	Homogeneous
Ian	Production Manager: Responsible for the technical management, supervision and control of food production processes.	Homogeneous
Sam	Quality Manager: Oversee the overall quality and safety of the organisation's food products; ensures that food products meet standards set by both their organisation and regulatory authorities; develop and review quality and safety policies and manage audits by third-party inspectors.	Homogeneous
Ella	Research and Development Manager: Responsible for leading efforts involved in new product or process development and improvements with direct responsibility for specific projects.	Homogeneous
Fred	Maintenance Manager: Functions as the asset manager to manage and organise the maintenance department across all shifts; maintain preventive maintenance schedules to minimise or eliminate equipment breakdowns and lost manufacturing opportunities; ensures that all safety standards and PRP's are communicated, understood, and visible.	Heterogeneous
Jim	Packaging Manager Manage and organise the packaging department; execute the strategy for packaging development and operations, including functional design and manufacturing excellence, to ensure consumer preference and competitive performance of their packaging	Heterogeneous

identify important areas of interests, formulate penetrating questions on them and generate hypothesis for further investigation (Welman *et al.*, 2005). This supports the spirit of the grounded theory methodology and its *constant comparative method*. Data is primarily obtained using individual interviewing. However, to some extent, the analysis of relevant documentation such as International Standards and materials distributed by consultants are used.

In order to commence with data collection, the researcher obtained ethical clearance from the ethical committee of University of Stellenbosch. All interviews met the requirements by the ethics policy of the University. Interviews are recorded for the purpose of coding analysis and for accuracy of transcribed data (Creswell, 2007; Corbin and Strauss, 2008). The interviews are transcribed in order to capture human emotions and lively interactions. The researcher pursue with data collection, data interpretation and data analysis in isolation with no assistance from another analysts. Bradley *et al.* (2007) clearly stipulates that a single researcher conducting all transcribing of data or coding is sufficient and preferred. This allows the researcher to intertwine with the interviewing instrument, data collection and analysis process. However, it is acknowledged that it may not be possible to repeat such an analysis by others who encounter traditions and paradigms differently. Thus, the disclosure of the researcher's biases and philosophical approaches is discussed in sections 4.1.1 and 4.3.

The Interview Protocol

Semi-structured in-depth and in-person interview are conducted that based questions on the participants' experiences about the phenomenon. The interview questions are based on the three pre-determined parameters of the topic under discussion to include issues that pertain largely the integration of AM with TQM. The following three parameters serve as reference for the first prompting questions (as identified in section 3.6):

1. Communication between the quality and maintenance or operational department are poor.
2. AM could possible benefit the food industry's competitive advantage.
3. Managerial principles should be addressed prior to implementing an effective integrated management system.

The phenomenon under investigation is the relationship between AM and TQM suitable for all food industry types within South Africa. Strauss and Corbin (1998) explicitly states that the researcher is allowed to refer to literature to formulate questions that act as a starting point for initial observations and interviews. Thus, the semi-structured interview's list of questions are framed using formation depicted in the extensive literature review seen in chapter 2 and 3, whose aim is to measure the knowledge of participants in the context of the phenomenon. These above-listed parameters serve as the first round of interviewing only. The data gathered from initial interviews directly influence the content of the subsequent interviews from which concepts and categories are generated (Strauss and Corbin, 1998). Thus, these parameters are deliberately broadly outlined for the participants in a non-standardised manner because these parameters should be flexible enough to allow incorporation of unexpected themes that emerged during early interviews.

Furthermore, open-ended questions are asked throughout the data collection process, allowing participants the freedom to explain their first-hand experiences relating

to the theme. Additionally, the researcher attempts asking questions in an in-direct manner in which the participants are not pressured to answer in a particular way in preference of the researcher. This enables them the freedom of answering questions in an unbiased manner, hence, all participants are encouraged to discuss anything that came to mind. This is consistent with the premise of grounded theory concerning early data analysis which ultimately shapes subsequent data collection.

As discussed in section 1.2, it is prominent that AM is relatively new to the food industry. As such, care is taken when the purpose of the research study is introduced to the participant. It has been widely confirmed by researchers that when introducing new concepts to participants, it should be explained in the form of valid examples, pictures, videos or illustrations which they could respond to (Anon, 2009; Corbin and Strauss, 2014). Responding to this, a well-described introduction is prepared which explains the purpose of the research study, provides a general overview of AM and covers practical issues of consent and recording to prevent the display of bias in the interview situation. See appendix B.4 for the research purpose introduction used during the interview.

During the interview, prompt and probe questions are used to exclude bias interpretation as far as possible. Prompt questions are further questions or invitation to talk that introduce something not mentioned by the interviewee or encourage them to elaborate on the topic while probe questions provide further clarification of something the interviewee has mentioned. Most importantly, concluding probing questions are used to promote validity and unbiased interpretation of the interview instrument. These questions enables the researcher to ask probing or follow-up questions to further explore specific information relevant to the question or the specific answer given and to learn more about the in-depth experiences of the participants to minimise bias (Willis, 2005a; Turner, 2010). The probing questions during interviewing are characterised by unbiased phrasing, using non-leading verbal probing techniques. Typical examples of probing and concluding questions considered during interviewing are shown in table 4.2. Since semi-structured interviewing is used, it is not likely to know in advance when to use the probing questions, but it serves as a helpful guide to use during interviewing if deemed necessary.

The Pilot test

Prior to constructing the questions for the initial interview, a pilot test is presented to pre-test the quality of the interview protocol (the data collecting instrument) and to identify potential researcher biases (Chenail, 2011). The pilot test allows the researcher to refine and revise unambiguous interview questions while at the same time contributing to internal reliability in terms of the holistic understanding of AM introduced in the letter of consent and interview introduction. The pilot test, in the form of a *cognitive interview*, is performed with a respondent not included in the sample. The *verbal probing* (also known as retrospective interviewing) procedure is used during this interview. This procedure specifically focusses on evaluating the interview to help identify problems, errors and misunderstood questions to ultimately

Table 4.2: Types of probing question considered during interviewing (Adopted from Willis (2005a))

Type of probes	Example
Comprehension or Interpretation	What does the term mean to you?
	Why did you say that?
	What were you thinking about when you said that?
Paraphrasing	Can you repeat the question I just asked in your own words?
	Do you understand this?
	Is the question clear?
Confidence Judgement	How sure are you about the answer you just provided?
	How do you remember that?
Recall	I don't quite understand what you mean by that, could you please explain that part to me again?
	Sorry, I don't understand. Could you help by giving an example?
	Why do you think <i>'that'</i> is caused by <i>'this'</i> ?
Evaluation	How do you know it is worthwhile or worthless?
	What are the pros and cons of the situation?
Pause	The interviewer says nothing and wait until the interviewee continues.
Funnelling	You said <i>'that'</i> , but how do you feel about <i>'this'</i> ?
	You just told me about <i>'that'</i> , I would like to know about <i>'this'</i> .
	How did you get to that answer?
General	Could you tell me more about that please?
	Tell me what you were thinking about when you said that? I have noticed that you hesitated when I asked that question.
Concluding	Is there any further comments that you would wish to add?
	Is there anything else that you think that I have missed but should be considered?

produce the most appropriate questions (Willis, 2005b).

In order not to lose limited research participants and their valuable information to the study, the *interviewing the investigator* technique, as advised by Chenail (2011), is used concurrently with the *cognitive interview* approach. Ultimately, the *interviewing the investigator* technique precede the cognitive procedure to serve as a useful first step for the investigator to create and revise the interview protocol to help address the concern of ethics, to generate the proposed information, to access

potential researcher biases, and to gain valuable perspective in what it feels like to be interviewed before the cognitive interview proceeds. The concurrent operation of these two approaches contributes to the instrumentation improvement process and limit researcher biases. The pilot test procedure are conducted (in alignment to Chenail (2011) and Willis (2005a)) in two consecutive parts:

I Interview the Investigator:

1. The researcher assumes the role of a study participant and also act as the interviewer to conduct the interview.
2. The interviewer as interviewee reviews the informed consent form and notes any unclear or confusing passages and then signs the form before beginning the recording.
3. Administer the interview in the same manner and under similar conditions as planned for the actual data collection. The interviewer as interviewee reads the question out loud and then answers the question.
4. Record the time taken to complete the interview.
5. The interview is critiqued. This is accomplished as follow: the researcher plays back the recordings and cross-walk the questions as written out. Also, notes are made to identify what seemed to work or not work well in the interview. Lastly, the responses produced during the investigator's probing questions are noted and analysed. Throughout this process the emotions of surprise, frustration, and satisfaction is observed and assessed in relation to the occurrence of the interview.
6. The results of the interview are analysed from which modifications are suggested and the original list of questions revised, edited and annotated.
7. If necessary, the interviewing the interviewer procedure is repeated until point of saturation is reached. Saturation is achieved when no new questions are generated, no new modifications are suggested, or no new potential biases are identified. Once saturation and ethical clearance are obtained, the second part of the pilot test, the cognitive interview, proceeds.

II The Cognitive Interview:

1. Administer the interview in the same manner and under similar conditions as planned for the actual data collection.
2. Record the time taken to complete the interview.
3. Pay attention to instances when respondents hesitate to answer or ask for clarification and make note of where this occurs. This may serve as a good indication that questions or answers are vague, difficult to understand or have more than one meaning.
4. After the respondent finishes the interview, it is explained that the interviewer will now ask how the respondent understood each question and response choice.

5. The interview questions are chronologically reviewed again and cognitive probe questions are asked. The probe questions are based on five guiding probes and the interviewers' observation.
6. The results of the cognitive interview are analysed from which the questions are carefully revised and all unnecessary, difficult or ambiguous questions are discarded or improved upon.

Refer to appendix B.3 for the results of the pilot tests. The questions used during the pilot tests are constructed using the three prompting questions derived from literature (see sections 4.1.4.4 and 3.6) as a baseline. Upon completion of the pilot test, the questions are revised and refined to the following principal questions:

1. Do you think AM could possibly help overcome the competitive pressure of producing high-quality food products?
2. Do you think AM would be beneficial to the food industry?
3. When concerned with the holistic system of food quality and food safety, where would you suggest AM to be integrated within the existing TQM system of food industries?
4. What would you classify as a suitable asset with regard to the food industry?
5. Do you think management finds it difficult to connect maintenance management with quality performance?
6. In what manner does management align their managing principles and responsibilities to the holistic management system of food quality and safety?
7. If the alignment between TQM and AM are successfully achieved on a strategic level, how would you suggest it to be practically achieved on an operational (day-to-day) level?
8. Is there any further comments that you would wish to add or is there anything else that you think that I have missed but should be considered?
9. To whom should you suggest I talk to further explore the possibility of integrating AM with TQM?

In consideration of the pilot test and other relevant factors, the final interview protocol (data collecting instrument) is constructed as seen in appendix B.4.

4.1.4.5 Data Analysis and Interpretation

The general strategy of inquiry of grounded theory is to derive a theory of a process, action or interaction grounded in the views of the participants. Two primary characteristics of this strategy are the *constant comparison* of data with emerging categories and *theoretical sampling* of different groups (Creswell, 2014). Grounded theory is known for its detailed procedures for analysis. As mentioned before, grounded theory consists of three analytic phases: *open*; *axial*, and *selective coding* (Creswell,

2007). These phases consequently provide a procedure for developing categories of information (i.e. *open coding*), interconnecting the categories (i.e. *axial coding*), and building a “story” that connects the categories (i.e. *selective coding*) which finally ends with a discursive set of theoretical propositions. Very often, at an extensive level of analysis, the researcher can create a conditional matrix, which is optional (Creswell, 2007). As earlier mentioned in section 4.1.4.2, this study seeks to develop a substantive-level theory that does not require the extensive level of analysis. Hence, the conditional matrix is ignored.

In figure 4.2, a summary of the research process is presented. Refer to this figure while reading the following discussion to relate to the grounded theory’s systematic analysis process and its three analytic phases.

During the first phase of *open coding*, the researcher examines the texts (e.g. field-notes, documents, or transcripts) for correspondent categories of information that support the text. In the present study, transcripts are used during the coding process in order to organise all data similarly. With regard to the *open coding* phase, all categories are generated using strict emphasis on analytic and sensitive matters, and not representative matters. This enables diversity and contradiction within data to finally establish similarities or differences. All similarities and differences are established using the process of asking theoretical, sensitising and practical questions as well as making theoretical comparisons. These questions are described respectively; theoretical questions enable the researcher to see process, variations and connections; sensitising questions help to explore the direction whereto data is indicating; and practical questions provide direction for theoretical sampling and theory generation (Strauss and Corbin, 1998).

According to Strauss and Corbin (1998), *asking questions* assists with making proper theoretical comparisons, which in turn, is defined as “an analytic tool used to stimulate thinking about properties and dimensions of categories” (Strauss and Corbin, 1998). Strauss and Corbin (1998) and Creswell (2007) refer to this as the *constant comparative method*. Using the *constant comparative method*, as discussed earlier, allows the researcher to code and analyse data, to generate theory systematically, and to “saturate” the categories Creswell (2007). In order to reach saturation, the researcher attempts to identify instances that represent the category and continues to identify (alongside with interviewing) until new information no longer provide further insight into the category. All categories depicts certain properties which, in turn, presents specific dimensions. Overall, this process allows the researcher to reduce the database to a confined set of categories that characterise the process or action under exploration during the grounded theory study (Creswell, 2007).

Following this, one open category is selected as the core phenomenon of interest (Creswell, 2007; Corbin and Strauss, 2008). Once the core phenomenon is established, the researcher ensues with the grounded theory process and returns to the database once again to understand the categories that relate to the core phenomenon. If necessary, additional data is collected to support the phenomenon. This typically refers to the *axial coding* process in which the database is reviewed to provide in-

sight in explaining the phenomenon (Creswell, 2007; Corbin and Strauss, 2008). All information obtained during this coding phase is then visualised into a figure, known as the *axial coding paradigm*, which presents the theory in the form of a theoretical model.

Finally, the researcher continues to generate propositions or statements that describe the interrelationship between categories in the *axial coding paradigm*. This phase represents *selective coding* (Creswell, 2007; Corbin and Strauss, 2008), which it eventually led into the development of a framework and a theory related to the experiences of the sample (as presented in chapter 5 and summarised in chapter 6).

All data is interpreted by way of comparison of emergent theory with existing relevant literature. The inclusion of literature is only used as a supplementary and affirmation source in an attempt to reflect on results and to establish the domain to which the study findings can be confirmed for significances (Strauss and Corbin, 1998). This is deemed necessary to clearly establish and show the parameters within which the generated theory is applicable and advisable. However, literature is only consulted once the data collection and analysis process commence in order to comply to the inductive nature of analysis and interpretation within the grounded theory methodology (Strauss and Corbin, 1998). The data analysis and interpretation is discussed in detail in chapter 5 (See figure 4.2 for a simplified summary of the research process used throughout this study).

4.2 Verification of Research Results

This section discusses the validity, reliability and trustworthiness of results, the researcher-paradigm fit, as well as the role of the researcher in this study in sections 4.2.1 to 4.2.3.

4.2.1 Validity, Reliability and Trustworthiness of results

All research approaches and corresponding researchers desire to have confidence about the results and findings as well as with their data. For this reason, the grounded theory procedures (i.e. the *constant comparative method*, theoretical sampling and theoretical saturation) are primarily established to guide confidence within results. In support of this, other procedures to ensure credibility and trustworthiness of results are adopted to enhance the rigour of the study. However, validation in qualitative research has been a high debate amongst many social scientists. Acting upon these criticisms, appropriate measures are endorsed in the design of this study.

Validity in qualitative research does not have the same connotations as it has in quantitative research (Creswell, 2014); nor does reliability, which examines stability, or generalisability, which represents the external validity of applying results. Thus, in qualitative research, validity assumes the role of assessing the accuracy of the findings as grounded in the view of participants and the researcher by employing certain procedures (Creswell, 2007, 2014). In qualitative research, reliability indicates consistency of the approach the researcher adopts (Creswell, 2014). Thus, within the

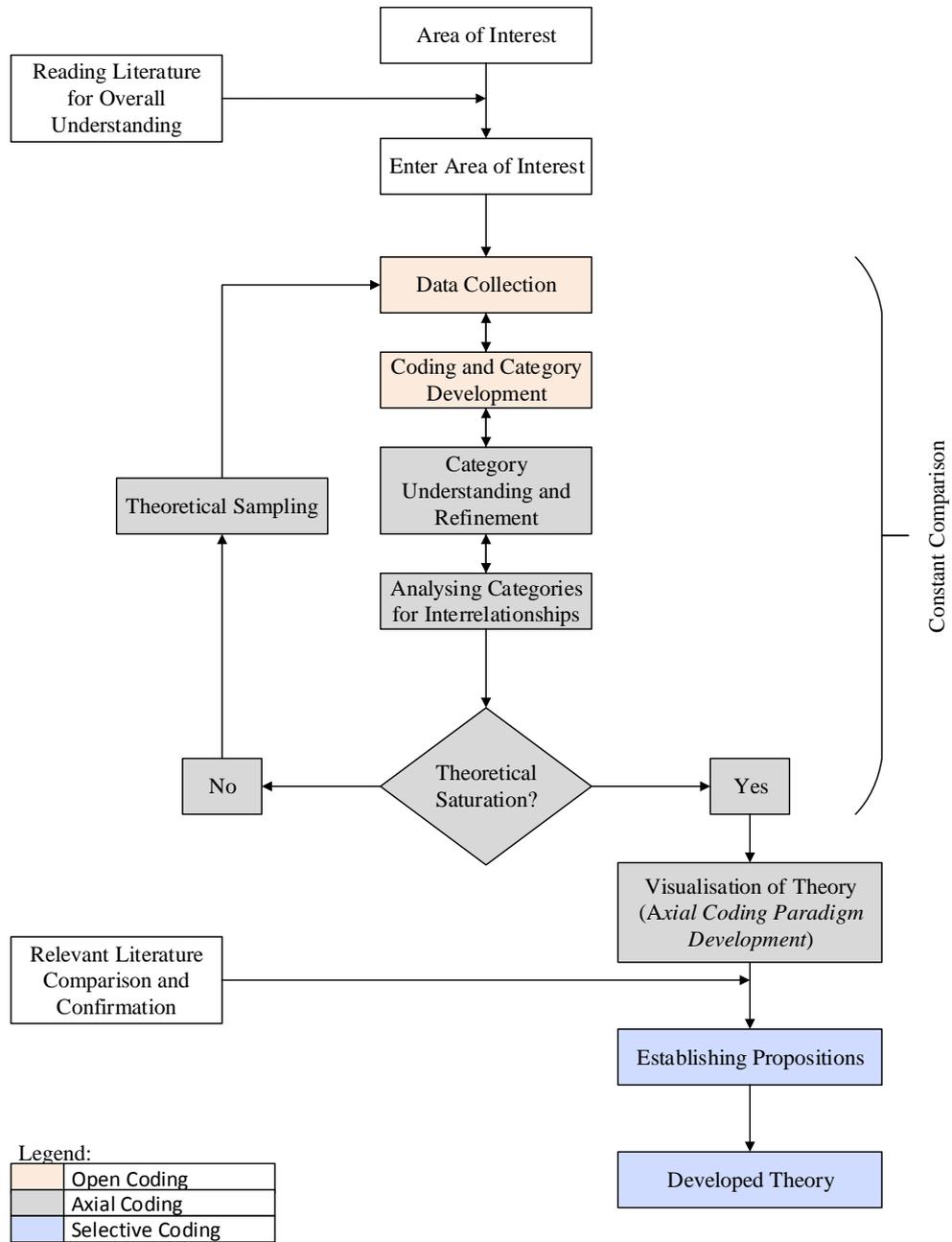


Figure 4.2: Grounded theory research analysis process

world of qualitative research, terms such as *trustworthiness*, *authenticity*, and *credibility* are addressed regularly (Lincoln *et al.*, 2011; Creswell, 2014).

In an attempt to address trustworthiness of the results within the present study as well as to maintain an objective stance, *triangulation* and *member checking* is

adopted. Triangulation refers to the use of multiple and different data sources of information to provide corroborating evidence in order to build justification for categories (Strauss and Corbin, 1998; Creswell, 2007, 2014). There exists several types of triangulation, namely data, investigator, theory and methodological triangulation. In this study, the researcher uses three different data gathering sampling strategies: theoretical sampling; snowball sampling; and discriminative sampling which also presents as the heterogeneous sample. Therefore, data triangulation ensued during early data analysis, which contributed to attaining data from different perspectives from participants. This can be claimed to constitute adding validity to the study.

In member checking, the researcher seeks participants' views of credibility of the findings and interpretations (Creswell, 2014). During the process of data analysing and interpretation, the researcher asked two randomly selected participants – hence the ratification is not absolute since only a sample of participants are used – to confirm the accuracy of specific descriptions and emerging categories. Also, at the end of the analytic study, the researcher presents to the participants the final *axial coding paradigm* and corresponding categories in the form of a follow-up interview. This provides them with the opportunity to comment on the findings. Using member checking allows the researcher to authenticate transcripts and to ensure that individual perspectives and experiences of participants are presented in an accurate manner.

Finally, the researcher uses long passages to ensure that evidence substantiate claims and to properly show multiple perspectives. In addition, the researcher incorporates quotes to provide participants' perspectives to assist with conveying the findings consistently. Both the former and latter enables readers to make decisions on their own regarding transferability (Creswell, 2007). Such a detailed and descriptive discussion allows the readers to experience the theory realistically and in a more vivid manner. This procedure also enhances the validity of the study (Creswell, 2014).

With regard to reliability, voice recording is used to enhance the detail and accuracy of transcripts. It also allows the researcher to indicate trivial, but crucial, pauses and overlaps (Creswell, 2007); something that is often misguided when using hand written notes only. The qualitative computer software, *Nvivo*, is used to assist with recording, coding and analysing of data. As mentioned in section 4.1.4.4, the pilot test is conducted for several reasons. However, in the light of the topic of reliability, it is deemed necessary to establish a pilot test prior to early data analysis to establish a holistic understanding of AM amongst all participants. This is done to ensure internal reliability. All of the above-mentioned contributes to the enhancement of reliability as well as validity within the present study.

4.2.2 The Researcher-Paradigm Fit

More recently, qualitative researchers tend to be more self-disclosing about the way they write their qualitative findings (Creswell, 2007). Creswell (2007) further advocates that an omniscient writer is no longer accepted. While assessing which paradigm is applicable to the research topic under investigation, it became also nec-

essary to determine the fit of the researcher between the proposed methodology and her own world-view. Thus, the researcher adopts the notion of reflexivity. According to Creswell (2007), reflexivity means that the researcher or author is conscious of the biases, experiences and values that they bring upon the qualitative research study. The researcher, therefore, acknowledge that the way she writes is a reflection of her own interpretation based upon the insight of literature and participants; meaning that the researcher attempts to describe her fit within the study.

Primarily, the researcher identified that the qualitative research is a good fit because of her overall preference for interpretative research and the direct involvement in sustained and intensive experiences with participants. Concerning this, the identification of personal background, biases, values and reflexivity explicitly depict those factors that shaped the interpretation formed during the present study (Creswell, 2014).

The researcher's perceptions for the overlap between TQM and AM are shaped by personal experience. She holds a degree in B.Sc Food Science, which is incessantly focused on quality control (QC), quality assurance (QA) and quality management (QM). During the time of her undergraduate course, she attended compulsory industrial training from which she closely worked with both the quality department and the engineering department throughout the production process of various food product types. During industrial training, she experienced and observed numerous issues regarding product waste, product scrapping, product rework and product specification deviations caused by physical asset failures or poor management of assets. She also attained a PGDip in Industrial Engineering and is currently enrolled for the MEng degree, within the environment of engineering management (specifically focusing on AM). This enables her to understand the intersection between engineering and food science. In the interim, the intersection of engineering with the food quality environment intrigued her attention.

Unlike the participants of this study, the researcher does not have high-level experience of integrating management systems and practical issues at hand. However, due to her sensitivity for this topic, she attains a well grounded understanding of the nuances and cues of quality systems within the food industry. This provides valuable insight into the perceptions of those involved in professional quality systems and every-day issues encountered in the food industry. In that light, she has ensued to search for possible solutions to the food industry's every-day situations with the support from the engineering structure and design.

Despite the differences between the industrial experiences of the participants and the researcher herself, her tertiary experience has confidently steered her to include her own perceptions into the research study, to some extent; in concert with her preconceived insight and sensitivity towards the topic. Thus, the researcher's perception of integrating engineering aspects and structure to food quality aspects and every-day production problems created a central belief that some aspects of AM can be beneficial to the food industry if incorporated into their existing Total Quality Management System (TQMS). However, the complexity and implications of integrat-

ing two distinct management systems within the food industry exists which further justifies the qualitative methodology. The insertion of the researcher's own biases, notions and perceptions can never be defined to precision, therefore, qualitative research is required.

4.2.3 The Role and Impact of the Researcher

In qualitative research, the researcher assumes the role of collecting data, analysing data or examining documents, observe participant behaviours or interviewing participants (Creswell, 2014). The researcher is the key instrument to qualitative research and, therefore, assumes multiple roles to conduct this study.

The researchers' experience regarding the intersection of food science and engineering prompted arising questions, which steered the direction of this study. The researcher values her experience as an important factor as it became a basis for theorising when interacting with the senior managers at the beginning of the study. In contribution to this, she adopted the technique of *asking questions* throughout the remainder of the study to enable herself to probe, develop provisional answers, think out of the box, and to become acquainted with the data (Corbin and Strauss, 2008).

Apart from this, her role as qualitative researcher is the most critical, particularly during the process of data analysis and interpretation. The researcher enters the lives of senior managers who have had years of experience, thus, she is sensitive towards their competencies and acknowledged the fact that most people tend to withdraw themselves if their competencies are critiqued or disregarded as important. She, therefore, distances her own experience and perceptions, and always appraise their knowledge and competencies. This make them feel important and comfortable in elaborating on their experiences. The researcher's sensitivity towards them enhances her access to their insights of day-to-day situations.

Her position as a qualitative researcher, who also has the experience of observing production problems and product failures caused by poor AM and knowledge regarding food systems, as discussed in section 4.2.2, is advantageous to this study. The grounded theory methodology explicitly require the researcher to be theoretical sensitive in order to formalise and conceptualise theory emerging from data (Corbin and Strauss, 2008). Theoretical sensitivity allows her to easily interpret data since she has the necessary experience of the topic under investigation. As mentioned before, sensitivity grows with exposure to data, hence, theoretical sensitivity allows the researcher to be in unison with the meanings embedded in data (Corbin and Strauss, 1990). Sensitivity enables her to see beneath the obvious to discover the new. Using alternating processes of data collection and analysis, meanings that are illusive at first became clear, which often refers to sudden insights (Strauss and Corbin, 1998). Importantly, these insights does not occur haphazardly, rather they appear from researcher sensitivity, experience and knowledge. Therefore, the researcher cannot divorce herself from data collection since knowledge is coupled with objectivity that prepare her as an analyst to understand the meaning of data without forcing her explanations on data (Strauss and Corbin, 1998). Both professional experience

and literature are used as a source of sensitivity; to gain greater understanding of participant explanations and to stimulate thinking about properties and for asking conceptual questions.

The participants needed to understand the two contradicting environments of food quality and food safety as well as asset care and exploitation. In the form of a brief overview, the researcher are able to properly explain AM to those from the food environment and to properly explain TQM to those from the engineering environment. This is critical to ensure accurate and trustworthy data collection as well as to ensure that all participants are at speaking terms. Overall, the latter improves internal reliability. The brief overviews are used dominantly during the integration of International Organisation for Standardisation (ISO) 55001 with Foundation for Food Safety Certification (FSSC) 22000, seen in chapter 5 (section 5.2.5.2) and 6 (section 6.3.3), since the integrated system alongside the *axial coding paradigm* are developed with the perspective of participants from the food environment, which is presented for confirmation or dis-confirmation with the perspective of two participants from an engineering environment. It is, therefore, important to introduce and explain the different worlds prior to doing the exercise of integration as well as verifying the *axial coding paradigm*.

Considering the interplay between research and the researcher, it is clear that the researcher is an instrument of analysis (Strauss and Corbin, 1998). Therefore, it is deemed necessary to maintain a balance between the qualities of objectivity (refer to section 4.2.1) and sensitivity (as described in sections 4.2.2 and 4.2.3) during the process of analysis.

4.3 Ethical Considerations

On account of the focus of this research, data inquiry will commence using the grounded theory methodology and semi-structured interviewing that is based on the opinions, inputs and experiences of senior managers toward the integrated approach of AM and TQM. Therefore, no ethical discrimination regarding personal and organisational feelings, belief, culture or experiences is of concern to this study. No known risks or discomforts, inconvenience, psychological stress and stigmatisation are associated with this study.

This study adheres to all relevant ethical standards and policy's of scholarly and scientific research stipulated by Stellenbosch University. All interviews are conducted according to this ethics policy. For further reading regarding principle ethical consideration used during data inquiry, see appendix B.2 for the formal letter of consent. The letter of consent states the requirements by the ethics policy of Stellenbosch University. With careful consideration of ethical issues related to the study, the researcher attained permission from the University's Research Ethics Committee (REC) to commence with data collections (see appendix B.1 for the REC approval). This further enhances the protection of participants.

Participants' identities, personal details, documents, records and organisation names are kept confidential and anonymous using pseudonyms. Their contribution to the findings is accessible to the researcher, supervisor and examiner solely. Any information that is obtained in connection with this study and that can be identified with the participant will remain confidential. The researcher solely have access to the recordings and handwritten notes of the interview. Both recordings and handwritten notes are transcribed to an electronic document that is safely stored on a qualitative computer software program, *Nvivo*, on a personal computer with a password. No third party will be able to access these documents. The recordings and handwritten documents will be confiscated and disposed off to ascertain confidentiality post completion of the study.

4.4 Chapter Conclusion

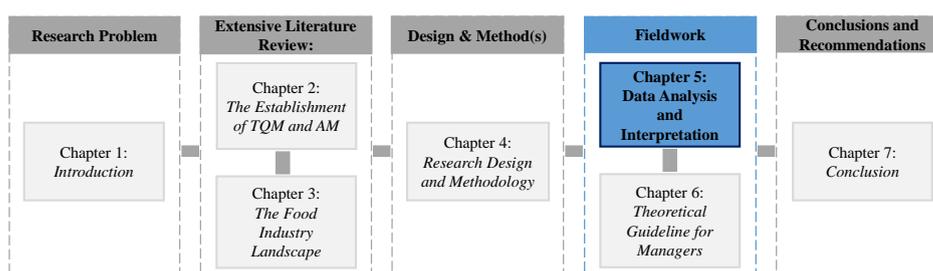
In conclusion, chapter 4 constructed a well-defined research methodology that is appropriate to the research problem statement and objectives defined in sections 1.2 and 1.4 respectively. This chapter discussed the chosen qualitative research paradigm and design, known as grounded theory analysis, in detail. Moreover, all other important methods, tools and techniques used in accordance to the guidelines of the grounded theory methodology were discussed. The procedure for measuring the verification of research results was discussed in relation to the aspects of validity, reliability and trustworthiness of results, the researcher-paradigm fit, and the role and impact of the researcher. The chapter concludes with a brief discussion of ethical considerations in relevance to the University's REC.

This chapter advanced into establishing the third sub-objective of this research study. Recalling from section 1.4, a well-defined research methodology was constructed. Thus, the third sub-objective was met.

The next chapter elaborates upon the grounded theory process for data analysis and interpretation and retrospectively conveys the results of the process.

Chapter 5

Data Analysis and Interpretation



This study proceeded in the same manner as how Creswell (2007) describes any study based upon grounded theory as a “zigzag process”. Creswell (2007) describes it as “out to the field to gather information, into the office to analyse the data, back to the field to gather more information, into the office to analyse the data, and so forth”. In order to provide structure for the data analysis and interpretation, this chapter is divided into two primary sections, namely: *early data analysis* that is concerned with the development of codes and categories; and *theoretical development* that is concerned with the development of the core phenomenon. These sections are described, analysed and interpreted based upon participants’ opinions and inputs from both the heterogeneous and homogeneous sample. Concordant to the grounded theory process, this chapter ends with a discursive set of theoretical propositions. In this chapter, the Asset Management System (AMS) is referred to as the International Organisation for Standardisation (ISO) 55000 to provide guidance for effective Asset Management (AM) while the Total Quality Management System (TQMS) refers to a set of multiple food standards designed according to customer demands and business objectives. Throughout this chapter, computer software, *Nvivo*, is used to organise, categorise and analyse raw data.

5.1 Early Data Analysis

In this section, a brief introduction to early data analysis, the process used in early data analysis to develop codes and categories as well as its results are discussed in sections 5.1.1 to 5.1.3.

5.1.1 Introduction

Two popular approaches to grounded theory exists; they are the systematic procedures of Corbin and Strauss (2008) and the constructivist approach of Charmaz (2014). For the purpose of this study, the systematic and analytic procedures of Corbin and Strauss (2008) is used. Within this type of procedure, it is continuously advocated that theory should be inductively generated through the systematic analysis of data to help explain the phenomenon (Creswell, 2007). In the view of Corbin and Strauss (2008), the fundamental part for theory development is the use of the *constant comparative method*. Therefore, the *constant comparative method* is used throughout this study. During the early phases of data analysis, each interview is transcribed from which the data is immediately analysed prior to proceeding with the next round of interviews. Methodology and data analysis, therefore, proceed simultaneously. During this phase, twenty categories are generated in a systematic manner. The process of codes and category development and the results of the process are described in sections 5.1.2 and 5.1.3 respectively.

5.1.2 The Process of developing Codes and Categories

The development of codes and categories procedure is in line with the grounded theory methodology (Creswell, 2007; Corbin and Strauss, 2008; Charmaz, 1990). After completion of the early interviews, all interviews are transcribed into documents which are imported into the *Nvivo* software (QSR International: NVivo, 2012) for early data analysis. This computer software is used to organise, categorise and analyse raw data. It also serves the purpose for memoing, interpreting, and visualising data, which are very well known analysis procedures used in grounded theory (Corbin and Strauss, 2008). The *Nvivo* software (QSR International: NVivo, 2012) is also used in order to conform to ethical considerations since it provides security for storing the database and relevant files together into a single file.

An important first step to the early data analysis is to comprehend the meaning of the interviews in their entirety (Creswell, 2007). All transcripts are reviewed several times to help identify emergent themes. During the process of reading for overall understanding, written records, better known as *memos* (Corbin and Strauss, 2008), are used to help explore the database. Strauss and Corbin (1998) define memos as the researcher's "records of analysis, thoughts, interpretations, questions, and directions for further data collections". Thus, the technique of memoing is used throughout the remainder of the data analysis process.

As the researcher read through the transcribed data, short sections with descriptive codes are summarised and categorised on the *Nvivo* software (QSR International:

NVivo, 2012). This procedure is called *open coding*. Corbin and Strauss (2008) and Creswell (2007) describes *open coding* as the first step of theoretical analysis that pertains to the initial discovery of categories of information. Corbin and Strauss (2008) suggests that open coding is used “to produce concepts that seem to fit the data”. Therefore, these concepts or categories are provisional and only aim to open the enquiry from which the researcher can categorise the data into distinct parts and carefully examine, compare for similarities and differences and ask questions that reflect the phenomena found in the data. As suggested by Creswell (2007), codes can be labelled using *in vivo* codes (i.e. the words often used by participants) or *in vitro* codes (i.e. the expressions introduced by the researcher). The researcher uses both these code labels during the *open coding* procedure.

Coding is done using sentence or paragraph analysis (Corbin and Strauss, 2008). As the researcher progressed through the data, the *constant comparative method* of analysis is used. Corbin and Strauss (2008) defines the *constant comparative method* as:

“The analytic process of comparing different pieces of data for similarities and differences...comparing incident against incident for similarities and differences.”

From *open coding*, *axial coding* ensued. According to Corbin and Strauss (2008), *axial coding* is used to begin the process of reassembling the fragmented data obtained during *open coding*. The purpose for *axial coding* is to develop dimensions and properties for each category (Corbin and Strauss, 2008). This required the researcher to examine each open code in detail and to expand, explore and examine the relationship between codes. Very often, the researcher proceed with *open* and *axial coding* simultaneously. According to Strauss and Corbin (1998), “axial coding does require that the analyst have some categories, but often a sense of how categories relate begins to emerge during *open coding*”. Considering the latter statement, coding intensively and concertedly around single categories even during the early stages of data analysis is expected.

5.1.3 Results of Early Data Analysis

As a result of the development of dimensions of the categories, a list of interview questions is generated for the next round of data collection. During the process of the second stage of coding, codes of significant similarities are combined as one category, other codes are renamed that appeared coherent and for others the code name became the category. The process of *constant comparison* and *theoretical sampling* continued throughout the analysis until the point of conceptual saturation is reached (Corbin and Strauss, 2008). Upon generating categories and developing their dimensions, the most critical phase of analysis is to interpret the categories holistically. At this point, all relevant properties and dimensions are critically analysed to obtain a clear understanding of each category from which the core phenomenon became comprehensible (Corbin and Strauss, 2008). New insights into links between these categories emerged from which a list of twenty categories is identified. See table 5.1 for the list and description of the twenty categories developed during *open* and *axial coding*.

Table 5.1: Code structure based upon participant comments and interpretation

Category Name	Description
<i>AM link to the food industry</i>	How the food industry think AM could benefit their organisation and how they think they will overcome the competitive pressure of producing high-quality product with AM. Possible links (were AM will fit best) towards the food industry.
<i>Asset classes</i>	The classes the participants suggest are relevant within the food industry; typical classes that emerge are people, machines and equipment, customers, brands and reputation.
<i>Asset problems</i>	Typical problems that food management encounter with assets which include the classes of machines, equipment, and people.
<i>Communication</i>	Communication problems which erode within departments; these include silo thinking and constant conflict between engineering or maintenance and quality.
<i>Customer satisfaction</i>	Product specifications, regulatory and legislative requirements demanded by customers.
<i>Engineering vs Food Industry</i>	The differences between food manufacturing and industrial manufacturing.
<i>Financial Implications</i>	Financial issues that often prevent the food industry from investing in new technology or machines or training.
<i>Integration implications</i>	Integration suggested by participants: overlapping of systems; implementation obstacles; consequences for this integration to happen (training, systems, culture)
<i>Integration of AM with TQM</i>	Possible mapping of ISO 55000 with selected standards which also includes any links found between AM and TQM.
<i>ISO 55000</i>	Understanding the integration of ISO 55000.
<i>Management systems (standards)</i>	General information regarding standards, systems relevant to the food industry.
<i>PRP's and SOP's</i>	Prerequisite Programs and Standard Operating Procedures
<i>Standard selection (business objectives)</i>	Standard selections are related to business objectives (e.g. GFSI certification)
<i>Integration of AM with TQM on Operational Level</i>	Suggestions from participants on how they think the integration will look like on an operational level.
<i>Leadership</i>	Top management responsibilities
<i>Management principles</i>	Starting point of implementing sound standards and operating an integrated system holistically within the organisation.
<i>People</i>	People should have a common goal, shared vision and work in a holistic environment where everybody must work together as a team.
<i>Person responsible for AM</i>	Person responsible for AM
<i>Training</i>	Training is seen as critical in the food industry.
<i>Value chain</i>	Business-to-Business vs Business-to-Consumer

5.2 Theoretical Development

In this theoretical development section the detailed components of the standard grounded theory visual model, also known as the *axial coding paradigm*, will be developed. In figure 5.1 the final developed *axial coding paradigm* is illustrated. As summarised in section 1.5 the grounded theory procedure aim to identify the following categories: causal conditions; the phenomenon; contextual and intervening conditions; strategies; and consequences. The origin of, and interrelationship between, these categories are explained in sections 5.2.1 to 5.2.6.6. These categories visually describes the origin of *axial coding paradigm*.

Theoretical development data analysis is aimed at generating links between the developed categories. The *constant comparative method* is used to reduce the category or code structure developed during the early data analysis, seen in section 5.1. In due course of this process, a few categories merged into one category and others are renamed. In addition to the *constant comparative method*, as well as *asking questions* during analysis, visualisation is used to draw logic diagrams which are derived from memo writing. In accordance to the systematic procedure of Corbin and Strauss (2008), visualisation allows the researcher to further depict relationships between analytic concepts. This technique is found useful in the identification of clear links between categories. Linking between categories resulted in creating cumulative categories of context, which in turn, assist with finding the interrelationship amongst categories that support an emerging phenomenon.

At this stage, the data is analysed into a more abstract level for context, from which the selected core category, that represents the *phenomenon*, is investigated in detail. The core category is selected from the *open* and *axial coding* code structure (see table 5.1) based upon the following criteria: the category that seems central to the process being studied; the frequency of occurrence in the data; and its allowance for maximum variation in terms of dimensions, properties, conditions, strategies and consequences (Creswell, 2007). The category named *Integrating AM with Total Quality Management (TQM)* serves the purpose of the core category, hence, the core *phenomenon* which is renamed as *Systems Integration*, in this study. After this, other essential categories are analysed to uncover their relationships and to explore *causal conditions* (those factors that caused the phenomenon), specify *strategies* (actions taken in response to the phenomenon), identify *contextual* and *intervening conditions* (situational factors that influence strategies), and delineate *consequences* (outcomes from using the strategies) (Creswell, 2007) for this phenomenon. Any categories that did not serve any purpose or meaning to the phenomenon of emerging theory are eliminated. In the case of this study, the category *Value Chain* is eliminated.

In the interim, the initial twenty categories listed in table 5.1 have now been merged, renamed and reduced to six categories that relate to, support and explain the core phenomenon in terms of conditions, strategies and consequences. Its interrelationships are transcribed into a *axial coding paradigm*, based upon the combined use of coding and visualisation. See figure 5.1 for the representation of the *axial coding paradigm* which is modelled on the basis of the standard visual model developed

during the grounded theory methodology. Depicted in figure 5.1 is the development of the five emergent categories for this research. These categories are based upon data analysis and interpretation and are stipulated accordingly:

- causal conditions (i.e. asset problems, communication, people, leadership, the need for AM);
- the phenomenon (i.e. *Systems Integration*)
- contextual conditions developing the coping strategy for *Systems Integration*;
- intervening conditions influencing the coping strategy for *Systems Integration* (i.e. customer satisfaction, management systems, standard selection)
- coping strategy for implementation of *Systems Integration* (i.e. integrating on strategic level, methodology for *Systems Integration*); and
- consequences and integration implications (i.e. certification and auditing, person responsible, training obligatory, change management, management principles, financial implications).

The above-listed categories represent the main themes that describe the holistic approach to integrating two management systems within South African food industries. During the grounded theory analysis a gap, known as poor quality food products and customer dissatisfaction, within the food industry is presented, which is caused by the existence of asset problems, communication problems and poor people management or lack of top management commitment to asset care. These gaps can be closed when holistically considering all aspects supporting the core phenomenon, named *Systems Integration*. All in all, the latter could lead to high-quality food products and customer satisfaction as well (refer to figure 5.1).

The grounded theory analysis serves as an approach to develop a guideline to assist management to cope with achieving high-quality food products in order to survive the stringent demands. At this stage, the researcher ensued with selective coding in which the *axial coding paradigm* (figure 5.1) is used to assemble a story that describes the interrelationship of the above-listed categories which are illustrated in the *axial coding paradigm* (figure 5.1). The following sections discuss the relationships between the categories retrospectively, which in turn, describes the origin of figure 5.1. Take note that the theory developed in relevance to the homogeneous sample (i.e. in context to the quality and food perspectives) to which it is confirmed or dis-confirmed by the heterogeneous sample (i.e. in context to the maintenance perspectives). For this reason, the interrelationship between categories is based upon the opinions interpreted from both samples. While reading the following sections, refer to appendix B.5 for a dialogue between the researcher and corresponding participants.

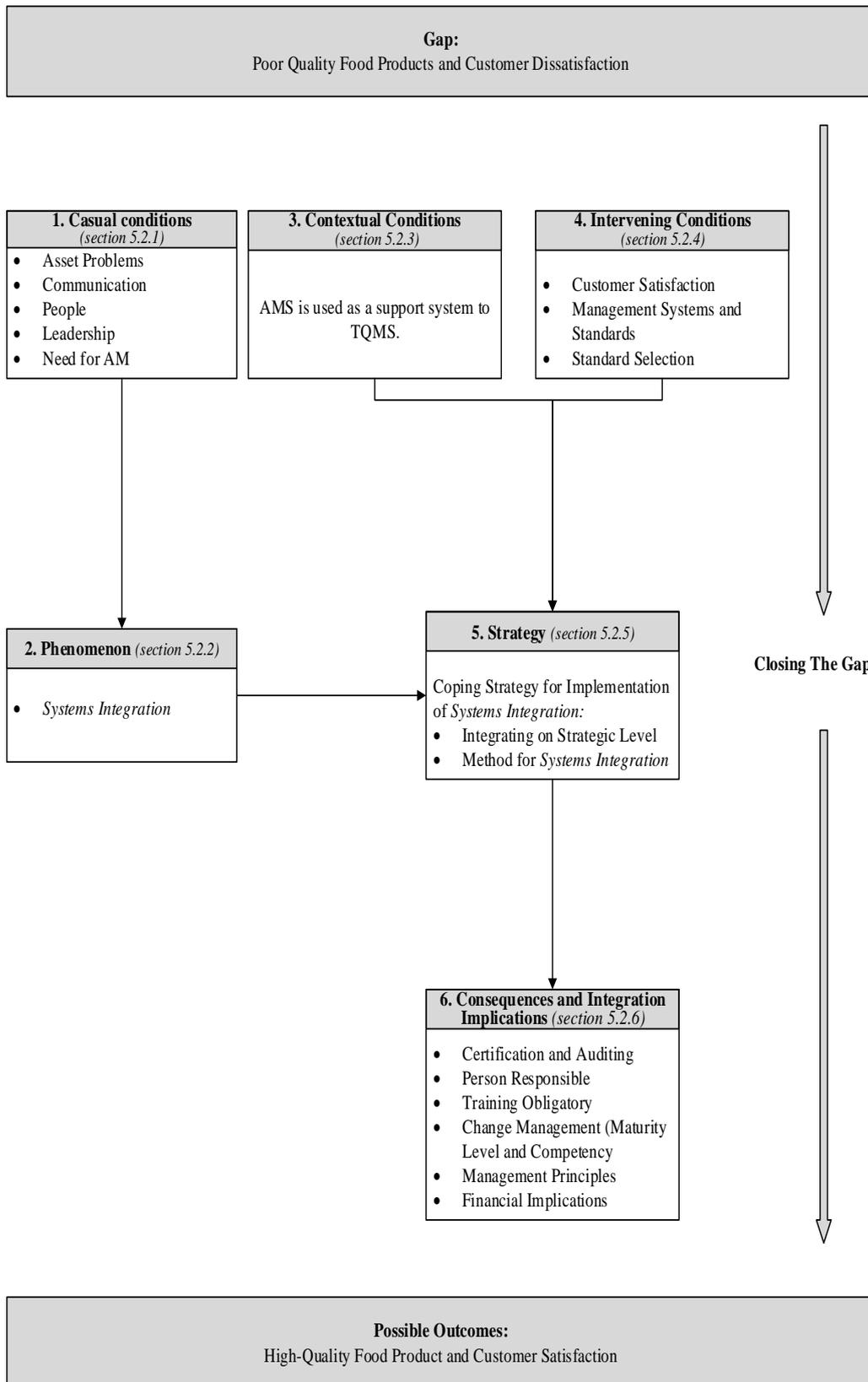


Figure 5.1: Theoretical model (*axial coding paradigm*) for integrating AM with TQM

5.2.1 Causal Conditions

The researcher has defined and confirmed five causal condition factors of eight distinct food organisations, namely: asset problems; communication; people; leadership; and need for AM in the food industry. These factors of causal conditions emerged from the data, which led to the need for certain phenomenological experiences related to the integrated approach. Within the succeeding sections (sections 5.2.1.1 to 5.2.1.5), an interpretation of data from senior managers' experiences in the context of these factors is presented. This section ends with a summary (section 5.2.1.6).

5.2.1.1 Asset Problems

As previously discussed in section 2.2.2.1, assets are defined as anything that has potential or actual value to an organisation. Hence, Fred define "asset problems" as anything that causes a problem within the definition of assets. This is critical to consider when reading the discussion regarding "asset problems".

In the context of AM, it is identified that different classes for asset types exists. In section 2.2.2.1 it is mentioned that physical assets are the focal asset class of AM, however other asset interface classes (the non-physical assets such as human, information, financial and intangible assets) are also considered as important when holistically managing assets.

The food industry generally speaks of "*machines*", "*equipment*" and "*infrastructure*" as assets that add value to the organisation (Laura, Renee, Alec, Ian, Sam, Ella: in-depth interview). The latter represent physical assets. Interestingly, Renee argued that assets could be anything that has a direct influence on the quality and food safety of the product, she said:

"I would say that any equipment that has physical contact with the product which could influence the quality and food safety of it. That 'equipment' that I'm referring to also includes the design, maintenance, the effectiveness and adaptability of it" (Renee: in-depth interview).

Thus, Renee clearly acknowledge that assets significantly correlates with achieving high-quality and food safe products. This is a very important connection to make between AM and quality and food safety performance. It has been previously speculated that if assets are managed properly (see section 1.1), high-quality performance will be yielded. Renee, therefore, confirms that this speculation is true and deserves valuable exploration.

Apart from the physical assets, all participants did acknowledge that "*people is an important asset*" which also brings value to the organisation (Laura, Garry, Renee, Alec, Ian, Sam, Ella: in-depth interview). The human asset class within the food industry is very often "*overlooked*" (Alec: in-depth interview). Alec observes that:

"... but I would also want to include another asset, which is people, this is sometimes overlooked. People are key to the success of a business which

also is an asset. People is the biggest asset that one can possess in life, you need to involve people in our systems. Because people are those who run and design the systems and the assets...People is another important asset since people entails sharing the right information ” (Alec: in-depth interview).

Contributing to Alec’s remark on people “*sharing the right information*”, Garry supported his statement and explained that the human asset class, together with the other asset classes, is important to the food industry:

“The elements of human assets are included or are necessary in the functioning of other standards, so, quite often companies can fail in certain aspect of communicating the message of what are our targets this year. Your whole intellectual properties things are those intangibles which in some companies have very high values of goodwill write downs. You know, what isn’t an asset at the end of the day? An asset can be anything that adds value to an organisation. It’s not just machines and equipment. For instance, in corporates it is very different the control of the intangibles” (Garry: in-depth interview).

Alec further ranks the asset classes in descending order of importance:

“Definitely people. That would be my number one asset. Because people do the stuff physically, you can’t achieve anything without people. People need to work towards one shared vision, work together as a team. Then I would say Information is the second important asset. The correct information is critical, you need information; information is another key asset. Without knowledge you will not go far . Information and knowledge is critical for operating acquiring the correct physical assets (which are my third important asset). Because without the right knowledge, you will not be able to purchase or acquire the correct equipment, so you have to employ the correct people with the knowledge of equipment and suppliers. These three I would suggests is important, all the other things will fall into place within these three. Money is important yes, but it is not the solution to everything” (Alec: in-depth interview).

Similar experiences are echoed from the other participants. Particularly, Sam confirmed that the two most relevant assets to the food industry is the physical assets and the human assets. It is however, the responsibility of the human assets to operate, maintain and sustain the physical assets. At this stage, it is clear that the human aspects of assets are overlooked and neglected within the food industry. Accordingly, the category named *People* is discussed in greater detail in section 5.2.1.3.

Assets (whether human or physical) tend to cause serious final product implications within the food industry, due to negligence and improper management of assets (Laura, Garry, Renee, Ian, Alec and Sam: in-depth interview). All participants argue that machine eruptions and/or failures directly influence the final product specifications in terms of product quality and food safety. Laura explained the latter with a typical example that occasionally occurs when a machine is not properly managed:

“The machine fills pouches with the product from which a cap shoot brings down caps and places in on the pouch which are then tightly sealed with the capper machine. But that cap shoot is currently ineffective since it cannot properly place the caps on the pouches. It does not work accurately. Now, instead of the machine operating at a speed of 12, we assigned two people to the machine to manually place the caps on the pouches which immediately reduces the speed of the machine to 9. Instead of producing 21000 pouches per shift of 8 hours, we only produces 14000 pouches in 8 hours. Thus, we are currently only 66% efficient. So, if we could have properly maintained that piece of equipment or reacted to the problem sooner...just imagine what we could have saved over three months. Remember, we are now increasing the expenses of the product with a third of its usual price because we are now only two thirds efficient – this decreases our profit with 30%. You could now just imagine, if you refer to food safety, how this problem of poor capping will influence the food safety of the product, the hygiene of it. Because it is operating at a slower speed, it causes fluctuations in temperature since it is not performing spot on at 80 degrees every time. Now you have to remember, the product will start to blow-up because of this. This is now a very good example for me of a machine that could have been maintained better, because obviously in influences both the quality and safety of the food product. Also, it prevents you from achieving your bottom-line” (Laura: in-depth interview).

Laura clearly faces an issue of poor management of assets. It appeared that she is frustrated with this type of problem and also emphasise that poor management of assets results in lack of efficiency because food organisations try to find the easy way out of solving problems instead of facing the problem directly. In frustration, Laura argues that these types of problems result in serious consequences and therefore influence the food quality and food safety of the product. In turn, product defects occur.

In response to this, Laura, alongside Garry and Renee, suggests that these types of problems could have been prevented if AM was practised. Laura specifically said that *“if that principle”* (referring to proper management of assets) *“could have been understood amongst the production manager and his supervisors”* this problem would not have occurred. This is one of the many reasons why AM should be investigated within the food industry. Aside from only focussing on product deviations and food safety issues, this type of problem also results in throughput failures and induced money losses. In these types of situations, it is *“better to not run production because of the increased product costs”* since the organisation is not yielding profit any longer (Laura: in-depth interview). In accordance to the literature analysis (see sections 2.3.2 and 2.3.3), profit is known as one of the objectives of AM. As such, AM strives to optimise processes to deliver improved Return on Assets (ROA) and profitability. Thus, it is appropriate for, and expected of, Laura to emphasise her belief of acknowledging AM as important. As a final remark to this example, it is critical for equipment to run efficiently, since temperature fluctuations and speed cause

serious implications toward the final product in context to its quality and food safety.

More specifically, Renee advocates that due to temperature fluctuations, *“the colour and taste of the product will deviate from batch to batch”* (Renee: in-depth interview). She openly admits that the food industry *“do not operate the machines efficiently”* since they *“operate the machine overtime and over its determined capacity”*. This led to the conclusion that those machines *“do not add value”* to the production process any longer since it is now *“causing quality problems”* (Renee: in-depth interview). In turn, the food safety of the final product will be influenced and defects occur. This concern that is shared among all participants and should, therefore, be addressed. The food industry in its entirety seems to lack proper guidance for the proper management of their assets; however some *“individual companies will be better”* at managing their assets than others (Garry: follow-up in-depth interview). This is one of the many reasons for participants’ logical thinking of incorporating AM within their quality systems, which justifies the problem statement as discussed in section 1.2.

It occurs to the researcher that food organisations typically hold onto old and overworked physical assets. In the light of this topic, Renee expressed her frustration towards the incapability of the food industry for capital investments or desire for changes in plant designs to better production. She explains, in agreement with what Laura has also acknowledged, that the food industry’s incapability of investing in new assets leads to increased losses of money in the long-term (Renee and Laura: in-depth interview).

Another problem of equal importance is the lack of proper root cause analysis and inspections prior to production. Garry observes that:

“If you look at food manufacturing, we talk about it on a daily basis and sometimes in companies they don’t drill down far enough into the root cause of failures. From my own experience, if you do that, quite often you’re having this link with your plant equipment and your assets that are used to manufacture your product until you’re finding something that you haven’t maintained properly or you have forgotten about or you should have put it into place. So perhaps, an AMS will assist in helping to improve those situations. In the end of the day if your assets failing because you are not maintaining it then its reducing the value, maybe reducing the cycle life of the asset unnecessarily ” (Garry: in-depth interview).

Alec’s opinion regarding asset problems is similar to the above statement made by Garry. He specifically points out that due to the negligence or improper maintenance of assets, the asset will over time lose its effectiveness, especially if it is operated post its indented life cycle (Renee, Alec, Garry: in-depth interview). Alec refers to this problem as *“catastrophic”* since it will lead to *“a lot of money loss”*, confirming observations made by both Laura and Renee. Not only will money be lost, it will ultimately lead to the loss of business caused by customer dissatisfaction. Additionally, both Jim and Fred argue that the negligence of assets, especially

physical assets, lead to quality inconsistency which causes consumer complaints and unsatisfied customers (Jim and Fred: in-depth confirmation interview). Alec also made another important comment which should not be ignored; he says that:

“A damaged brand is not manageable, you can’t restore that brand. A damaged brand occurs due to production hiccups or errors or equipment failures. This could damage the companies’ reputation. This would cause consumers to create a stigma against your product. It is very difficult to repair that damaged brand and lost relationship (because you are not in direct contact with the client, but your product is)...No food manufacturing company wants to be associated with equipment that operates ineffectively or those who are falling apart that could lead to serious food poisoning that could lead to illnesses or causes of death. No food company wants to be involved in killing people-that is my way of expressing the importance of it” (Alec: in-depth interview).

Alec clearly makes a viable connection between asset problems (caused by production hiccups or equipment failures) with damaged brands. Sam echoes Alec’s opinion of damaged brands by arguing that typical problems related to assets are *“time consuming”* which causes loss in valuable *“time”*, *“money loss”*, sometimes even *“quality loss”* and *“brand and reputation loss”* (Sam: in-depth interview). It is therefore evident that damaged brand correlates with serious damages to the company’s reputation and causes customer dissatisfaction (Alec, Ian and Sam: in-depth interview). As recalled from literature, customer demand for certain specifications and standards are critical for all food organisations and in order to keep customers happy, it is required to address these types of problems (Refer to sections 3.1 and 3.4).

In the context of the human asset class, it is believed by the participants that improper management of people also relates to increased problems of physical assets, resulting to poor quality and unsafe food products. Ian explains that their organisation faces *“retrenchment”* caused by increased costs of quality. *“Quality, keeps the organisation running”* and it is food organisations’ main focus (Ian: in-depth interview). However, Ian’s organisation is facing many financial issues, but top management decides that it is better to reduce labour costs, rather than to invest in identifying and fixing the root causes, which is often caused by improper maintenance schedules, to improve quality (Ian: in-depth interview). He further explains that their organisation, or the food industry in general, tries to save money by ignoring the criticality of asset maintenance. Food organisations would rather *“push the machine until it completely breaks”*. In support of Ian’s argument, Garry adds that *“unfortunately in practice much revolves around cash flow, asset support through maintenance is sometimes not carried out in the hope that it could be postponed until later”* (Garry: follow-up in-depth interview). He further mentioned that it is typical to *“reduce costs rather than investment”*. Clearly this suggests that most food organisations utilise reactive maintenance instead of preventive or proactive maintenance. This causes serious problems within the organisation in that profit, performance and customer satisfaction decreases.

Laura, Renee, Alec, Ian and Sam all agreed that if food organisations are not properly maintaining their assets or neglecting its importance, serious implications (such as “*shut-downs*” or even “*close-downs*” (Ian: in-depth interview)) will accumulate over time. As a result, the problems become unmanageable. It is suggested by all participants that the food industry needs an AMS to assist improving these type of situations. The food industry, therefore, feels strongly about the benefits that AM could bring to their organisation.

From the preceding discussion, it is evident that the two main asset classes, human and physical assets, identified throughout the eight food organisations are interlinked to one another. Thus, these asset classes should be managed critically since both cause quality and food safety related issues. In turn, damages to the brand and reputation leads to unsatisfied customers. Observable, food organisations should take note of these implications in order to be capable of holistically addressing its related issues.

5.2.1.2 Communication

Communication is identified as the corner stone of many problems related to food organisations’ overall performance and most importantly, the quality of the final product. Laura made a very important remark about the food industry acknowledging AM as a possible solution to their many problems. She observes that:

“AM is not yet known to the food industry as a management system. Everyone wants to know a little bit of it yes, so they do measure the Overall Equipment Effectiveness (OEE), but they do not know the philosophy behind it or what its management style does nor do they know what it could mention to the food industry...I think it is totally unknown within the food industry. However, it seems to become more important over time. The food industry is definitely starting to look at it” (Laura: in-depth interview).

Similarly, Ian, Renee, Ella, Fred and Jim acknowledges that AM is not yet known to the food industry, but to some extent, they do implement some elements of AM and its AMS without realising that they are doing it. More specifically, these participants argue that their organisations does implement it but “*do not call it AM*” (Ian, Renee: in-depth interview). AM is commonly confused with the very tedious and negative term “*maintenance*” used within the organisations (Fred and Jim: in-depth confirmation interview). When people in food organisations speak of “*maintenance*” or “*breakdowns*”, they immediately react negatively to it since it became a known cause for continuously slowing or influencing effective production (Renee: in-depth interview). Moreover, Jim stresses that, unfortunately, AM is a field of interest that does not yet acquired the attention it deserves. In order to overcome this mindset, Renee suggests that the term “AM” should take the place of “*maintenance*” to create a positive environment for addressing maintenance related issues (Renee: in-depth interview). Fred approved of Renee’s opinion by stating the that:

“AM is often referred to as ‘maintenance’ and not AM. It is important to elevate its importance on a strategic level.”

Apart from the negative connotation made towards AM, other problems also emerged. All participants admits that *“communication gaps”* between departments, especially the *“maintenance management”, “operation management”* and *“quality or Food Safety Management (FSM) departments”* exists (Laura, Garry, Renee, Alec, Ian, Sam, and Ella: in-depth interview). Laura said that these departments are managed as *“separate silos”*. Moreover, Garry mentioned that there is *“a constant fight”* between departments while observing that:

“Absolutely 100%. That is a constant fight. Everywhere I’ve ever worked, from my earliest days from the age of 18 until now, it’s the constant battle. There never seems to be any alignment between engineering and...I wouldn’t want to box it into quality as much – but anything related to quality production. There is just a constant fight” (Garry: in-depth interview).

Garry agrees that there exists a gap between engineering and anything else that relates to quality, which includes: the product; the process; the production; the assets; and product specifications. He pointed out that *“it’s almost like the one side just doesn’t understand the other. One side sees the other side as a hindrance or as an annoyance.”*

Renee’s response towards communication problems between departments is significantly similar to what Laura, Garry and Alec observed. According to Renee, the lack of communication is *“where the gap is in the food industry”*. She also adds that *“engineers design and maintain assets that are within their framework of reference”*. Once this process of planning and designing is complete, only then does *“quality contribute to the process and identify things that do not work”*. Only when quality starts to partake in the designing phase would they identify things that would work well in the engineering context but within the context of quality it will not work at all (Renee: in-depth interview). This is a good example of departments not working together during planning and decision-making. It is important for everyone to partake in decisions to prevent problems from occurring.

In contribution to what Garry’s remarked earlier, Alec also finds that *“conflict between departments”* exists because they have *“conflicts of interest”*. Alec also strongly pointed out that *“maintenance management, production, and quality do not see eye to eye”*. They can’t sit in one room because they are down each other’s throats, the reason being that *“this one blames that one, and that one blames this one for that”* (Alec: in-depth interview).

Another example of communication problems is failing to ensue with a proper *“two way communication channel”* between the level of competencies amongst management and operators or floor workers (Alec: in-depth interview). From experience working at distinct organisations, Alec explains that many organisations have *“unnecessary production hassles because of communication failures”*. He stresses that

“sometimes we over complicate things especially in the way we communicate”, thus, “we need to simplify the way we communicate” and “keep it straightforward”. It is critical to acknowledge the different levels of competencies since “the ways we communicate on floor level is completely different to the way we communicate on management level”. It is, therefore, suggested that things be kept simple and communicate on a level that everyone can understand the topic in discussion. Alec further observes that it is “catastrophic if somebody assumes something that you didn’t actually say, because this goes on to production and then you discover this problem only later”. Poor communication, therefore, leads to problematic production and final product implications. Evidently, communication is critical for any food organisation. If an error is identified too late during a production process high amounts of “money is lost and you need to rework your product due to a lot of damages, which means that the amount of profit that you are supposed to be making is lost, including time (time is money)” (Alec and Sam: in-depth interview). Moreover, if this communication error should occur, the company will experience “a lot of hiccups or negative results just because of one simple mistake” (Alec: in-depth interview).

There are various reasons for the occurrence of communication gaps between departments, according to the participants, who repeatedly stated that these departments (referring to quality and engineering) typically have distinct *“framework of references”* (Renee: in-depth interview), *“different level of competencies”* (Sam, Renee: in-depth interview), *“different cultures”* (Laura: in-depth interview) and *“different mentalities”* (Sam: in-depth interview) or they *“think differently”* (Ella: in-depth interview).

While elaborating the level of competency differences, Renee, Sam, Laura and Ella stressed that those persons responsible for maintenance, are not aware of their actions towards the quality of final food products. Both Laura and Renee argued that maintenance believe that they are only there to do their required task, but do not reckon that their tasks have any consequences (Laura and Renee: in-depth interview). Laura stresses the following:

“When a machine breaks or quality parameters deviates from specifications during production, maintenance are called upon to attend to the problem. At that point, it is difficult to explain to maintenance and to try and make them understand that there is something wrong with the quality of the product. Typically, maintenance do not think in terms of the quality of the product. For them it is all about making sure that the machine operates twenty-four-seven, no matter what the outcomes are. This is a big gap within the industry” (Laura: in-depth interview).

Concerning the problem of miscommunication or misinterpretation of responsibilities, various employees’ levels of competencies are not yet at the desired level of managing processes effectively. It is evident that maintenance do not acquire sufficient training and knowledge regarding quality and food safety. For this reason, most participants admit and suggest that their training programs should also include aspects of quality and food safety. Renee specifically points out: *“management*

do not include maintenance in food training, not with regard to food safety and not with regard to food quality. But maintenance is important because every action that they do on the production floor influences the quality and food safety of the product” (Renee: in-depth interview).

The participants believe that “*education and training*” (which is discussed in more detail in section 5.2.6.3) can help change department’s mind sets towards attaining a culture of holistic quality. Training for operating physical assets is critical to be used in combination with the food safety and food quality systems. This concurs with the idea of integrating AM with TQM. Laura and Ella propose that “*AM should be used as a support system*” as it could support many problems, including asset problems and communication problems. This is one of the foundations for creating the phenomenon of integration.

Notwithstanding the fact that all participants acknowledges the differences between departments, communication gaps will vary from organisation to organisation as well as the type of management style or culture that is practised within the food organisation itself. In this regard, Ella states that:

“Communication gaps does exist yes, but it depend on organisation to organisation. I believe all have communication gaps because quality and engineers have different mindsets of doing thing” (Ella: in-depth interview).

Laura, Garry, Alec and Ian echoes Ella’s statement when they all agreed that severity of communication issues “*varies between organisations*” and “*different cultures*”; whilst the involvement of, and management style of, “*top management*” play an important role for resolving asset related problems. Most of the time, the related asset problems are caused by the existence of communication barriers, poor two-way communication channels and improper knowledge or training or a combination of knowledge and training.

Garry made a very important remark about leadership¹. From experience, he believes that to overcome these communication stigmatisation and cultural differences you have to have strong “*leadership*”. He stresses that:

“The best way, the only way, of moving that aspect over is through leadership. And applying all of the softer skills, the interdependent skills towards people, the understanding how the other side is thinking. Seeing their side of the story in order to help create the right environment for improvement” (Garry: in-depth interview).

Moreover, Laura believes that “*with strong leadership, AM can assist in managing the change to overcome poor communication*” (Laura: follow-up in-depth interview).

¹Leadership is a “process whereby a person influences others to accomplish a set of goals or objectives within an organisation”. To be an effective leader, one should attain the ability to cause followers to want to achieve desired outcomes. Herein lies the art of strong leadership (Hancock, 2012).

Fred affirms both Garry's and Laura's observation regarding leadership; he asserts that: asset problems "*need to be considered at the design of the AM strategy by the people and leadership² are responsible for it*". It may, therefore, be implied that top management commitment and support is critical for change management and the management of every-day problems, including orchestrating organisational communication channels to work. At the end of the day "*you can't have continuous improvement in any industry, without everyone agreeing on a common goal*" (Garry: in-depth interview). Thus, communication problems and asset problems correlate with leadership, which is elaborated on in section 5.2.1.4.

All participants, thus, proposes that AM will assist with asset problems (Laura, Garry, Renee, Ian, Alec, Sam, Ella: in-depth interview) as well as breaking down silos by allowing all parties or departments to work as a team (Laura, Sam: in-depth interview). Sam sums up the issue regarding poor inter-departmental communication when he observes that:

"...there is different INVOCOMS (Employee Involvement through Communication for Commitment and Innovation) meetings for different departments. There is a meeting for production, quality and engineering separately but all at the same time. So I would suggest that you need to have that, all meetings should be held in the same room were all parties are included and all talking about their issues, and how are they then going about working today and to resolve the problems as a team. Because, now, we are not holistically addressing those issues. We have those meetings alone. So how is everybody going to know about all the different problems? All these problems are linked with each other? Are they now going to send email to one another? That's not very accurate. So this comes back to the communication gap that we've spoken about. We know about a problem for an example, but do we really know it was fixed accurately? We won't know, because nothing was communicated about that. That is a big problem that I find with the meetings. So I would say that we should have meetings that include all the different parties. So we should have 15 minute meetings to discuss all the problems that we had and how are we going to solve them and what are we expected to achieve for the day. But again, this is a very big problem" (Sam: in-depth interview).

In an attempt to understand the holistic purpose of INVOCOMS, Sam explains them this way: "*meetings that we have every morning or before we start with each shift where we talk with our people with things like what happened the day before*". It also includes conversations that considers preventative and continuous improvement planning, Sam says it considers "*what are we going to do going forward*" (Sam: in-depth interview). Hence, INVOCOMS allow organisations to discuss all issues related to a shift before they are allowed to proceed with production in the succeeding shift. With reference to Sam's observation above, holistic communication

²Participants often use the term *leadership* in context of the leader of the organisation that represents the top manager. For the convenience of the reader, note that if the participants speak of *leadership*, they mean to say *top manager* or *top management* or *top management commitment*.

and discussions between departments are inevitable. Noticeably, this is a problem that his organisation, and many others face. However, once again this contributes to the need for co-operation of engineering and quality departments, or more specifically, the incorporation of two distinct systems, AM and TQM. Sam provided a valid example of miscommunication between departments, which is worth noting:

“Us, from the quality side, we are like the ‘police’ of production. We do not run production, we only go and check if they are doing what they are supposed to do or are they doing it according to customer specifications or expectations or are they doing it according to what the quality standard is saying. So know if production doesn’t communicate with us to say that ‘the product that we are running currently, the quality is deteriorating, or the product is not as firm as the previous batch’, and still run it at normal temperature or normal speed. That causes a big problem, because you are going to have two different classes of products, one that is firm and the other is mushy. So two cans with the same product does not look the same, the quality differs, it deviates. Whereas, if you know what your machine can do and at what point you will need to access your machine or at what point you will need to access your raw materials, and adjust your cooker parameters, or your speed based on what your raw materials looks like. When we are running INVOCOMS, production just want to read throughputs and their throughputs will be met, but all the other parties will have a problem because the product is over cooked. But for production, they make up all their targets. So by the end of the day, all the product at the warehouse is overcooked product, we cannot sell it” (Sam: in-depth interview).

Sam agrees that AM *“will allow all parties to discuss issues together”* to ease the process of fixing problems which food organisations noticeably lack at this stage. Clearly, collaboration and teamwork is another critical topic (see sections 2.1.4.3 and 2.1.4.9 for in-depth discussions).

Alec makes a link between communication and teamwork by stating that:

“Communication is a stumble in everything that we do...because we have to be very careful when sharing information – we have to be sensitive towards people and think about how you are saying things. So if you do not approach things as a team, you will always be down each other’s throats” (Alec: in-depth interview).

Here, Alec implies that teamwork is required to communicate properly. These are all responsibilities of top management which is discussed in section 5.2.1.4. Improper communication channels within the quality, operations and production departments as well as culture differences, cause asset problems (e.g. quality deviations caused by inefficient operations or maintenance of physical assets by human assets). In this regard, Garry had the following to say:

“It is possible to blame many things on communication. Probably coupled to that working in silos. Teamwork is the key and that is driven by from the top” (Garry: follow-up in-depth interview).

Teamwork is inevitably the key consideration for overcoming communication problems, hence, top management should drive this predicament of communication problems. Also, proper people management, which is discussed in section 5.2.1.3, is critical to prevent the silo effect. Throughout all interviews, the general management principles of TQM have continuously been recalled by all participants, without formally addressing and realising it.

5.2.1.3 People

At the heart of any organisation, especially food organisations, people play an important role. Without people, systems implementation will fail as well as effective equipment operations and production performance. Additionally, people are responsible for sharing accurate information as well as maintaining effective systems and sustainable assets. In turn, it is the people who will be responsible for maintaining physical assets and to operate production more effectively. People should, therefore, not be misinterpreted for their importance. The topic of people has become an important and critical discussion amongst all participants.

As mentioned in section 5.2.1.1, although sometimes overlooked, people are identified as an important asset to the food industry among all participants. The participants have explained that proper management of the human asset class is required to resolve many asset related issues and communication barriers; thus, people need sufficient attention. Alec emphasised this by saying that:

“With regard to equipment or ‘physical assets’, we need people, we need the intellectual property, we need information and communication – without all that, your business will not survive...People are key to the success of a business which also is an asset. People is the biggest asset that one can possess in life, you need to involve people in our systems. Because people are those who run and design the systems and the assets. In order to run these processes, the people need to understand it and communicate it in a very simplified way. You need to know the knowledge level of every individual since every company runs differently” (Alec: in-depth interview).

As mentioned earlier, AM is identified as a suitable support system to the food organisation in an attempt to resolve many asset related issues, which are mainly caused by improper communication channels between departments and misinterpretation of maintenance role towards attaining food quality and food safety. It is advised by all participants that an integrated system is deemed appropriate for AM to continuously improve the TQMS. In order to establish AM together with the food industry’s current food quality and food safety systems (also known as the TQMS), effective people management is required (Garry: follow-up in-depth interview).

Considering the essence of people management for the holistic integrated approach, the following important factors about people should be understood (Laura, Garry, Alec, Ian, Sam, Ella: in-depth interview):

- All people should be involved throughout decision-making.
- People should collaborate.
- A vision should be shared amongst everyone.
- Competent people should be employed that add value.
- Education and training is required for optimal use of physical (i.e. operating machine and equipment to its full capacity to yield production performance and prevent final product deviations) and non-physical assets.

All of the above-mentioned factors represents elements of the “soft” management principles mentioned in section 2.1.4. Top management will have to attain the responsibility of people management (Garry: follow-up in-depth interview) as well as all the “soft” aspects of management. This is elaborated on in section 5.2.1.4.

Alec has made a strong correlation between AM and people management. In context to AM, he says that it is required to “*acquire the right equipment for the processes*”, and this is the same for people management since “*people should acquire the right information in order to create processes*” and to operate physical assets (Alec: in-depth interview). It is important that all parties (or departments) collaborate during the introduction of AM for effective implementation of it. Alec emphasises that “*it is important that everybody partake because everyone has a certain area of expertise and that input is important in making the project successful*” (Alec: in-depth interview). In order to ascertain effective implementation of any new system or project, a holistic environment and culture should be envisaged in order to establish a collaborative team that shares one vision. Also teamwork and collaboration is required throughout need assessments and decision-making (Alec, Garry, Sam: In-depth interview). Therefore, “*leadership should assure proper management*” of people (Laura and Garry: follow-up in-depth interview).

People partake in various elements and physical activities concerning the TQMS within the food industry. Automatically people will also be part of the AMS and will be hand-on with the implementation of it. When integrating these systems, care should be taken for proper management of people.

As mentioned in section 5.2.1.2, those people responsible for maintenance often fail to recognise their valuable inputs and actions toward attaining high-quality and food safe products. In order to overcome this communication barrier and to prevent poor production from occurring, Alec specifically states that:

“...people need to be motivated and educated on operating machines and equipment. The people on the floor are our eyes and ears, so we need to trust them to do things efficiently. You need to get your people to a

certain way of thinking, to a certain culture of doing things to deliver high quality products to satisfy the customer. You need the people to commit to the same vision, the same culture. People are an asset that needs to be managed properly, you need to treat people right. If the people are not happy, it could cause unnecessary problems, which comes back to possibly affecting our brand. People are an asset that needs to be managed properly” (Alec: in-depth interview).

Obviously, this is a serious problem that the food industry currently faces. Although the food industry recognises that people are important assets, there is still “a lack when it comes to the recognition of when people perform according to their Key Performance Indicators (KPI) and Key Performance Areas (KPA)” (Laura: follow-up in-depth interview). For this reason, the human asset class is neglected and immediate attention is required to remedy it. Alec emphasised this when he pointed out:

“...let the maintenance people see for themselves were they fit into the big picture, let them realise what how big their responsibility is regarding food quality. Again, it is top management’s responsibility to program this way of thinking into ones head. Show them your vision, and explain to them the importance of maintaining that vision. Explain to them what their role is in the big picture, what their contribution is to the organisation. Sell the idea to that person, change the way they think the way he or she sees things, change the way they precepts things. Tell that person what their actions is towards quality, explain to them the consequences. It all goes back to top management (what did they programmed him with). If you treat somebody as important and treats that person as an equal to everybody else, they will perform. Tell the person how they could add value to the organisation, how they are an asset to the organisation and how important that person is to the success of the business. If you point out a problem to a person, that person should be programmed in a way so that they feel honoured to try and fix the problem or to provide their services, and top management should trust that person with their responsibilities. People should look forward to delivering their service and to do their part for the organisation”(Alec: in-depth interview).

All participants are in agreement that proper people management will help to overcome asset related problems, and inter-department silos from reoccurring, as well as poor management of processes. Laura, for example, made the following remark:

The only way how people will properly manage processes is when they have goals and objectives to work against. These goals and objectives should be SMART (Specific, Measurable, Achievable, Relevant, Time-bound) and aligned with the business’s vision and mission. Regular Individual Performance Appraisals (IPA’s) should be held with each and every individual in order to determine the progress on goals and objectives (Laura: follow-up in-depth interview).

The food production process sometimes relies on manual operation of physical assets. Contradicting this, the engineering industry is mainly automated and does not rely on people to operate physical assets. For this reason, the human asset class is once again regarded as critical within the food industry. Therefore, people should be properly managed, as suggested by Laura (refer to her statement regarding SMART objectives and IPA's). Undoubtedly, the food industry has to *“invest in the people”* (Sam: in-depth interview). Sam also adds that the food industry has to employ only competent people *“whom have the skills to operate machines”* and if not, training is obligatory to effectively operate machines and equipment (Sam: in-depth interview). It became apparent that if people lack these basic elements of knowledge and information, and if the organisation lacks proper structures to employ one vision or one culture, they will *“have people who are pulling in different directions”* (Renee, Sam: in-depth interview).

Once again, participants propose that AM could help with problems associated to those caused by (a) physical asset failures, which are caused by negligence or improper operation, or (b) poor communication, which are caused by interdepartmental miscommunication or underestimating roles and responsibilities. All these problems concern people. Both Laura and Sam contemplate that *“AM could help change the mentality of people so that they could realise the implications of these type of problems”*. Thus, perhaps through integration, AM could bring quality and engineering departments to collaborate with one another, something that is not yet on a competent level within many food organisations. Fred believes that *“the integration or alignment of the systems will improve collaboration between manufacturing departments breaking down silos and aligning KPA's and KPI's”*.

Evidently, people require structures and guidance (Garry: in-depth interview). Thus, top management has the responsibility to provide people with guidance as well as a healthy and proactive environment, especially when considering incorporating a new aspect to their TQMS. In section 2.1.4.6, employee involvement is considered as critical for establishing an effective work environment and as part of effective TQM application, valuing the workforce is essential. The topic of leadership is discussed in the succeeding section.

5.2.1.4 Leadership

“...If we speak of the organisation as a human body, everybody within the organisation is an organ, and each organ has a specific job to do to keep the body to function efficiently” (Alec: in-depth interview).

Alec explained the typical structure of an organisation using a visual representation of the human body. According to him, top management represents the “brain” of the human body from which they assume the role of orchestrating the “organs” (representing the people) to keep the organisation (representing the body) functioning efficiently. Alec explained how he perceives a good manager to be with an example:

“...If you have a holistic approach to managing the problem (referring to what is the problem, what is the cause of the problem, how are we going

to manage the problem and how are we going to solve the problem) and not focussing on an individual of who might have caused the problem. So, top management style of managing conflict is important since it will create either communication errors or effective communications” (Alec: in-depth interview).

Reflecting on Alec’s perception, all participants argues that top management and their style of managing people directly influences the culture of the organisation as well as overall performance of the organisation.

In sections 5.2.1.1 and 5.2.1.2, it is continuously advocated that people are the reason for many problems occurring within the current TQMS of the eight distinct food organisations. It has also been mentioned by the participants that top management are responsible for allowing asset related problems and communication problems to occur or are responsible for preventing these from occurring. Therefore, all participant’s opinions regarding leadership and how to overcome tedious problems, top management has the following responsibilities (Laura, Garry, Renee, Ian, Alec, Sam, Ella: in-depth interview):

- realise the value of assets;
- be committed to the organisation, and to the entire workforce;
- be positive;
- focus on achieving high-quality and food safe food products;
- focus on identifying and acquiring necessary resources to better high-quality and food safe food products by ultimately improving production;
- support the understanding of resource significance;
- focus on breaking down silos and establish two-way communication channels;
- communicate in a simplified manner so that all employees understand;
- acknowledge that machine and men have the biggest influence on the quality of the final product;
- create awareness amongst maintenance employees for producing high-quality food products;
- include the workforce during decision-making and include their opinions and knowledge during brainstorming;
- equip the workforce with the necessary tools, techniques and knowledge;
- establish employee empowerment – delegate responsibilities to managers and respect their responsibilities and trust them to do it efficiently;
- promote teamwork;

- positively translate visions, objectives and goals, especially when introducing new projects;
- establish recognition and reward – provide proper people management and value each individuals' inputs;
- be the motivator for senior management and other workers;
- manage change – be responsible for establishing a shared culture or manage the way of thinking and people's attitudes towards implementing new things;
- create a culture for collaboration and flexibility;
- share their visions with the workforce;
- acknowledge that a proper AMS, that measures the performance of machine and people during food production, would improve the quality performance of production, produce high-quality and food safe food products, and produce at affordable cost.

It is also believed that the food industry is lagging behind because they are only focused on *“food quality and food safety, but never looked at how to manage assets properly to produce products cost effectively”* (Laura: in-depth interview). Perhaps, if *“assets are attended to prior to anything else”* and if *“assets is managed properly”* by top management, the food industry will not be in this dilemma (Laura: in-depth interview). It should, however, be noted that the level of asset care will drastically differ between a developing and first world country (Fred: in-depth confirmation interview), especially since developing countries, such as South Africa, rather employ unschooled or uneducated workers which influences the efficiency of asset care (Jim: in-depth confirmation interview).

It has previously been stressed that AM will be beneficial to the food industry. Once again, Laura expresses her strong opinion towards the need for accomplishing AM incorporation with their systems. She said that if *“assets are managed properly”* and top management understands the importance of it, *“one of the automatic outputs that will yield is improved quality, and most definitely safe food products which does not contain any hazards, at a better and affordable price, since everything will be done more effectively”* (Laura: in-depth interview). Thus, if AM is considered for implementation, the benefits of AM should be discussed with top management to encourage them to commit to the integrated approach or to managing their assets effectively.

Figure 5.2 depicts the relationship between top management and people. This figure is constructed using the combined application of memoing and visualisation. Figure 5.2 clearly explains that it is required of top management to manage people and systems properly in order to ultimately be able to overcome conflict of interest among departments. Moreover, to overcome the conflict of interest, as discussed in sections 5.2.1.1 and 5.2.1.2, it is continuously suggested by the participants that AM will assist top management if they communicate the benefits of it sufficiently. Alec finds that:

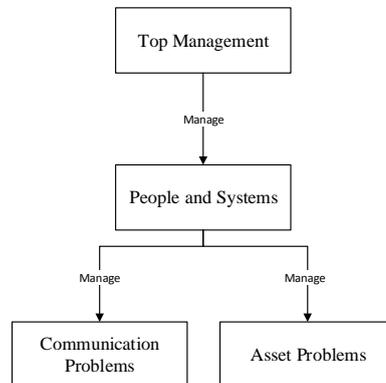


Figure 5.2: The summary of top management responsibilities

“Top management is important to share a vision. For instance, in your case (AM integration), top management could say that there is a solution to our problems and hiccups during production by implementing an integrated approach of AM, sharing the vision of AM, sharing the possibility of its benefits within the food industry” (Alec: in-depth interview).

Similarly, Fred points out that when addressing asset problems, leadership will be the most critical part of ensuring that AM works. In his words:

“...it is clear that systems such as AM are crucial towards achieving business objectives. But it is critical to emphasise that these system needs constant energy and activation. Systems like AM do not resolve or remove problems or failures. It is leadership and behaviours such as ownership and being present and engaged towards achieving common goals reached through collaboration and buy in that is key to manage required business outcomes” (Fred: in-depth confirmation interview).

This concludes the role of the top manager when facing current organisational issues. When considering the inclusion of AM with TQM, it is critical to note that AM will not be responsible for solving the issues discussed in the previous section. It will, however, assist top management to improve their systems and business outcomes. Throughout chapter 2, leadership and top management commitment were discussed and regarded as essential in consideration of both TQM and AM as separate management approaches. Literature supports the argument made by participants that leadership and top management commitment is critical, as was shown in sections 2.1.4.2, 2.2.4.5 and 2.3.2.

5.2.1.5 The Need for AM

In the preceding sections, it is established that AM will assist with overcoming problems related to assets and communication. All participants agree that there is a

definite need for AM. Since AM is identified by the participants as a possible assisting system to the various problems their organisation encounter, it is inevitable that AM should be incorporated in South African food industries.

The food industry is complex in that it produces seasonal and non-seasonal food products of various varieties and has to conform to stringent regulatory and legislative requirements demanded from customers (see sections 1.1 and 3.4). Additionally, the high demand for high-quality and food safe food products has become an evasive topic to compete with. All participants have commented that in order to “*survive*” with these high quality demands and competitive environment to keep customers happy, food organisations “*will do anything or implement new things to better their current systems*” (Laura, Garry, Renee, Alec, Ian, Sam, Ella: in-depth interview). Evidently, this statement refers to the adoption of standards (whether it is certified or not) to support satisfying the stringent demands from customers and to remain competitive. This suggests that if the AMS is adopted, it will provide extending benefits as well as support the quality and food safety of the final product, which is the main focus to any food organisation.

Currently, the South African food industry is “*lagging behind*” (Laura, Garry, Renee: in-depth interview) other countries, especially the “*European food industries*” (Renee: in-depth interview). Apart from this, since the food industry is dependant on seasonality and offers wide varieties of product types, precision is not the focus of the food industries, which contradicts engineering industries who strive for precision. In the context of this study, precision refers to the ability to manufacture consistently to which the production process can be reproduced almost to exactness.

Laura identified that the “*most important measure for operations is OEE*” and food organisations have to “*be able to measure it which consists of availability, lost over, down time, yields and quality of the product*” (Laura: in-depth interview). As mentioned in sections 2.3.2 and 2.3.3, OEE is the measure for AM. Laura further stressed that in respect to all food organisations that she previously worked at (which were five corporate food organisations), none of those organisations has ever reached an OEE higher than 60%. She, therefore, implies that the South African food industry is either within the Industry Average or Laggards class of performance (Refer to section 2.3.3). Laura acknowledges that the “*world-class OEE is approximately 85%*”. The latter is a confirmation that the food industry is lagging behind those of other countries and to other type of industries. In order to increase OEE, machines, equipment and people should be managed in such a way that they perform effectively and efficiently (Laura: in-depth interview). Responding to this, Garry argues that AM will serve as a “*part*” to increasing OEE, capability and overall performance (Garry: follow-up in-depth interview).

Renee, Ian and Alec also reflects the same opinion regarding the South African food industry. Renee specifically mentioned that, from her past experience with European organisations, the South African food industry does not acknowledge the importance of “*finding the balance between costs, risks and performance or throughput*”. This correlates with the underpinning concepts of defining AM, as depicted in

section 2.2.2.1. Therefore Renee's statement is valid. Moreover, Ian commented that the food industry's complexity for exporting internationally further complicates the high demand for achieving high-quality food products in order to keep the customers happy or to keep the business running by adapting to new trends and competitive pressures (Ian: in-depth interview). He further suggested that *"anything that could help improve their processes and quality of the final product will add benefits"* (Ian: in-depth interview). In support of Ian, Ella explains that as long as quality and food safety remains a priority, *"anything that adds value to achieve the optimum point will be beneficial to the food industry"* and *"anything that brings forward improvements, will naturally support food standards"* (Ella: in-depth interview).

In addition a discussion earlier, it is evident that food organisations perceive assets or maintenance of assets as *"something that needs to be done just because they were told to"* (Laura, Renee, Ian: in-depth interview). AM was not always a popular topic to most, but *"nowadays people are willing to spend money on maintenance to improve production and to achieve high-quality products"* in respond to the high demands (Ian: in-depth interview). However, managing assets is *"not yet part of the holistic structure and planning of the organisation"* and there exists *"no measure of determining the benefits of assets towards quality and production"* (Renee: in-depth interview). For this reason, both Garry and Renee argue that AM should be implemented to *"realise the value from assets"* and to create a culture where the term "maintenance" should be perceived as "AM", to no longer undermine the importance of "maintenance" and "management of assets". It has previously been pointed out by participants that engineers have a certain way of thinking and do things in their frame of reference (see section 5.2.1.2). Generally, they do not know how critical their actions are toward yielding a high-quality and safe food product because they lack the knowledge of food characteristics and other hazardous factors. In response to this, Laura prompts that *"If AM would be integrated with your existing quality food safety systems, it would change the way engineers think about food products"*. She further states that:

"I think it will change the way engineers are thinking because AM would be part of the quality and Food Safety Management System (FSMS). They will then recognise their input and impact per clause. For example, within the management commitment statement we will know address AM and will serve as an objective within that statement, through this the engineers will recognise parts that are familiar to them. In turn, they will recognise where their parts serves as important to the quality and FSMS (Laura: follow-up in-depth interview).

The above-statement made by Laura provides a direct correlation of the possibility of integrating systems and to subsequently change the way engineers perceive AM and its effect on food products. To some extent, Garry opposes the latter statement. Garry observed that AM will not necessarily change all aspects of how an engineer responds to their critical role towards achieving good final products, it will however *"help all concerned with food safety to integrate all systems since they are interdependent"* (Garry: follow-up in-depth interview) and integration *"will incorpo-*

rate interdependence preferences". Additionally, should AM be integrated into the TQMS, *"the maintenance and production departments will become more part of the system and will have goals and objectives to achieve"* (Laura: follow-up in-depth interview); through this, *"communication gaps"* (such as misinterpretations, poor information sharing, etc.) *"will be closed"*.

Brand and reputation are of fundamental importance to all food organisation. Branding forms part of the non-physical asset classes which correlates with production outcomes, and in turn, customer satisfaction. Contributing to Alec's opinion, Ian further explained that if production errors should occur, which causes product deviation, the brand of the product will be influenced and could, therefore, lead to the loss of customers (Ian and Alec: in-depth interview). This contributes to the other examples explaining why AM should be implemented to assist their current food systems to ultimately produce high-quality and food safe products and to sustain their brand and reputation.

All participants feel that in order for the food industry to regain their competitive advantage they should strive towards implementing AM, or attempt to use it in support of the food industry in order to improve the effectiveness and efficiency of assets. In turn, this will positively influence the quality of the food products. Since machines and equipment are critical for the production of food products, acquiring proper assets and maintaining proper management of assets correlates with consistent production (Jim: in-depth confirmation interview) and high-quality food products as well as satisfied customers (Laura, Alec, Renee, Ella: in-depth interview) as well as reduce money losses, and in turn, business losses (Alec: in-depth interview).

Ian made a very important remark about their current systems. He says that *"without a proper TQMS, then no other systems will be in place"*. He further mentioned that *"within the TQMS errors are bound to happen and due to the increased competition of quality, food organisations has to keep up with new trends and demands to remain competitive"*. If the food industry does not keep up with new trends and demands, *"businesses have to close down"* if they no longer are able to fulfil the demands of customers (Ian: in-depth interview). Once again, he stresses his opinion regarding the need for AM incorporation within their current systems since *"anything that adds value to the food organisation's final product will provide benefits"*. Alec further stressed on the opinion expressed by Ian:

"...you don't want to under deliver to your clients or you don't want to underperform, especially in this modern day world where there is a lot of competition out there, there is a lot of people who do things differently than you are doing so you have to keep up with times, the clients, the trends and demands – you need to exceed the expectations of your customer. If you don't exceed, you can't cope nowadays" (Alec: in-depth interview).

In order to produce a competitive product to the market *"which are competi-*

tive in quality and competitive in price" (Laura: in-depth interview), *"the factory³ should produce products more effectively, to improve the price for the final product to enter the market"*. With regard to throughputs, Laura explains that resources (such as the people, electricity, product) are expensive, and during production care should be taken to improve management of resources (also referred to as assets) to reduce production time and at the same time, production costs and cost of quality (Laura: in-depth interview). South Africa is currently facing problems such as *"energy and water scarce"* (Ian and Renee: in-depth interview), thus the food industry should start planning how to save resources. Both Ian and Renee argues that AM is required for this. In contribution to the known fact that the South African food industry is lagging behind, Sam also agrees that if the AMS could be aligned to their system, it would be beneficial, since it will *"be easier to compete with the international world"* (Sam: in-depth interview).

Jim concludes this argument by pointing out that *"AM is something that will make the organisation better"* as opposed to *"something that the organisation must have to achieve expected results"*. This implies that AM is a *"competitive advantage"* as opposed to food systems that are a *"must have"* to yield expected results since it is something that is expected from an organisation to implement (Jim: in-depth confirmation interview). This argument is in unison with what was first conceptualised in section 1.1. Therefore, literature affirms that AM will be beneficial to the food industry's holistic system for achieving quality since it will create a competitive advantage and it collaborates with many issues identified.

In consideration of all the above, it is concluded that AM will support the food industry by closing evident and problematic gaps within the general food organisation in South Africa and improve the quality of their processes and products. Since the food industry is lagging behind and need to align themselves with new and innovative projects to *"survive"* in the high quality competitive environment. Also, all food industries have to do everything, and will do anything, to keep customers happy; they have to meet and exceed customer expectations. The term *"exceeding"* refers to AM; with the incorporation of AM the food industry could exceed the customers expectations and give additional benefits to the organisation that other competitors do not have.

With regard to all discussed reasons for the need for AM to be incorporated within the TQMS (refer to sections 5.2.1.1 to 5.2.1.4), Alec considers AM as *"an important tool to management"* and he believes that *"it would be a great tool to improve many things that are relevant to the food industry"* (Alec: in-depth interview). Concerning this statement, Alec alongside Laura and Sam, explains that AM is collaborative to many other problems or issues or difficulties; Alec says:

"I think it can be collaborative to many difficulties that we encounter on a daily basis. For me yes AM would be beneficial...it also applies to many

³Laura uses the term "factory" which should be referred to as the "food organisation's manufacturing department". From here on forward, take note that if the participants speak of a "factory", they mean to say the "food organisation's manufacturing department".

things that I already know about” (Alec: in-depth interview).

Importantly, Alec suggests that AM overlaps with various elements of the TQMS and other food related systems as well as responsibilities from different department in the organisation. Jim supports Alec’s perspective of overlap by stating that:

“The AMS due to its very nature will definitely overlap the TQMS. Both are management systems and will follow similar processes” (Jim: in-depth confirmation interview).

Responding to both Alec and Jim’s opinion, Laura advocates that *“since areas of overlap exists”* it is possible that *“through managing your assets you will yield in high-quality and safe products, world class OEE as well as have happy workers”* (Laura: follow-up in-depth interview). Garry further upholds this prediction, he believes it will be *“a natural progression to include AM”* since food safety systems themselves have previously evolved into integrated systems (this will be elaborated on in section 5.2.4.2). Hence, considering both Laura and Alec’s opinions provides a positive correlation between the need for AM and its feasibility for incorporation with TQM. Refer to section 2.3 for proof that literature supports the opinions of participant regarding the need for AM.

5.2.1.6 Summary

On account of coding, memoing and visualisation, figure 5.3 illustrates a summary of the relationships between the five causal conditions: asset problems; communication; people; leadership; and the need for AM. In respect of figure 5.1, figure 5.3 depicts the next level of detailed description of the first category, causal conditions.

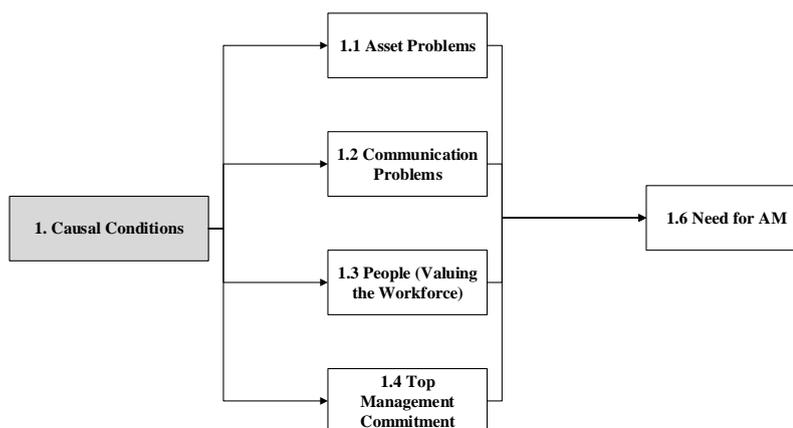


Figure 5.3: Summary of causal conditions

The need for AM is driven by the conditions of assets problems, communication, people and leadership. There is no indication that the latter four conditions are a prerequisite for another to drive the need for AM. In other words, either one or a combination of these conditions could drive the need for AM. These categories are, therefore, parallel to the need for AM.

5.2.2 The Phenomenon

The food industry differs from other non-food industries, such as the engineering industry, due to its high variability in probability of product specifications. In sections 1.1, 2.3.3 and 3.6 it is established that the food industry has to attain certain elements of engineering to remain competitive. In section 5.2.1.5 it is mentioned that the engineering industry strives for precision during product manufacturing, which are not a very common topic within the food industry; however, the precision of production will support the food systems to increase effectiveness and efficiency. Garry notes that:

“When you are looking at different aspects of the food industry, the closer you are to primary production, the more varied the probability of your specifications. The more processed you become, the more defined (should we say, the more engineered) your product becomes, and therefore, more precise specifications can apply. At our end of the production – on fruit processing for example – we are at the end where we are dealing with raw-natural products, which is incredibly variable, its seasonal (it varies from year to year), the ripening process (respirations continues after picking a fruit). So, there is a constant change and this makes our...settings for raw materials standards very wide and we try and do our best to run fruit at an optimal time. But often it is actually difficult to achieve that, especially if you have got constraints on production or capacity constraints. Sometimes those things are not the main priority...If you think of engineering it is concerned about reliability and making things work” (Garry: in-depth interview).

The above-statement reflects the contradiction between the food industry and the engineering industry. However, as previously mentioned, the food industry has to stay competitive within the market to deliver high-quality food products. The food industry, therefore, should consider those elements of engineering to benefit from it or improve their current systems and manner of production. Mainly due to the causal conditions (discussed in section 5.2.1) and drive towards precision and structure have led to the category of *Integrating AM with TQM*. The participants believe that it will provide positive inputs, not to change the food organisation, but to support the organisation, to help with more efficient and effective production processes and to achieve a small step towards becoming Best-in-Class. With the incorporation of AM, it is evident from the participants' remarks that South African food organisations could become “industry leaders” and compete with the world class leaders since it “*may improve quality of the product, efficiency of machines and productivity of the people*” (Laura: follow-up in-depth interview). Ultimately, the integration of

systems will create improved asset care and resource efficiency. This is obviously something that will not happen overnight, to the contrary, it will take years to see results (Laura: follow-up in-depth interview and Fred: in-depth confirmation interview), but integration might be the next big step towards achieving success. The food industry can borrow ideas and techniques from the engineering industry; no matter how small the idea is, it will contribute to achieving quality (Ian and Ella: in-depth interview).

Existing and emergent codes and categories are compared and contrasted with the category termed *Integrating AM with TQM*; this category is modified to accommodate the raw-data, resulting in the phenomenon that is named *Systems Integration*.

In conclusion, it is clear that theory and literature are in unison, confirming the argument of extending the food industry's TQMS with AMS incorporation, which is speculated in sections 1.1 and 1.2. In consideration of both literature and theory, it is proposed that *Systems Integration* will ultimately lead to improved asset care in the food industry. It is critical to note that *Systems Integration* is referred to as one management system that consists of a set of standards. Throughout the remainder of this document, take note that when the researcher speaks of an integrated system, it refers to one management system.

With the combined use of coding, memoing and visualisation, this section is summarised and illustrated in figure 5.4.

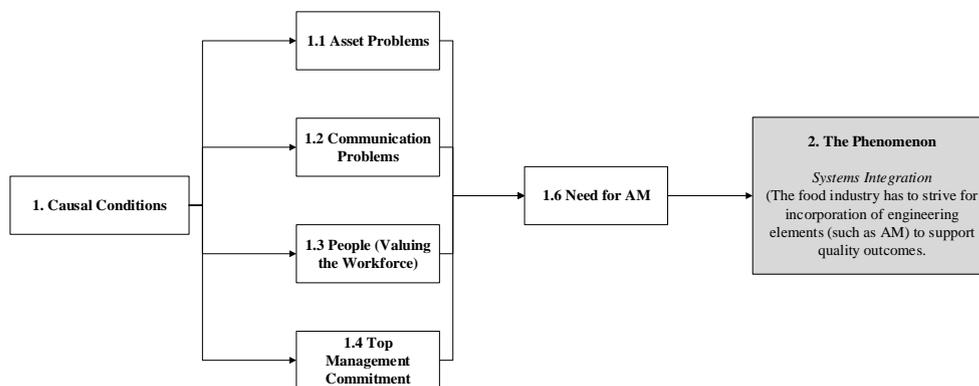


Figure 5.4: Summary of the phenomenon

Continuing from figure 5.3, figure 5.4 depicts the relationship between the causal conditions and the second category, the phenomenon, seen in the *axial coding paradigm* (figure 5.1). It is clear that *Systems Integration* has emerged from these influential categories.

5.2.3 Contextual Conditions Developing the Coping Strategy for *Systems Integration*

Contextual conditions delineate the context for developing the coping strategy for the implementation of *Systems Integration*. They present as the broad situational factors that influence the strategy.

Systems Integration is dependant on the food organisation's capability for growth and their holistic culture that they pursue. Also, the maturity level of *Systems Integration* and ability to implement systems successfully in the organisation is preliminary to integrating AM with TQM. Both Alec and Sam expresses their opinions regarding organisational growth and culture in terms of *Systems Integration* and implementation of it as follows:

“Depending on organisational culture and growth of an organisation. For example if systems or any management system are new to an organisation it can be dangerous to incorporate both systems in broad if they do not truly understand what the systems do. If it is overlapped within departments, it can be too much of an overload onto somebody to take care of the whole system on their own. I would suggest, depending on the organisation culture in terms of growth in their system management, I would suggest that they start the systems separately. Run and understand food safety on its own, because there are certain fundamentals which need to be addressed first. From my experience, if systems are not managed properly, either one of the systems can be overlooked – then we discover it only after certain things have happened. Certain organisations put an emphasis on certain things, I can give us as an example, health and safety is something that we've started with but being a food industry, our emphasis are more on food safety and quality because we are producing products that are safe and high in quality. Also, our stakeholders or retailers wants us to be food safety certified. Health and safety in alignment to our industry are therefore not really emphasised but we still need to keep health and safety in place. But all argue that we must rather focus on quality, because of SHEQ we want all these things but we must therefore acquire other expertise in implementing it. Health and safety is quite big on its own, so you have to spend a lot of time studying it and implementing it properly, because you could get really into trouble if your safety measures are not properly integrated” (Alec: in-depth interview).

“It would be better to integrate AM with our existing standards. But, if we want to implement it, we would first have to implement it as a separate standard alone. First run it and understand how it works and then if we would have to incorporate it with our food standards we could understand it better and find ways were we could implement it with our food safety standards...As I mentioned earlier, first run a prototype or a trial to see what results are obtained. If you are running it alone, you could later refer back to your existing standard and see where you could add on to your clauses of the existing standards if you would want

to incorporate the new standard. So you might find areas where your existing standard already tough on the areas of the other standard. So maybe through this you will find that it is applicable to just use your food standard where you can incorporate certain or appropriate clauses of the AM standard to the existing clauses. Because you might find that running two separate standards who are speaking the same language. Like we did with Hazard Analysis and Critical Control Point (HACCP) and British Retail Consortium (BRC). So we found that we were spending a lot of money on HACCP and BRC as two separate certificates, but why can't we rather incorporate HACCP into BRC and use it as one certificate since it speaks the same language. So this would be the same as in your case" (Sam: in-depth interview).

Alec and Sam strongly advocates that in order to have successful integration of AM with TQM, the AMS should firstly be implemented separately to determine the areas of overlap prior to integration. They do, however, acknowledge that integration is financially and time efficiently preferred for food organisations. Jim wondered whether or not the AMS will improve the engineering or operational uptime. Responding to Jim's question, Fred asserts that ISO 55000 will definitely induce operational uptime. This became a very critical topic that prompted for integration. Thus, Jim reiterates that:

"If you can persuade me that ISO 55000 will better the engineering or operational uptime, then I would say: 'okay, lets have a look at the system and identify areas of overlap, then overtime we can integrate it'. I would like to stress this again, I would like to have the framework for ISO 55000 implemented and understood before I want to integrate. Because Foundation for Food Safety Certification (FSSC) 22000 is already functioning well, I do not want it to be negatively influenced by a new system by integrating it with FSSC. There is a high risk that the FSMS will suffer if ISO 55000 dilutes its attention. It will not be simple to employ new people since an additional person will cost you a few R 100 000 to employ another manager. This is a big risk. In attempt of improving your FSMS you will first weaken it and food safety is so critical to a food organisation that you cannot afford to weaken it...it could influence the quality and resource allocation that was originally destined for the core system work of ensuring total quality and food safety" (Jim: in-depth confirmation interview).

Jim further argues that although the possible integration of AM introduces a risk to the existing system, *"it does not mean it should not happen"*. Importantly, *"management needs to recognise the risk and take mitigating action to prevent a dilution of systems resources to occur"*. It is worth noting that both Jim and Fred acknowledged that integration could be a possible solution since areas of overlap exists. Given the potential areas of overlap between the AMS and the TQMS, Jim observes, thus:

“This has potential areas of overlap, so you could sell the integration of systems as such: ‘I do not want this thing (referring to ISO 55000) to be stand alone. Previously you have implemented systems stand alone, but since ISO 55000 is resource effective, integration is preferred’.” (Jim: in-depth confirmation interview).

Taking the above discussions into perspective, it is evident that the food industry does not yet have the knowledge, or attained the correct culture for AM nor do they provide sufficient training regarding AM at this stage. The food industry does, however, contain some areas that overlap with AM. Hence, both Laura and Garry advise that the AMS should rather be used as a support system and be incorporated into the TQMS, instead of implementing it separately. To some extent, both Garry and Laura contradicts Alec and Sam’s opinion. Garry is of the opinion that:

“If there is areas of overlap, then I wouldn’t want to have to create something to satisfy another standard if its already incorporated into what I’m doing in FSSC 22000. Now there is a small part in the FSSC which is on maintenance, but not on assets as such, so if you can bring something that improves or adds value to the FSMS in general, then I would say yes integrate” (Garry: in-depth interview”).

Garry further argues that implementation of standards is *“demotivating when there are repetitions”*. In support of what Alec and Sam mentioned before, Garry agrees that implementing new standards *“can take time to mature”*. Thus, he proposed that *Systems Integration* is advised (Garry: follow-up in-depth interview). Ella echoed Garry’s opinion by pointing out that:

“If ISO 55000 has a background similar to the ISO 9000, it will easily fit in into what systems and standards that we currently have. We will typically incorporate the ISO 55000 standard with our system, rather than managing it as a standard ons its own” (Ella: in-depth interview).

In contribution to Garry and Ella’s opinion, Laura finds that:

“...integration of ISO 55000 with food safety standards is better. Implementing standards separately will cause departments to work and communicate in silos. In today’s economic climate around the world it is important that people from different departments in a business must work together as a team – individuals win a game but teams win a world cup (Laura: follow-up in-depth interview).

In this regard, Garry specifically elaborated on Laura’s opinion stating that integration would be preferred since *“it is always easier to manage systems that are aligned and part of each other”* (Garry: follow-up in-depth interview). Laura continued to stress her opinion of integration, rather than implementing it as a separate standard, as follows:

“AM will yield various benefits that are appropriate to the food industry and that they should strive towards attaining some elements of it. However, since our culture is not yet aligned to the AMS and we do not yet acquire the right knowledge about AM, it is possible for us to misinterpret its importance and benefits in due course of implementation process...Also, it will take years to master the implementation process of it. Implementation would take approximately one to two years before results are obtained...Thus, I suggest that integrating parts of the system would be the better option and to rather use it as a supporting system that provides additional benefits to the existing food systems to ultimately improve product quality. For example, ISO 18000 (Health and Safety) and ISO 14000 (Environment) are integrated into our TQMS (various other companies also do this) to comply with the minimum legislative requirements from government. These standards are then internally audited for continuous improvement opportunities. They do not have certification audits against these standards as more audits are time consuming and costly” (Laura: follow-up in-depth interview).

Jim confirms both Garry and Laura’s reasoning that integration of the AMS with TQMS is relevant since all systems encompass significantly similar management processes (Jim: in-depth confirmation interview). This has been confirmed continuously with the known integration of ISO 18000 and ISO 14000 with the TQMS as well as with ISO 9000 (Laura; in-depth interview). Concerning Laura’s argument that it will take years to implement a sound AMS, Fred supports her opinion as such:

“It depends on the complexity of the system. I also think that the level of the outcome that you require from an AMS will vary drastically depending on the complexity and size of the asset base. Here I take special cognisance of the definition of assets (anything that adds value or has the potential to add value) assets such as data and human capital can add immensely to the complexity of your business AMS. This level of complexity has at least a directly proportional impact on the implementation time line in my opinion” (Fred: in-depth confirmation interview).

In the view of this, it is important to consider the level of outcome one requires from the AMS and the complexity and size of the current asset base. Hence, it may take years to have a functioning integrated system, depending on how complex the organisation wishes it to be. The concern for certification, as prompted by Laura, is discussed in section 5.2.6.1. In response to the *phenomenon, Systems Integration*, it became evident that a support system corresponds to an applicable coping strategy for surviving the competitive pressure and the food industry’s inability to implement and maintain AM as a separate system to the already existent TQMS.

On account of coding, memoing and visualisation, figure 5.5 seen below depicts the next level of detailed description of the third category, context for developing coping strategy, represented in figure 5.1.

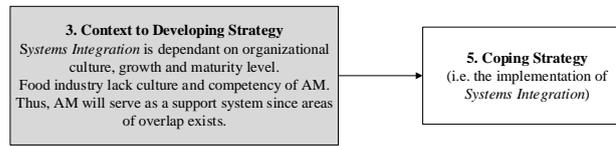


Figure 5.5: Summary of context for developing coping strategy for *Systems Integration*

It is clear that the broad situational conditions influences the implementation strategy for *System Integration*. A relationship between these categories, therefore, exists.

5.2.4 Intervening Conditions Influencing the Coping Strategy for *Systems Integration*

In addition to the context, intervening conditions exists. These are specific conditions that influences participant's choice for the coping strategy. The intervening conditions includes: customer satisfaction; management systems; and standard selection. These are discussed in sections 5.2.4.1 to 5.2.4.3. This section ends with a summary (see section 2.1.4.8).

5.2.4.1 Customer Satisfaction

In order to keep customers⁴ satisfied, it is important for the food industry to provide them with proof of commitment to delivering high-quality and food safe food products. Typically, the food industry should be certified in certain systems to provide commitment to achieve high-quality and food safe products (see section 3.1). In this regard, Laura observes that in order to provide commitment, the food industry should have a TQMS. She notes:

“If you want to satisfy your clients’, stakeholders’ and shareholders’ needs, you have to provide them with some sort of commitment to show that you as a company will produce the best quality and food safe product. Thus, systems are well developed within the food industry since all do realise that some logical manner for achieving quality and food safe products is required for the provision of the customer. Typically, this is what all your ISO’s is about” (Laura: in-depth interview).

All other participants echoes similar thoughts and opinions regarding customer satisfaction. Prior to establishing, designing and implementing systems or processes, *“you need to know your customer, you need to know what your customer wants”* (Alec: in-depth interview). Sam also mentioned that in order to compete with the

⁴A customer represents either one or more of the following: clients; shareholders; stakeholders; retailers; buyers and consumers (Fred and Jim: in-depth confirmation interview). Throughout the remainder of this document, this definition for customers should be used.

global market, you have to acknowledge the demands of customers for “*specific standards*” (Sam: in-depth interview).

Once the customer demands and requirements are understood, the food organisation can proceed with implementing management systems and its processes to accomplish customer satisfaction. Apart from this, the decision for systems may also be internally driven. Both Fred and Jim argues that food organisations sometimes decide for themselves what systems should be applied for the purpose of their own benefits (Fred and Jim: in-depth confirmation interview). This implies that no one instructed their organisation to implement a system such as HACCP, they are implementing it because they want to produce products that are low in risk for the sake of their own accomplishments (Fred and Jim: in-depth confirmation interview). Thus, it is inevitable for food organisations to want to produce high-quality and food safe products, hence they automatically adopt those management systems and processes to accomplish it.

The topic of customer demands and the selection of standards are also discussed in sections 3.1 and 3.4 respectively. Generally, food organisations differ from one another in terms of systems; more specifically, their TQMS will dramatically differ due to product types, organisational focus, and market types as well as standard acceptance (Ella and Alec: in-depth interview). Although the TQMS differ amongst food organisations, its principles remains the same (see section 3.4 for a discussion similar to what Ella and Alec opinionated). Once organisations have decided upon what their business objectives are, they will continue to select those standards that best support the organisation to achieve its objectives. The general topic of standard selection appropriate for the purpose of this study will be discussed in the sections to follow (sections 5.2.4.2 and 5.2.4.3) since appropriate standards are deemed necessary for customer satisfaction and will influence the strategy (Jim: in-depth confirmation interview).

5.2.4.2 Management Systems and Standards

Similar to those standards configuring TQMS, AMS is a formal management system that provides structure to achieving organisational objectives. Structure is identified as something that is generally known to the engineering industry, which is commonly unfamiliar to the food industry. In turn, the structure of AMS provides benefits to the existing food related systems of TQM. Garry asserts that:

“I think that...what formal systems do, or help businesses to do – doesn’t matter whether it is a QMS or FSMS or in this case an AMS – is that they are structured. Standards are structured, which forces you to comply in very specific ways. I think, in that respect, it’s always a good thing, because it is providing a guideline of best-practice – although you are responsible for implementing your interpretation of the standard but standards are really there to guide you in a way to conform against that”
(Garry: in-depth interview)

Garry clearly advocates that standards provide structure which ultimately assist organisations in becoming Best-in-Class. AM is identified in the literature (section 2.3.3) and by both Sam (in-depth interview) and Jim (in-depth confirmation interview) as a “*tool to management*” to provide structure, which ensures employee engagement and efficiency as well as to be the Best-in-Class (see section 5.2.1.5). Acknowledging the fact that AM will contribute to producing high-quality and food safe products by ensuring efficient asset operations (i.e. to prevent temperature fluctuations, speed differences and specification deviations), participants agree that the food industry requires AM to support their existing food standards to yield high-quality products. Thus, Laura suggests that in order to establish the link between AM and the food industry the “*standards should be integrated*”⁵. She believes that “*the integration of the AMS will enhance the TQMS*” and will create an appropriate way to introduce AM within the food industry and to establish a culture that creates a quality environment in all departments (Laura: follow-up in-depth interview).

Prior to selecting which standards are appropriate for the *Systems Integration*, the evolution of food systems seemed to be an important topic to Laura, Garry and Sam. The history of systems is discussed in section 3.1, however, Laura describes it in detail as follows:

“In the beginning most food factories in South Africa had to comply with the minimum requirements of South African Bureau of Standards (SABS) and Department of Health, where SABS certified products and Department of Health inspected food premises against R918. The manufacturers started to follow overseas companies, and also driven by retailers demands, with ISO 9001, basic Quality Management (QM). Then this was not enough for the food industry as the food industry were put under stress to produce safe food as well as high quality food. HACCP was then introduced to the South African food industry through South African National Standards (SANS) 10330, by then companies had two certification audits, one for quality and one for food safety. Then the world became over saturated with all the certifications audits and ISO 22000 emerged, which was ISO 9001 integrated with HACCP. Global Food Safety Initiative (GFSI) did not approve ISO 22000 for the food industry as it did not have enough emphasis on Prerequisite Programs (PRP). So ISO/TS 22002-1 was put together that focussed on PRP’s for the food industry. The ISO 22000 and ISO/TS 22002-1 became FSSC 22000 which the GFSI approved as a certified standard which food manufacturers can be audited and certified against” (Laura: follow-up in-depth interview).

Garry reflects on the evolution of the FSSC 22000 in this way:

“I would roll back to look at the evolution of Quality Management System (QMS) and how they were always quite separate – to me they always felt

⁵Laura refers to *Systems Integration* as standard integration. Take note that a system contains a set of standards which explains Laura’s reasoning for standard integration. From here on forward the researcher will only refer to *Systems Integration* which consists of a selection of appropriate standards.

quite separate. So if you think of a food company, they would have a QMS, then they would have a HACCP system, and then in the past the people had a system called British Standards Authority (BSI) 5750 that became ISO 9000. And my view, this approach was not holistic at all, it was creating these violins of control. So the QMS had its things, the HACCP system had its things (Good Manufacturing Practice's (GMP) and those things) and ISO was an engineering standard that was ported on to the food industry (or the industry in general) until the food industry adopted it and then later on they sort of realised that actually we don't make nuts and bolts, we make food. So the standard needs to be relevant to food. When the latest generation of standards came along, they integrated. So ISO 22000 or FSSC 22000 integrate, I think in a great way, QMS and FSMS (including HACCP) – in a very nice way” (Garry: in-depth interview).

Both Laura and Garry's comments regarding the certification evolution is in agreement with literature (refer to section 3.1 for the confirmation between theory and literature). Garry further commented that the GFSI assist food organisations with deciding upon suitable standards by stating that:

“I think if you look at the Global Food Safety Initiative, GFSI, (this is really a little bit of history on the evolution of the QMS) if you look at what they are set out to do, they look at world-wide, hence global, the fragmentation of Food Safety standards if you like. This is driven by the big corporates such as Coke, Unilever, Danone and all of these companies. With a view to saying ‘well we need to have certain food safety standards in our industry and from our supplier’. What standards are we happy with, what standards can we say that we are happy for our suppliers to have. So they did the industry a big favour, globally, and went into a huge amount of research and said ‘well, this is not good enough, ISO 22000 on its own is actually not good enough and BRC we like’. So they made a list of the approved standards in FSM” (Garry: in-depth interview).

Garry's statement confirms the discussion found in the literature analysis seen in section 3.1 and 3.2.1. If an organisation is GFSI approved, “customers value” those standards that are approved by the forum highly “as it gives them confidence that the food they consume is of high-quality and is safe” for consumption (Laura: Follow-up in-depth interview). Based on the combined input from comments made by both Garry and Laura, as well as the literature, a standard which are GFSI approved may be defined as appropriate for *Systems Integration*. Jim and Fred, affirmed that due to the overall trend for GFSI standards, the integration will be best if AM is incorporated to those standards that are GFSI benchmarked (Fred and Jim: in-depth confirmation interview). Although many other standards exists and are equally as viable as the GFSI systems, it is deemed appropriate to work with only those standards which are GFSI approved in respect of the scope of this study. The standard selected for *Systems Integration* is discussed in section 5.2.4.3.

As previously discussed in section 3.3, in order to achieve a successful TQMS, PRP's and food safety systems (e.g. HACCP) should be in place and addressed. In

accordance to this, Alec agrees that FSM is required for QM. As such, Alec finds that (refer to figure 3.1 for the representation of the holistic TQM system while reading his observation):

“They speak of food safety a lot nowadays in FSM, so they are slowly moving away from speaking of QM – food safety is seen as the more appropriate term to use. But, important, food safety was integrated into the QMS which uses a lot of fundamentals of TQM like your Plan-Do-Check-Act (PDCA) cycle. So actually you will see that all these systems are integrated and work together. One system is never efficient on its own, but that integration will be difficult to separate. They speak of food safety, but actually it forms part of your QMS...Quality nowadays are spoken or seen as FSM. So if you speak of AM it must be termed as one name ‘Quality’ so that if they want to know about AM, they could refer to the QM department. It is more holistic, it is a huge approach. You can never separate food quality from food safety and those management systems relevant to your food company – it is all integrated” (Alec: in-depth interview).

Considering both Alec’s narrative illustration of how he perceives the TQMS to look like and the representation of the TQMS in figure 3.1, a simple diagram indicating the relevance between systems emerged from memoing and visualisation. Refer to figure 5.6 for this representation.

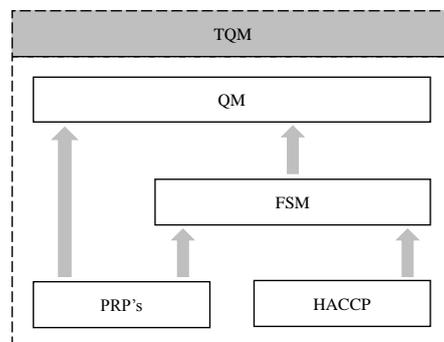


Figure 5.6: A summary of the TQMS

Alec, further remarked that food organisations and their top managers should “*design something that is acceptable to the food industry*” when taking hazardous objects or items (e.g. glass) into consideration during operation of physical assets. According to him, it is also important for the food industry to manage hazardous objects within a “*proper system*”, which is suggestive of AM (Alec: in-depth interview). Care has to, however, be taken when integrating such a system to ascertain that the system is “*food grade*” and therefore the “*food industry has to design all processes with a food perspective*” as well as consider the “*elements of food safety*”

(Alec: in-depth interview), otherwise it will fail.

According to Fred, it is critical to consider that ISO 55000 is “a nice to have” as opposed to FSSC 22000 or any other FSMS that is a “must have” (Fred: in-depth confirmation interview). Thus, it is typical for food industries to rather spend time and effort on FSM first to manage the immediate high and evident risk (Fred: in-depth confirmation interview; Ella: in-depth interview), because the organisations’ first impression towards *System Integration* may be negative or confusing. It is plausible, therefore, that “AM and the integration of systems would come later” (Fred: in-depth confirmation interview), depending on the need, growth, culture and level of maturity of the organisation. As such, “management needs to be convinced of the benefit of a well maintained AMS such as ISO 55000” (Fred: in-depth confirmation interview). Refer to the benefits of the AMS in section 2.3 for in-depth understanding.

Integrating the AMS with food related standards, as opposed to implementing it in isolation, is suggested in order to prevent the TQMS from losing its focus of food products. If the AMS should be used as a separate system, the food industry will become too focussed on sustaining AM and over time, it will cause losing their main focus of producing high-quality food products (Laura, Renee, Ella: in-depth interview). Therefore, the participants advised that AM should rather be used as a support system to prevent it from becoming too technical for the food industry to handle. *Systems Integration* will continue to prevent AM isolation and losing its effectiveness over time.

Evidently, a relationship between TQM and AM exists. Alec specifically pointed out the correlation between the two as follows (Alec: in-depth interview):

- both are focused on people and processes as well as decision-making;
- both are focused on continuous improvements; and
- both address maintenance issues, corrective and preventative maintenance as well as maintenance schedules.

Jim confirmed that an inevitable relationship between TQM and AM exists. Supporting Alec’s judgement on the interrelationship between the management systems, Jim notes that:

“In a mechanised environment a close relationship will always exist between TQM and AM. The machines do the most of the work in modern fast moving consumer goods (FMCG) factory environments. The alignment of the machines, the set-up of the machines, all affect the final product quality which included cosmetic and ascetic appeal in a highly competitive brand conscious market. Oil leaks, vibrations, incorrect weighing can affect the food safety and legal issues which is part of consumer protection. Calibration and preventive maintenance tighter with the capital

expenditure program which should be selecting and maintaining the correct machines is very important...Both are management systems and will follow similar processes” (Jim: in-depth confirmation interview).

Thus, in the midst of the discussion seen above and both Alec’s and Jim’s opinion regarding systems interrelationship, it may be interpreted that AM will be supplementary to all food systems, including PRP’s, HACCP, FSM, and QM (Alec: in-depth interview). Refer to figure 5.7 for the representation of the proposed TQM system; figure 5.7 is supplementary to figure 5.6 based on the combined input from the participants). Additionally, since customer satisfaction is a priority and since customers demand high-quality and food safe products, the focus for all food organisation is mostly concerned with achieving high-quality food products to satisfy customers. In turn, it is deemed appropriate to supplement the TQMS with AMS, according to the participants.

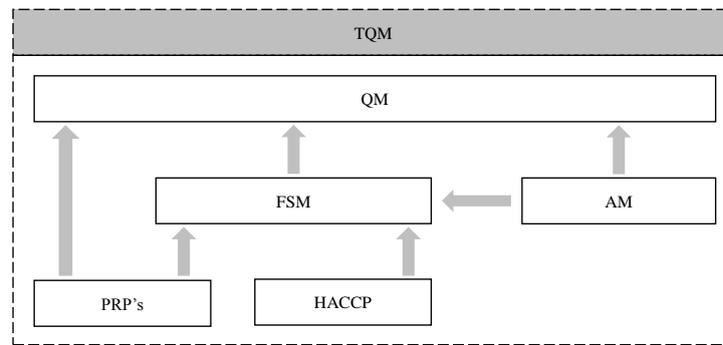


Figure 5.7: A visual representation of the proposed integration of AM with TQM

Both Fred and Jim uphold the interpretation that AM is supplementary to all food systems as true. More specifically, Fred state that:

“This surely does make sense. The fact that FSSC requires AM representation acknowledges the impact of aspects from the various disciplines in the business. It helps to ensure alignment of outputs towards achieving TQM and ultimately agreed business goals” (Fred: in-depth confirmation interview).

5.2.4.3 Standard Selection

For the purpose of *Systems Integration*, participants identified that the AMS should be incorporated with their existing TQMS. In an attempt to discern the most appropriate food system to use for integration, raw data steered towards the GFSI benchmarked standards (see section 5.2.4.2). Moreover, all participants spoke about the benefits of implementing standards that are GFSI benchmarked. As seen in section 3.2.1, the GFSI approved standards are:

- BRC – Global standard for food safety (Issue 6);
- International Food Standard (IFS) (Version 6);
- Safe Quality Food Standard (SQF);
- FSSC 22000; and
- Dutch HACCP-based food safety system

During the investigation of the eight distinct food organisations, it became evident that all eight participants implemented at least one of the above-listed standards in addition to HACCP. Table 5.2 depicts those standards that each participant's organisation currently implement and attains certification for. Moreover, it is established by all participants that "*certain areas of overlap*" (Alec: in-depth interview) within the GFSI benchmarked FSMS exists for the incorporation of the AMS and ISO 55000.

Table 5.2: Standards applied across the eight organisations

Organisation	GFSI Standards				
	BRC	IFS	SQF	FSSC 22000	HACCP
1				X	X
2				X	X
3				X	X
4					X
5	X	X			X
6	X	X			X
7				X	X
8				X	X

When asked which specific standard would be the most appropriate for *Systems Integration* for the purpose of this study, both Garry and Laura position themselves and their organisation toward the FSSC 22000. They motivated that:

"FSSC...that current standard is sort of the 'Rolls Royce' of FSM, but bear in mind as a bare minimum, that's HACCP. That's not a QMS, that's really one part of the system...If we got FSSC in place throughout our company I would be very happy" (Garry: in-depth interview).

"I suggest you use the FSSC standard for integration. This is the standard to which all food organisations within South-Africa tend to implement. Not only does this standard allow you to provide produce products locally,

it also allows for exporting products internationally, since the GFSI has approved it. Most companies only use BRC or IFS standards because customers demand the organisation to be certified towards those standards. BRC is specifically required for export to England and IFS for export to Germany. For example, there will be German organisations that will not purchase your product, since they specifically purchase only products from organisations whom comply to the IFS standard. Just as same, some England organisations will not purchase your product if they do not comply to the BRC standard” (Laura: follow-up in-depth interview).

To contribute to the final decision on using FSSC 22000 for the integration of ISO 55000, Laura stresses that:

“To my knowledge, there are approximately 5000 organisations that conforms to the FSSC auditing standard, and there is only five organisation that conform to BRC and three that conform to IFS alongside BRC. This is a commonly known fact to most, but you can extract a survey from the internet to confirm this. However, this is a very common ratio of FSSC versus BRC or IFS usage in South Africa. Most organisations implement FSSC...to contribute to the decision for FSSC as a suitable standard for integration, is that it originated from ISO 22000. And the reason to why ISO 22000 has originated is because the world want only one standard to which they have to be audited for, and not 110 other standards. Now, all that has become part of the ISO 22000 is the ISO/TS 22001 specifications which represent your PRP's. Thus, the merging of the ISO 22000 and ISO/TS 22002-1 results in the FSSC 22000” (Laura: follow-up in-depth interview).

In response to Laura's comment, a survey is compiled to confirm the ratio of organisations using FSSC versus BRC or IFS. See table 5.3 for the results regarding FSSC 22000 and BRC 22000. Although BRC is currently the leading safety and quality certification programme (BRC, 2014), FSCC 22000 is the fastest growing ISO based food certification scheme for food safety systems (FSSC 22000, 2015). As seen in table 5.3, it is clear that over the past 5 years, FSCC 22000 had an immense incline in organisations achieving certification for FSSC 22000 in comparison to the incline of BRC over the past 25 years. In 5 years, FSCC 22000 certification expanded to a total number of 10592 valid certificates across 140 countries (FSSC 22000, 2015), a trend that is believed to grow even more rapidly. This concludes and confirms Laura's opinion that the general food industry tends towards FSSC 22000 certification.

Laura continues the discussion on *Systems Integration* (ISO 55000 with FSSC 22000) in the light of quality as follows:

“It is not necessary to integrate ISO 55000 with the ISO 9000 standard, because the FSSC 22000 is based on the ISO 9000. ISO 9000 is already addressed within FSSC 22000 and HACCP is already integrated into the

Table 5.3: The certification trend for FSSC 22000 and BRC (Adopted from FSSC 22000 (2015); BRC (2014))

	FSSC 22000	BRC
Description	FSSC 22000 is the fastest growing ISO based FS certification scheme	BRC Global Standards is a leading safety and quality certification programme
Total number of valid certificates	10607	230 000
Countries	140	123
Total years in industry	5	25

ISO 22000. Thus, the ISO 22000 automatically consists of ISO 9000 and the HACCP system. All that the ISO 22000 short is the PRP's. Thus, the ISO/TS 22002-1 incorporated into the ISO 22000 which in turn results in the FSSC 22000. Once again, the GFSI approved the FSSC because they also do not want you to comply to a thousand other standards. It is impossible to manage to many standards at once. Thus, this is one more reason why I would prefer to implement the FSSC 22000" (Laura: follow-up in-depth interview).

In consideration of the results in tables 5.3 and 5.2 and the arguments made by Garry and Laura, it is deemed necessary to use FSSC 22000 as the baseline TQMS standard for the integration of the AMS standard, ISO 55000. Depending on customer demands and regulatory requirements, it is possible to integrate the ISO 55000 standard with other relevant food systems as reflected in table 3.1. However, for the purpose of keeping the scope of this study manageable, FSSC is selected as basis for further development.

5.2.4.4 Summary

Figure 5.8 illustrates a summary of section 5.2.4. This figure depicts the specific situational conditions that influences the emergence of the coping strategy for *Systems Integration* implementation. These conditions are: customer satisfaction; management systems; and standard selection. The illustration is based upon the simultaneous use of coding, memoing and visualisation.

Alongside figure 5.5, figure 5.8 illustrates the interrelationship between the contextual and intervening conditions that influence the coping strategy. The intervening conditions present as category number four in figure 5.1.

5.2.5 Coping Strategy for Implementation of *Systems Integration*

In respect of the context and intervening conditions described in sections 5.2.3 and 5.2.4, a coping strategy for implementation of *Systems Integration* is developed. On account of the grounded theory methodology, the coping strategy refers to the actions taken in response to the phenomenon, which describes how to cope with

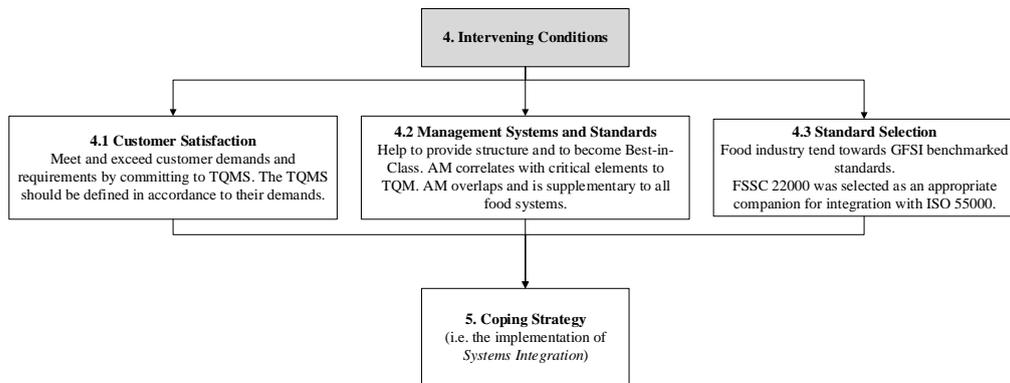


Figure 5.8: Summary of the intervening conditions of the coping strategy for *Systems Integration*

its emergence (Creswell, 2007). In this study, the coping strategy is concerned with coping with the implementation of *Systems Integration* – an integrated approach between AMS and TQMS. The coping strategy consists of two parallel strategy activities, namely integrating on strategic level and methodology for *Systems Integration* (sections 5.2.5.1 and 5.2.5.2). Since this study depends on the participants, and few other resources were available, most of the coping strategy is described in accordance to the participants’ emotions and internal opinions. This section ends with a summary (section 5.2.5.3).

5.2.5.1 Integrating on Strategic Level

Systems Integration will not succeed without top management commitment (Laura and Garry: follow-up in-depth interview). Thus, top management strategically has to “make the decision for integrating ISO 55000 in their organisation, because they believe it can bring positive results” to manufacturing (Laura and Alec: in-depth interview), implying that top management commitment to *Systems Integration* is essential. Consequently, *Systems Integration* has a direct influence on the deliverables of the manufacturing part of the value chain. Once the top manager configured their decision for integrating ISO 55000, they are also responsible for conducting a formal meeting to “communicate” the vision for the integrated approach as well as to “appoint a team leader that will drive the integration process” (Laura and Garry: follow-up in-depth interview). The top manager is also accountable for ensuring that the vision is translated to the second in line management team (i.e. senior managers), which it is translated to the third in line management team (i.e. middle and junior managers) and then the supervisors or operators (Laura and Alec: in-depth interview). Both Jim and Fred reasoned that it would be preferred if the top manager make the decision and enforce their decision onto the other parties. This will, in turn, “avoid any unnecessary debates” between parties (Fred and Jim: in-depth confirmation interview). All in all, this implies that a “top-down approach” for introducing the *Systems Integration* is required. This is a topic that is continuously

discussed by all participants.

Once top management is committed to the integrated approach, they are also responsible for defining proper “*goals or objectives*” to which they should assign relevant activities and corresponding tasks (e.g. policies, records, Standard Operating Procedures (SOP) or PRP’s, etc.) to senior management in order to achieve the defined “*goals or objectives*” (Laura: in-depth interview). Laura, together with Ella, explained that the food industry generally have six departments that translate and are responsible for the “*goals or objectives*”. Laura refer to the six departments as the “*six legs*” of the organisation, namely (Laura: in-depth interview):

1. ***Operations*** – that is the typical measure of OEE and the maintenance of assets (e.g. to manage throughputs, outputs, plant availability, downtimes and breakdowns and etc.). It does not include the management of assets as the focus of asset care is basic.
2. ***Food Quality and Food Safety*** – that is to manage the quality and safety of products through the supply chain. The FSSC standard correlates with this department for which certification must be attained.
3. ***Health and Safety*** – that is to manage the people or workforce and product in a health and safe manner. The ISO 18000 standard correlates with this department for which certification should be attained if required.
4. ***Environment and Sustainability*** – that is to provide a healthy and sustainable work environment. The ISO 14000 standard correlates with this department for which certification should be attained if required.
5. ***Human Resources*** – that is to manage the people and provide them with adequate training, good work environment, equipped with the right resources in order to deliver or perform work of excellence.

Without formally addressing it, the participants identified and discussed certain concepts of AM that relates with elements of activities of the above-listed departments (Laura, Garry, Ian, Alec, Sam, Ella: in-depth interview). It is, therefore, applicable to integrate the AMS throughout all six departments since it contains areas of overlap with food standards that are applied within these departments. However, participants continuously argued that the AMS should first be incorporated into the quality department from which the integration should be managed and delegated. Also, for the purpose and scope of this study, the integration process proceeds within the quality department which are concerned with food quality and food safety in an attempt to address the problem statement (refer to sections 1.6 and 1.2 respectively). The *Systems Integration* process (as selected and identified in section 5.2.4.3) is discussed in the section that follows (section 5.2.5.2).

5.2.5.2 Methodology for *Systems Integration*

The methodology for *Systems Integration* is based upon the expert opinions of the participants. Laura, Garry, Alec, Ian, Sam and Ella described how to approach

aligning ISO 55000 with their food systems. More specifically, Laura and Garry described how to achieve an integrated system when integrating ISO 55000 with FSSC 22000.

In general, “each standard has different clauses” and each standard has “paragraphs” or “requirements” that the organisation has to follow (Laura: in-depth interview) in order to comply with the standard. Laura explains that in those clauses that correspond to AM or address issues related to AM, the ISO 55000 should be “hooked to that specific clause so that clause also address AM”. Both Laura and Garry says that it “would be easy to integrate those standards” (Laura and Garry: in-depth interview). Laura suggested that all that is required is to “physically sit with both standards and then slot the AM system in the existent clauses that appears to be relevant” (Laura: in-depth interview). This process may also be called the mapping of systems.

The approach to *Systems Integration* prompted by Laura is used throughout the process of aligning and integrating the series of ISO 55000 standards with FSSC 22000. For this reason, Laura is invited to participate with the practical integration of these systems for her expert knowledge in FSSC 22000 and her familiarity with management systems. An explanation of the ISO 55000 standard is given to Laura prior to proceeding with the integration procedure.

Based on Laura’s strategy for integrating standards, the systems integration process proceeds accordingly (Laura: in-depth interview and follow-up in-depth interview):

Step 1 *Introduction to standards:*

- a. Laura introduce and explain the outline of the FSSC 22000 standard to the researcher;
- b. The researcher introduce and explain the outline of the ISO 55000 standard to Laura.

Step 2 *Clause incorporation:*

- a. Laura explain each clause of the FSSC 2200 separately in great detail;
- b. The researcher carefully listens and notes the relevance to each clause from which she identifies the corresponding clause of the ISO 55000;
- c. Once the relevant clause is identified, both Laura and the researcher discuss its appropriateness from which it is decided whether to incorporate or to ignore;
- d. If agreed to incorporate, proceed with step 3; if agreed to ignore, repeat step 2 until a relevant clause has been identified.

Step 3 *Strategic development:*

- a. Incorporate relevant ISO 55000 clause to FSSC 22000;

- b. The researcher reflects on ISO 55002 if certain areas of overlaps require further explanation;
- c. If deemed necessary, Laura made viable comments to accommodate the incorporated clause.

Step 4 Confirmation:

- a. Laura and the researcher repeat step 1 to step 3 for confirmation.
- b. If deemed necessary, appropriate revisions and improvements are made.

Refer to table 6.1 (seen in chapter 6), for the representation of the final aligned system. Also, all other important elements of the integrated system are discussed in chapter 6. The researcher apologises to the reader for documenting the results in chapter 6. The results of integration are documented in chapter 6 to ease the reading process and to guide management through the process of *Systems Integration* implementation simply because of the size of this document.

5.2.5.3 Summary

On account of coding, memoing and visualisation, figure 5.9 illustrates a summary of the relationships between the contextual and intervening conditions with the coping strategy. In respect of figure 5.1, figure 5.9 depicts the next level of detailed description of the fifth category. Figure 5.9 further depicts the two strategy activities parallel to the coping strategy for *Systems Integration* implementation. These activities delineate the integration process used on a strategic level as well as describe the methodology used for *Systems Integration*. The strategy activities serve as the basis for the theoretical guideline and the emerging integration process that proceeds with four procedural steps.

Up to this point, in sections 5.2.1 to 5.2.5 the prerequisite for the coping strategy as well as the coping strategy are discussed. The next section documents the consequences and integration implications of the coping strategy.

5.2.6 Consequences and Integration Implications

In the context of the coping strategy for implementation of *Systems Integration*, as identified by participants, consequences from using the coping strategy emerged. Those interested in implementing the integrated approach should carefully consider the consequences and integration implications of the *System Integration*. Six categories representing the underlining consequences are identified and discussed accordingly, these are: certification and auditing; person responsible for the integrated system; education and training; change management (i.e level of maturity and competency); management principles; and financial implications. These are discussed in sections 5.2.6.1 to 5.2.6.6. From coding, memoming and visualisation figure 5.10 emerged which illustrates the interrelationship between the coping strategy and the six categories of consequences. This section ends with a summary (see section 5.2.6.7).

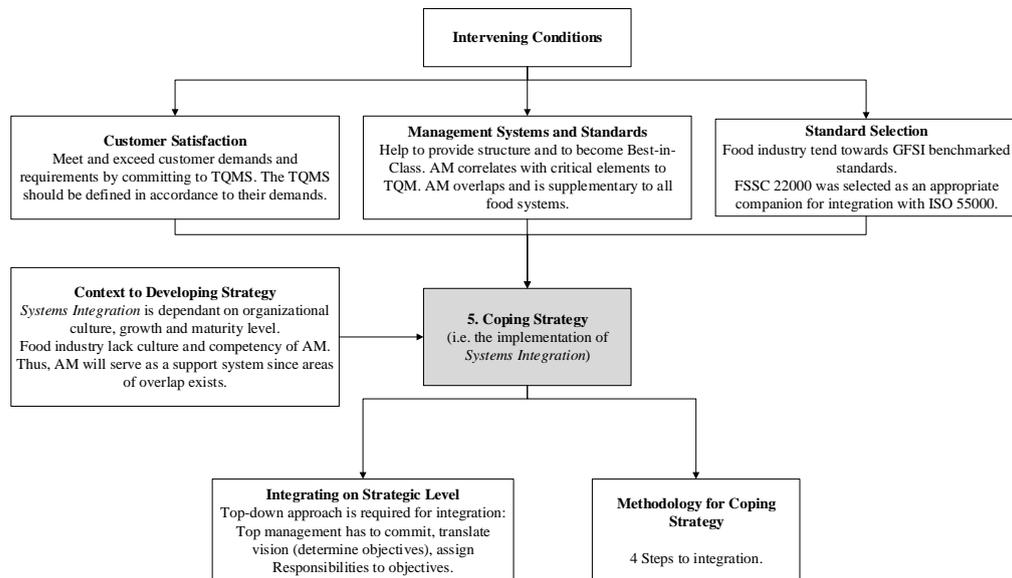


Figure 5.9: Summary of the coping strategy for implementation of *Systems Integration*

5.2.6.1 Certification and Auditing

Certification, as mentioned in sections 3.1 and 3.6, is a very powerful tool for food industries to use when competing globally. Certification requirements rely solely on, and is driven by, customer demands (Laura, Ella, Alec: in-depth interview; Garry: follow-up in-depth interview). Generally, food organisations tend to implement standards that are certified to increase client base profiles and organisational profitability. However, according to Ella and Laura, certification only applies to those customers seeking “*external auditing*”.

Typically, those food organisations who comply with an international market and export their products are obliged to conform to a certified standard that is demanded by the supporting customer (Laura: follow-up in-depth interview; Ella: in-depth interview). Apart from certification only in demand from international markets, many other national or private customers also demand food organisations to be certified, normally certified for food safety since it has become an important topic to achieving high-quality and food safe products (Alec and Sam: in-depth interview).

To ascertain certification, auditing is required on those standards striving for certification (Ella: in-depth interview). According to both Ella and Laura, this type of auditing is called “*external auditing*”. Normally, external certification bodies (e.g. SABS, Société Générale de Surveillance (SGS), Bureau Veritas (BV), ProCert, Technical Inspection Association (TUV), National Sanitation Foundation (NSF), SAIGlobal and Certified Master Inspector (CMI)) will control the auditing process which occurs whenever the customer demands for an external audit (Laura: follow-up interview). Contradicting this, the other type of auditing, called “*internal auditing*”,

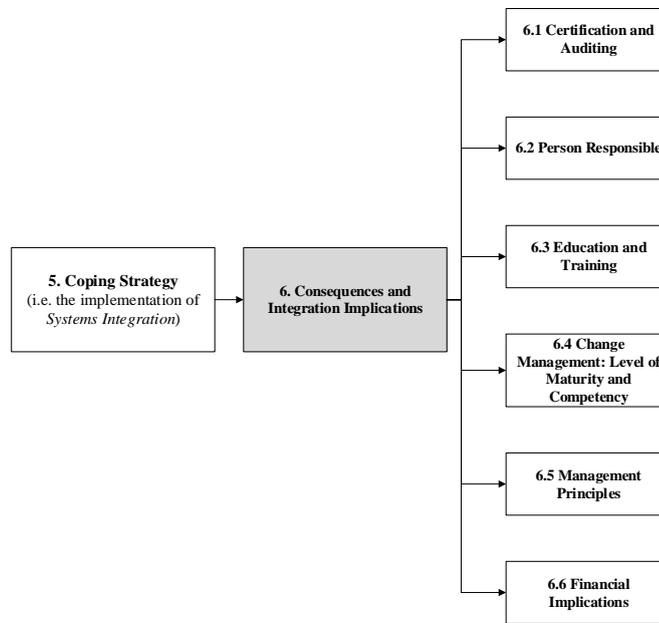


Figure 5.10: Interrelationship between the coping strategy and consequences

is required for those standards that do not need to be certified, but the organisation still have to conform to the standard (Ella: in-depth interview). Therefore, “*internal auditing*” is commonly used to provide “*structure*” (Garry: in-depth interview) and to provide a frame of reference to establish or verify whether the organisation internally conform to the standard or not (Ella: in-depth interview). Laura summarises the difference between internal and external auditing as follows:

“For continuous improvement, any system must be audited internally against a frequent schedule. External auditing is used for certification”
(Laura: follow-up in-depth interview).

In consideration of “*internal auditing*” for continuous improvement and “*external auditing*” for certification, participants agree that certification for ISO 55000 will not be necessary (Laura, Garry, Alec, Sam, and Ella: in-depth interview). Ian states that certification for ISO 55000 will be more beneficial to their organisation since their organisation values certification as powerful for the exporting industry (Ian: in-depth interview), however, all other participants advocates that certification for ISO 55000 will not be necessary. Laura’s exact words are:

“No certification would be required, because it will enhance the TQMS. From my point of view, I think it is better to incorporate ISO 55000 in TQMS, rather than implementing it. Otherwise it will create another certification audit which becomes overwhelming. Like for instance, health and safety, the ISO 18000, is incorporated into the TQMS but not audited for certification on ISO 18000. But we follow the principles in order

to comply with legislation (OSH Act). We could have implemented ISO 18000, but then the certification audit becomes tedious and is unnecessary, thus, as long as you comply with the legislation's minimal requirements it is in order. Also, it becomes very expensive to have a second certification audit. Thus, I would prefer to comply with ISO 55000 rather than implementing it and be certified for it. Another example is ISO 14000, which is Environment, which are also part of the TQMS but is not certified audited. It is however audited internally. This principle is very common in the food industry...they do not have certification audits against these standards as more audits are time consuming and costly (Laura: follow-up in-depth interview).

Sam and Ella echoes the above-statement while Fred reckons that it is not necessary to be ISO 55000 certified, however, the organisation has to comply to the standard to achieve an effective AMS (Fred: in-depth confirmation interview). Thus, it is critical to accomplish effective AM through the holistic understanding and elements of managing assets over its entire life cycle (Fred: in-depth confirmation interview). Thus, the AMS will be used as a supporting system as suggested by both Laura and Ella, while Laura and Ella find that it will be relevant to use the AMS as a non-certified standard which are internally audited for continuous improvement (Laura: follow-up in-depth interview; Ella: in-depth interview). Thus, in order for food organisations to comply with the integrated system, “*internal auditing*” is a requirement to ultimately achieve high-quality food products. If certification is an option for the organisation in the near future, Garry proposes that it would be necessary to analyse the cost and or benefits of certification prior to seeking for accreditation (Garry: follow-up in-depth interview). In other words, all factors involved in the integration and certification process should be evaluated before attempting to establish certification.

5.2.6.2 Person Responsible

AM is a broad and a holistic management approach to assuring sustainable assets and balancing the optimum point between conflicting elements such as cost, risk, and performance (Woodhouse, 2006; IAM, 2014). Refer to section 2.2.2.1 and figure 2.7 for an in-depth understanding of balancing the optimum point. Once *Systems Integration* is accomplished successfully on a strategic level, all participants agreed that one person should take responsibility for continuously improving and maintaining the integrated system on an operational level, especially someone with the knowledge and passion for AM.

It is important to assign a person who has the knowledge and experience of integrated systems within a quality and food safety context since the objective of the integration is to improve the production of high-quality food products (i.e. the TQMS) with a supporting system (i.e. the AMS). For this reason, Laura, Ella, Alec and Sam argue that it would be preferable to assign this responsibility to the quality and food safety department. Ella had the following to say:

“I would say that AM will fall within two supporting departments, quality and engineering. I think that AM should be managed in accordance to quality in a generic manner since engineering will not be able to manage it alone because they will not necessarily have the required theoretical background of quality. Therefore, there should always be a quality person present...To prevent the AM system losing its essence and importance, the quality department must take the responsibility, from which they instruct the engineers to what they should do. Thus quality has to communicate the AM elements and activities to the engineers. Not that they would want to do it since they already have so much things at their hands. Thus, I would say it is better to integrate in order to prevent work-overload on one person” (Ella: in-depth interview).

Alec and Laura echoed the above statement made by Ella. Laura observes that:

“Normally the food safety team leader is the Quality Assurance (QA) Manager of the organisation that leads the food safety team. So the food safety team leader can also lead the integration of AM into TQMS. That person will appoint an expert on AM to be part of the team to provide their expertise to the team (or meeting). Thus the QA manager will take the responsibility of the system from which they delegate responsibilities to competent employees to which they have to report to. The QA manager do not necessarily have to attain all the knowledge of AM, because their team is multidisciplinary which provides valuable insight in the daily tasks and operations...An administrative person such as the QA manager or the technical manager will take charge of such a system; they are referred to as the systems administrator. That person will then instruct the maintenance manager how to proceed with the procedure of the integrated system and to ensure that it is in place. Therefore it stays the technical manager’s responsibility and the maintenance manager should report to them” (Laura: follow-up in-depth interview).

In order to overcome the confusion between the roles of the technical and QA manager, Laura provides the following explanation:

“Depending on the organisation and their work structure that they ensue, some organisations have strong QA managers with good technological background, but others do not. Thus in the case of where organisations do not have strong QA managers, they have a technical Manager that manages the QA manager...the QA manager or the food safety team leader will be responsible for the administration of the system, and the technical manager, that is accountable for the quality and food safety system, will be the person to which the QA manager or food safety team leader will report to. The technical manager is normally qualified in food science, technology, factory machinery and has a good background of manufacturing practices, therefore, they will be accountable for asset care and the QA manager will be responsible for the integrated system. The technical

manager may also designate the engineering manager⁶ as the expert of AM which will then be the leader of asset care. However, the QA manager or food safety team leader will still administer the system” (Laura: follow-up in-depth interview).

Jim supports Laura’s statement that it is possible that the QA manager will lack technical knowledge, especially when working with the integrated system. Jim said that the person responsible should *“be more than just an administrative clerk”* (Jim: in-depth confirmation interview). If a technical manager is present, Jim advised that it will be better to assign the responsibility of the integrated system to that person. He is of the opinion that the *“technical manager will be able to foresee the system from a strategic point of view”* as well as to be able to comprehend the *“financial consequences”* on a *“tactical and operational level”* (Jim: in-depth confirmation interview).

It is evident that the concern for work overload, especially for the quality department, caused by the integration of a new system persists (Jim and Fred: in-depth confirmation interview). However, Ella has made the statement earlier that integration would decrease the responsibility of one person managing it in isolation. Therefore, supplementary to Ella’s (alongside Alec and Sam) opinion regarding work-overload for the quality department, Laura argues:

“...It is going to be a work-overload yes, but remember, the technical manager is going to manage the system. That person is only going to ascertain that the system and records of it is in place. The operations or maintenance manager will have the responsibility to comply only to that ‘part’ of the system. Therefore, it will not be required to appoint an additional person to take responsibility for AM, because the operations or maintenance manager will automatically attain that responsibility. This is exactly what they normally do with a quality and food safety system. Similarly, you also get the health and safety and environment system, but, the quality manager also put these elements into the system that they have to manage. Someone such as the ‘officer’ will then ensue working in-depth with those systems – usually it would be someone like the HR manager” (Laura: follow-up in-depth interview).

Taking this into consideration, it is viable to conclude that the quality department should take the responsibility for the integrated system and it will not be necessary to employ an additional person to take responsibility for it. Hence, the QA manager should be responsible for administering the integrated system that includes the responsibilities of keeping records and assigning activities or tasks to the engineering manager who is selected as the expert of AM. If present, the technical manager is accountable for asset care to which they also delegate the integrated system in terms of assigning responsibilities to the QA manager. The engineering manager however should be educated and trained to operate and maintain assets in accordance to the AM principles and should at all times report to the QA manager or the technical

⁶The engineering manager represents as either the operations manager or maintenance manager within the food industry.

manager. Accomplishing this, high-quality food products will be achieved. Take note that each representative of the food safety team will use only one system to achieve their daily tasks, the integrated system, which should be administrated by the systems administrator, known as the QA manager. Training obligations are discussed in the succeeding section (section 5.2.6.3).

5.2.6.3 Education and Training

The causal conditions, discussed in section 5.2.1, reflect that proper education and training is required to provide support to the various problems identified as well as the *Systems Integration* implementation coping strategy. All participants agree that “*education and training is critical*” to the food industry to ensure effective operation of physical assets (Alec, Sam and Ian: in-depth interview) and efficient understanding of achieving only high-quality food products (Renee and Sam: in-depth interview).

With regard to the discussion about communication problems between maintenance and their knowledge of quality performance and quality related results (refer to section 5.2.1.2), Renee suggests that employees responsible for maintenance should be provided with training for the inclusion of a proper background of quality and food safety of products. Thus, all employees that have direct contact with the product, physical assets or systems are obliged to attend basic training programs of food quality and food safety together with AM. In contribution to the common misconception of quality importance amongst maintenance or operational employees and the engineering manager, Renee expressed strongly that if training or education is not sufficient and employees are not at the same level of competency on food quality and food safety, “*the organisation may not be certified for a food quality or food safe system*” since it will lead to false declaration of certification and misinterpretation of expectations. Sam expressed his belief that it is important to train and educate the people to make them understand that “*food safety is not just about having a good product but it is about investing in machines*”, or any type of assets, too (Sam: in-depth interview).

It is established in section 5.2.1.3 that the food industry relies on the people to manually operate physical assets and non-physical assets which often causes deviation from quality specification. In contrast, the engineering industry relies on automated physical assets which leads to more precise production. Thus, managing people effectively is of great importance to the food industry. Contributing to Renee’s opinion regarding training, Laura, Alec, Ian and Sam observe that education and training is obligatory to ascertain the utilisation of physical assets to its full capacity (Renee, Laura, Alec, Ian and Sam: in-depth interview). Furthermore, both Laura and Ian states that it is common to the food industry to invest in people that are “*unschooled*” to “*lower the labour costs*”. Laura remarks that:

“...one often see in the food industry that advanced assets are acquired but within a year it has been modified in such a way that it becomes hand operated again. For example, our pouch filling machine is fully automated and should only be operated by one person, but, currently there are two

additional operators who put the caps onto the pouches manually. So it seems it is easier to put two people on the broken line than to maintain the capping system. If that operator would have been managed and trained appropriately to know how to look after their machine, this might not have happened. Managing people as an asset could have prevented this example from happening. The food industry in general in SA is not prepared to pay for qualified operators, so they rather take an unschooled labourer to work. But, also then, employing this unschooled labourer, the food industry neglects this employee and does not provide sufficient training and education. AM will then help to ensure the realisation of people as assets to prevent these types of problems from reoccurring” (Laura: follow-up in-depth interview).

“We see it year in and year out that our people is not highly schooled, but they must know of Pest Control, foreign objects, avoid eating in the factory, hygiene, safety. We have numerous audits in a year, and it becomes more important to employ the right employees and provide them with sufficient training...” (Ian: in-depth interview).

Although these “*unschooled*” people are obliged to undergo the minimal requirements for education and training, it remains a high risk for causing problems in most food organisations. It is also a matter of “*undisciplined people*” (Sam: in-depth interview; Jim: in-depth confirmation interview). Aggravating the problem of employing “*unschooled*” people, those who are not disciplined will worsen the causes of problems to continuously occur. For this reason, all participants argue that the food industry has to “*invest in employees*” (Sam: in-depth interview) to provide them with proper training opportunities and to equip them with the correct tools, knowledge and information prior to integrating systems. With reference to the supervisors, operators or other floor workers, “*they need to know what is a good product and what is not a good product*” (Sam: in-depth interview). This is critical for achieving a desired high-quality product and for continuous improvement. Jim believes that *Systems Integration*, mainly due to the “*top-down approach*” required for effective AM incorporation, will induce the “*discretionary efforts*” within food organisations (Jim: in-depth confirmation interview). “*Discretionary efforts*” are defined as the difference in the level of effort an individual is capable of bringing to an activity or a task, and the effort required only to get by or make do (Katoma, 2011). It can further be defined as an individual’s freedom of choice in which motivation is utilised. “*Discretionary efforts*”, therefore, refer to as a voluntary effort as it is based on an individual’s desire to engage in organisational activities because that individual is interested and willing to put extra effort into the activity (Katoma, 2011). Strong leadership and top management commitment to AM will, therefore, provide structure and guide employees to be more disciplined. In turn, employee involvement and employee engagement will automatically develop with increased “*discretionary efforts*”.

Amidst the *Systems Integration* implementation coping strategy, participants argue that education and training (or knowledge) are important. Alec stresses that:

“For you to come and introduce an integrated system into an organisation that has never had such a system before could be catastrophic. Because, the person responsible for implementing that system might not be experienced in certain disciplines of the system. For example, it does not necessarily mean that somebody that are used to quality (say a food technologists) can manage health and safety, can manage AM. Within the food industry, food professionals can come into the business as food technologists but they never had the background of machines or equipment, so you would need people to understand and are passionate about your physical assets. So we need to identify each other’s expertise before thinking of implementing a holistic or integrated system” (Alec: in-depth interview).

Clearly, Alec believes that if people does not have adequate knowledge, information or training regarding AM, it will lead to serious implications since they will not be able to run such a system efficiently. As such, experience or knowledge is critical. It is, therefore, required to employ and assign responsibilities to those employees that understand and are passionate about the physical assets. Sam proposes that *“continues training”* should be pursued throughout the *“entire season”* (Sam: in-depth interview). Contributing to this, Laura proposes that *“formal training”* is necessary to assist with, and to effectively manage the, integrated approach:

“...an overview training course on a new standard that is to be integrated into TQMS will be necessary. The training should be formal and done by a trainer that is familiar with AM (Laura: follow-up in-depth interview).

Laura further explains that *“top-down training”* should be employed throughout the organisation striving for integrating AM with TQM. According to her, *“top-down training”* means that top management should be trained first, then the senior managers, then the middle managers, then the junior managers and supervisors, then operators and controllers, and lastly, the shop floor workers. Complementary to this *“top-down training”*, it is important to introduce and explain the vision of the integrated system to all employees using the *“top-down approach”*, discussed in section 5.2.5.1. Participants, therefore, believes that the coping strategy for implementation of *Systems Integration* can successfully be achieved.

5.2.6.4 Change Management: Maturity Level and Competency

In general, systems are well developed and defined within the food industry; however, as mentioned in section 5.2.3, the coping strategy for implementation of *Systems Integration* is dependant on the organisation’s capability for growth and its culture in terms of flexibility, control, sustainability and continues improvement. The level of maturity of the organisation in terms of integrated systems and the level of competency of its workforce will influence the ability, effectiveness and efficiency of implementing the integrated approach. Thus, the success of it will depend on the organisation’s ability to manage change and the maturity level of the organisation.

Throughout the eight organisations, it has been identified that the level of AM competency is very low. Organisations often misinterpret the philosophy, or as Laura

says “*the principle*”, of it and use the term “maintenance” negatively as well as misalign the criticality for merging “maintenance” with “quality or food safety” perspectives. This was previously discussed in sections 5.2.1.1, 5.2.1.2 and 5.2.1.5. However, due to the lack of competency, food organisations should urgently act on and address these issues (Renee and Laura: in-depth interview; Garry: follow-up in-depth interview).

Ella explained that people, in general, are overworked and find new things as another burden. Moreover, people find it difficult to adapt to a changing environment and require sufficient time to accept the necessary changes (Ella: in-depth interview). She further suggests that, perhaps for the purpose of integration, it would be better to outsource an expert to help change the “*ways of working of people*” (Ella: in-depth interview). Alec reflects on change management similarly. Since most people, throughout the homogeneous sample, perceive AM or “maintenance” as something that they are told to do, they are not yet at the sufficient level of competency for implementing the AMS separately. This led to the coping strategy for implementation of *Systems Integration* to use two systems coherently to provide complementary inputs to their already existing TQMS. Therefore, change management is critical to food industries to assist changing the way people within the organisation perceive AM as well as to create a shared culture suitable for continuous improvement and collaboration (Garry: follow-up in-depth interview). In sections 5.2.1.2, 5.2.1.3 and 5.2.1.4, it is shown that it is critical to attain a shared culture that encompass all issues related to quality and attain collaboration between departments (see sections 5.2.1.5 and 5.2.4.2). Garry endorses this argument by pointing out that:

“Culture is driven from leadership, that must be in place to achieve corporate goals. A holistic approach will always be more sustainable than silos
(Garry: follow-up in-depth interview).

Clearly, attaining a holistic culture is critical to overcome problems which have been addressed earlier, especially since collaboration between departments is inevitable when considering integration. During the process of change, top management should take care when integrating or implementing the integrated system (Laura, Garry, Alec, Sam: in-depth interview) and, therefore, should create an environment and culture that are structured, but flexible enough, to accommodate them. This is consistent to what is discussed in sections 2.1.4.1, 2.2.3 and 2.2.4.5 regarding culture. It is important to note that integrated systems (or any other new system integrated to the existing system) take years of experience to master its complexity. It is, therefore, advised not to rush its implementation and expect results immediately. In order to prevent the *Systems Integration* from becoming yet another “*paperwork story*” (Alec: in-depth interview) or “*process of documentation*” (Ella: in-depth interview), people should be allowed the appropriate amount of time to understand and to approve of the integrated approach.

To ensure that all employees experience the benefits of AM, Alec and Ella argued that the vision and objectives of AM should be communicated in a positive way which considers the different levels of employee competencies throughout the organisation.

This will ultimately ensure that the message is communicated efficiently (Alec and Ella: in-depth interview). In the midst of the need for change, Laura feels that the food industry has to take action to change their current structure in order to achieve quality holistically. In her own words:

“I think the food industry in South Africa is ready for change to a next level otherwise they are going to fall behind and soon not be competitive in the market” (Laura: follow-up in-depth interview).

She proposed that as soon as a food organisation reaches the desired maturity level, they will be able to achieve the *Systems Integration* successfully; she notes:

“I think a company is mature for integration after their 3rd to 5th certification in FSSC or any other accredited food safety standard. I think by then (as soon as the FSSC is established properly), integration would be possible to be successfully achieved” (Laura: follow-up in-depth interview).

Therefore, those organisations that are competent in implementing a certified standard, such as FSSC 22000 (which is a good example of an existing integrated system (Garry: follow-up in-depth interview)), are capable of implementing a complex and holistic system that encompasses AM.

5.2.6.5 Management Principles

Throughout all interviews, it appears that all participants implement the TQM principles, within their day-to-day operations, without formally acknowledging it. In section 2.1.4, 12 TQM concepts⁷ is identified as critical amongst researchers and discussed in detail. The 12 TQM concepts are:

1. Culture
2. Leadership and Commitment – Creating the QM Environment
3. Teamwork
4. Customer Focus
5. Supplier Relationship
6. Employee Involvement – Valuing the Workforce (i.e. Employee Empowerment, Internal and External Partnership, Recognition and Reward, Education and Training)
7. Management by Fact
8. Practice of Quality Control Tools and Techniques

⁷The TQM principles are translated into TQM concepts as described in section 2.1.3. Note that the TQM concepts are also referred to as TQM principles, since concepts is merely a higher level of description of principles.

9. Continuous Improvement
10. Prevention – “Get things right the first time”
11. Competitive Benchmarking
12. Cost of Quality

To some extent, all the above-mentioned TQM concepts have been discussed throughout all the interviews. Some concepts are discussed more prominently than others, such as: culture; leadership and commitment; teamwork; customer focus; employee involvement; continuous improvement; competitive benchmarking; and cost of quality. Although all eight food organisations lack structure to support the TQM concepts and to formally address it, all implement these in some sort of way. Hence, the TQM concepts within the food industry is established (Laura: in-depth interview).

In the light of the general TQM principles, Laura, Garry, Alec and Sam all felt that management principles are important for the successful implementation of any other management system or standard. Garry, Alec, and Sam argue:

“I think in standards you have to yes, because they are structured. I suppose the logical steps would help you to build your system in the way that they want the system to be built and conform to the standard. It’s the same logical approach to the seven steps to building a HACCP system for an example, it’s really to structure you. The ISO 9000 standard is an engineering standard and it’s about structure...I think those management principles would help, but they are not the “beagle or the eagle” (Garry: in-depth interview).

“They are building blocks. For me they are the skeletons of the human body or the skeletons of a structure. We need to build on these, so we need to add flesh and organs on these skeletons. It is important that we make these principles relevant to the organisation and to ourselves and make use of it...It can be seen as the starting point. It serves as a good foundation to build on. It is an overlap of many things, it should not be seen as ‘it starts here and end there’ but rather as a good starting point of everything else. It is also important to consider that these principles should be aligned with an organisation who are passionate about growth and continues improvement or whatever they do (everybody should know what they strive for), they are going to soon realise that their business will die. There is a lot of competition out there, so you have to be bigger and better than the competitor to ensure that you can provide your client with the same stuff as the competitor but just better (offer them more). So, you need to keep up with times and trends and your industry knows (the way you are doing things). You also need to keep up with your management skills, your client’s needs and you need to meet and exceed your client’s needs and expectations...” (Alec: in-depth interview).

“Those principles, you have to incorporate all of these into your standards. So, people need to be built on a solid team. So you need to have an environment where all people are working as a team. We need to focus on continuous improvement, so people need to understand the direction we are heading to. So if we are focussing on continuous improvement, the people need to exactly understand what they should do to achieve it as one factory. So this goes back to the one vision and one culture. For example, the one principle saying that we should be customer focused (saying what do our customer want), so we as a team need to understand what the customer wants and strive towards it as a team...Before you start anything else, you have to share these principles with the people. Before you start with anything, be sure to have structures in place before you start with anything else. If you want to run production, make sure that all certain requirements and expectations are met before production starts or before you do anything” (Sam: in-depth interview).

People tend to steer themselves towards structure and find it easier to follow instructions to work toward a vision or something that is desired (Garry: in-depth interview). In the case of management principles, it provide structure for guiding people to achieve systems in a way that they designed the organisation to be (Garry, Alec and Sam: in-depth interview). This, however, is achieved through leadership or top management commitment. Although the participants agree that TQM principles are important, it merely serves as the foundation to the success of any other management systems or structures. However, without it, *“no other system can be implemented nor maintained”* (Laura: in-depth interview). Alec mentioned that *“without it you will yield results of a bad management system if not implemented”* (Alec: in-depth interview). Ian and Sam echoes both Laura and Alec’s opinion, thus, it is evident that management principles should be established prior to implementing any other management system or standard, particularly for *Systems Integration* or any integrated systems for that matter. This advanced into the need for establishing the 39 AM Subjects, whether or not all Subjects are deemed necessary to the food organisation. Fred remarked that some of the 39 AM Subjects are already in place without recognition, but require structure and in-depth understanding (Fred: in-depth confirmation interview).

With regard to AM, participants continuously observed that proper knowledge and information of the AMS should be envisaged holistically across the organisation, since AM principles have not yet been established. It, therefore, is necessary for the organisation interested in integrating the AMS with their TQMS, to consider the six AM Groups (section 2.2.4) and its 39 AM Subjects (appendix A.2). Moreover, in order to attain a holistic understanding of AM and to provide a valuable framework for implementing and assessing AM in an organisation, all 39 AM Subjects should be considered. The essence of the 39 AM Subjects establishment are discussed further in chapter 6.

In consideration of the participants’ opinions and their remarks regarding the strategy adopted in response to *Systems Integration* (see section 5.2.5), the researcher

could identify some of the AM 39 Subjects within data that could be utilised across the eight organisations. Refer to table 5.4 for a list of Subjects that are already utilised on a very basic level by the participants' corresponding organisations.

The AM Subjects listed in table 5.4 only represent those that are utilised in a way that could be compared to the activities and tasks known to the participants' organisations. It is critical to acknowledge that most of the Subjects that are utilised by the food organisations are focussed on food products and processes only, and do not necessarily consider any processes concerning effective management of assets. In other words, it appears that the food organisations do apply some aspects of the 39 AM Subjects (as listed in table 5.4), but only to some extent, since they do not formally address the context of assets in a structured manner. To the contrary, food organisations does not realise that they are utilising it.

Table 5.4: List of AM 39 Subjects utilised across the eight food organisations

Group Name	Subject Name
<i>Strategy and planning</i>	Demand Analysis; Strategic Planning; and AM Planning.
<i>Asset management decision-making</i>	Capital investment decision-making; Operations and maintenance decision-making; Lifecycle value realisation; Resourcing strategy; and Shutdowns and outage strategy.
<i>Lifecycle delivery</i>	Technical standards and legislations; Asset creation and acquisition; Systems engineering; Maintenance delivery; Asset operations; Resource management; Shutdown and outage management; and Fault and incident response.
<i>Asset information</i>	Asset information standards; and Data and information management.
<i>Organisation and people</i>	Procurement and supply chain management; Organisational structure; Organisational culture; and Competence management.
<i>Risk and review</i>	Risk assessment and management; Contingency planning and resilience analysis; Sustainable development; Management of change; Asset performance and health monitoring; Management review, audit and assurance; Asset costing and valuation; and Stakeholder engagement.

5.2.6.6 Financial Implications

South Africa is experiencing economic pressures, especially within the food market, as discussed in section 1.1. Moreover, the food industry often experiences resource scarcity and variation in products since it is dependant on seasonality (Luning and Marcelis, 2006; Dora *et al.*, 2013a). In consideration to the economic pressures and risk of resource scarcity, the food industry relies on effective and appropriate resources, skills and technology to achieve the desired outcomes of high-quality food products (Laura and Ella: in-depth interview). The latter is price intensive, and in order for the food organisation to compete with increased prices and high quality demands, they should adapt to these critical environments (Laura and Ella: in-depth interview). It has previously been identified that AM will support the food industry with these demands and although it will be expensive to establish and incorporate the AM culture, in the long-term it will yield financial profits. This statement is shared amongst the participants since most of them acknowledge that AM will create financial benefits over-time (Garry, Renee, Ian, Alec, Laura: in-depth interview).

Finances are identified as a general concern to food industries, especially since financial constraints influence decisions that food organisations make in the sense of maintaining assets. Since food organisations does not always have the capital to make the necessary improvements for defective assets or assets that are at the end of their lives, their decisions for asset investments are influenced. Participants, therefore, note that it will be difficult to persuade food organisations to implement the *Systems Integration* due to its high financial implications; that could include possible new employments, obligatory training, possible auditing accreditations if appropriate and valuable time, and investments in, and repair of, assets. Ian explained that the food industry does realise the importance of investing in new assets, or maintenance of assets. However, the crisis of financial instability remains. Ian confirms that:

“...At our company we have the problem of: ‘this is the CAPEX⁸ that we want to invest and this is the improvements that we want to achieve, but this will costs is say R 14 million rand’...if the executives come back to us an tell as that we only have R 10 million rand, then we can do noting about it. So we know of maintenance issues and neglected assets that requires attention, but we just accept those things that we can not get. Most of the time it is all about finances – financial pressure, especially in the time that we are currently living in and the type of industry that we have. People don’t tend to purchase a canned fruit if they are really hungry, they would rather buy something else. I work in this industry from the year 1992, and from then to know, I have never seen a good financial year. We have always been on the verge of survival. Our profit-line is very low. If there is only that amount of money available for ass to address asset related issued, then we just have to accept it. Last year we wanted to provide our employees with additional training, but at the

⁸CAPEX, or capital expenditure, represents as one basic category of business expenses. CAPEX are funds used by a company to acquire or upgrade physical assets such as property, buildings or equipment (IAM, 2014)

end there were not enough money to provide the training program. So it is not that we don't think that maintaining assets is important, it just that there is not always money for it" (Ian: in-depth interview).

As mentioned in section 5.2.1.1, Garry supports Ian's opinion since he explicitly stated that most decisions within food organisations resolves around cash flow (Garry: follow-up in-depth interview). Garry further mentioned that food organisations is a "*capital intensive business*" (Garry: follow-up in-depth interview), hence, a viable connection is made between literature and theory since it has been previously remarked, in section 1.1, that the food industry is referred to as an asset intensive industry. It is, therefore, expected that decision-making within the food industry revolves around cash flow and capital assets. It is typical for food organisations to first try to manipulate and reduce costs rather than to invest in assets (Garry: follow-up in-depth interview). Regarding the argument about financial implications that prevents the food industry from investing in assets, Garry responded accordingly:

"...it is a matter of strategy, risk management and expectations of growth. Company policy has a big role since single hurdle rates when calculating Internal Rate of Return (IRR) on new potential asset investments may wrongly reject projects with a negative Net Present Value (NPV) due to the wrong hurdle rate used" (Garry: follow-up in-depth interview).

In the light of the above statement made by Garry, it is critical to note that a new investment could yield serious financial implications if not properly investigated. Wrongly doing so could even lead to misleading results, such as rejecting projects that should otherwise not have been rejected. Upholding Ian's and Garry's opinion regarding the impact that finances have on decision-making, Jim and Fred, therefore, proposes that a "*business case*" is essential to overcome organisations to safeguard financial issues (Jim and Fred: in-depth confirmation interview). They also argue that any system can be implemented, but there is sometimes just not enough money to financially support it since some food organisations do not have the capital to make these investments. There are always going to be financial strains when considering a new implementation project, such as implementing the AMS. Thus, "*integration is axiomatically true in context of its causes and effects and its known benefits that it will provide*"; however, in order to successfully accomplish *Systems Integration*, the "*financial benefits of it should be further investigated*" to support its need for implementation (Jim and Fred: in-depth confirmation interview).

On senior management level, the managers typically deal with the management of physical assets and ensuring efficient operation; however, on top management level, the top manager often deals with capital expenditure budgeting, called CAPEX (also part of the Subject named *capital investment decision-making* (see table 5.4 and appendix A.2.2)), which are common to food organisations. In explanation towards defining CAPEX to which Ian mentioned earlier, Laura provided the following information (In a follow-up in-depth interview, Jim endorsed Laura's statement):

[Currently assets are acquired through a capital expenditure budgeting process] "*Currently assets such as machinery and equipment are dealt*

with through a system⁹ called CAPEX. This expenditure category is used when new machinery and equipment are required. This expenditure category calls for three quotations and a full Return on Investments (ROI). Depending on the outcome of this exercise the machinery or equipment are purchased. After that the machinery or equipment becomes an item in or on the financial statements where depreciation thereof is accounted for. Also the machinery or equipment becomes an item on the Maintenance or Preventative Maintenance Schedule for regular or annual or perhaps breakdown maintenance” (Laura: in-depth interview).

Referring to Ian and Jim’s confirmation of financial issues and the food industry’s financial instability, it is clear that it will be difficult to implement AM in isolation. Once again this provides proof that integrating AMS with food organisations’ TQMS is the best solution to assist with overcoming typical and current issues that food organisations face. According to Ian and Sam, it is expensive to compete within the international market, especially when the same type of product is produced in the exported country (Ian and Sam: in-depth interview). Thus quality has become an essential tool to compete with the high export price which led to the conclusion of using AM as a supporting system; in the view of the fact that participants agreed that it will assist with continuously improving the quality of the processes and products. Jim remarked that the TQMS (in their case FSSC 22000) provides assurance that a defective product is not allowed to be supplied to the market at all costs. What the AMS typically will accomplish is to assure that the production process is more effective in order to prevent defects from occurring and to provide consistency. This, however, can create a more expensive production process (Jim: in-depth confirmation interview). The latter may be negative in the short-term, but it will become beneficial in the long-term (Garry, Renee, Ian, Alec, Laura: in-depth interview). Both Jim and Fred stressed that there is a definite link between AM and TQM. Perhaps they are not directly linked to one another; however, AM will positively influence the cost of quality within one’s business (Jim and Fred: in-depth confirmation interview) since AM will ensure a cost effective production process and prevent product scrapping and product rework (Fred: in-depth confirmation interview). Refer to sections 2.1.4.12 and 2.3.3 for more detail regarding the cost of quality.

As a final remark, according to Laura, “*AM will ensure that the production process is managed more effectively, efficiently and productively. In turn it will decrease operation costs*” (Laura: follow-up in-depth interview). As a result of the increased production costs, cost of quality and input costs required to produce higher quality food products, it is believed that AM will help food organisations with addressing their financial challenges as well as with reducing their operation costs over time, since it is believed that AM will increase organisational profits by decreasing costs of quality over time (Laura, Renee, Ian, Ella, Alec: in-depth interview and Jim and Fred: in-depth confirmation interview).

⁹Laura referred to CAPEX as a system, but from here on the term system will be referred to as an expenditure category.

5.2.6.7 Summary

During the process of coding, memo writing and visualisation, figure 5.11 emerged. This figure 5.11 describes the next level of detail of the sixth category, named consequences (see figure 5.1). In response to the coping strategy for *Systems Integration* implementation, figure 5.11 illustrates a summary of the outcomes of using the strategy. Six consequences and integration implications emerged; these are: certification and auditing; person responsible; education and training; change management; management principle; and financial implications. When approaching the integrated approach to TQM and AM, these consequences are critical for consideration.

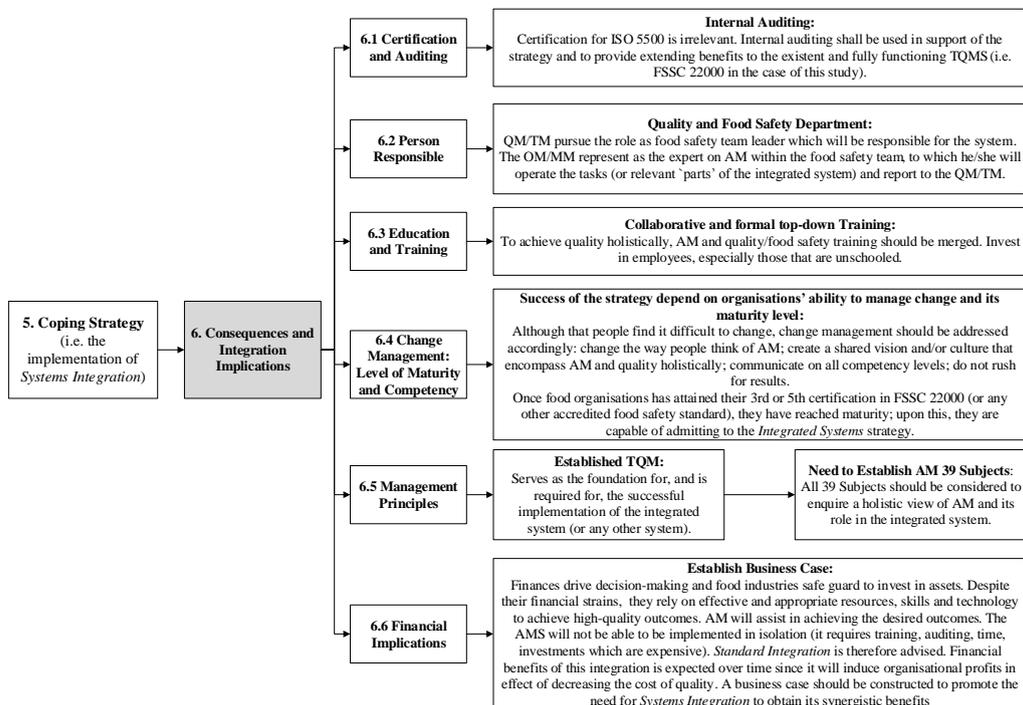


Figure 5.11: Summary of consequences and integration implications

5.2.7 Theoretical Propositions

Based on the grounded theory analysis and the development of a theory discussed in chapter 5, a discursive set of 20 propositions are identified. These propositions serve as a summary for the developed theory which also describes the interrelationship between categories in the *axial coding paradigm* (Refer to figure 5.1) as well as its corresponding figures that describes its next level of detail. The 20 propositions are listed accordingly:

1. Asset problems cause final product implications that often lead to poor final product quality and safety, in turn, this causes unhappy customers and loss of business.
2. People cause communication problems to occur, in turn, this leads to asset problems.
3. Communication is the cornerstone problem to many issues related to the food organisation's overall performance and final product quality.
4. People management should be envisaged to overcome communication issues, which in turn, will overcome asset problems. Hence, leadership and top management commitment is critical to address people management.
5. Integration will create interdependence and collaborations between departments which in effect will break down silos and align KPA's and KPI's.
6. A significant correlation between achieving high-quality and food safe products and AM incorporation exists. AM and leadership and top management commitment to AM will contribute to increasing product quality and safety.
7. AM will administer a competitive advantage and at the same time generate improvement to many aspects related to the food industries' holistic system for achieving quality (i.e. TQM) since AM is collaborative to addressing common issues identified.
8. AM overlaps with various elements of the TQMS, therefore, a strong correlation between the need for AM and its integration with TQM exists.
9. With the incorporation of AM, it is believed that South African food organisation could outclass their competition since it will lead to improved quality of the product, efficiency of equipment and productivity of the people. In turn, *Systems Integration* will create improved asset care.
10. In order to survive with the competitive pressure and to cope with their current inability to implement and maintain AM as a separate system, the integrated system should be used as a support system.
11. Strategically, a top-down approach is required to successfully achieve *Systems Integration*.
12. Certification for ISO 55000 is not necessary since *Systems Integration* is proposed. However, internal auditing is required to ensure conformance.
13. The systems administrator (the technical or quality manager) will take control of the integrated system and will represent the food safety team leader. The team will be multidisciplinary to which an expert on AM (the engineering manager) will take responsibility for the AM part of the integrated system.

14. Education and training is a precaution for the person responsible to the AM part of the integrated system as well as any other employee in direct contact with the assets. Hence, the food organisation has to invest in employees by providing them with top-down training.
15. The successful implementation of the integrated system will depend on the organisation's capability for growth, the culture that they envisage and their level of maturity in terms of systems. Thus, organisations may admit to *Systems Integration* once they have reached a certain level of maturity. Maturity is reached after the food organisation's 3rd or 5th successful FSSC 22000 accreditation.
16. *Systems Integration* is dependant on the organisations' ability to manage change to which top management should take responsibility.
17. Top management should envisage a collaborative culture that allows for the incorporation of the AMS with the TQMS which also enables flexibility, control, sustainability and continuous improvement.
18. TQM principles are established within the food industry, however, in order to achieve successful *Systems Integration* and effective AM, the 39 AM Subjects, whether or not all Subjects is relevant, should be established.
19. The incorporation of AM into the TQMS will create financial benefits in the long-term.
20. With the incorporation of the AMS into the TQMS, *Systems Integration* alongside effective AM, the effectiveness of both process management and organisational profits will be improved upon over time, since it will have a positive influence on cost of quality in time.

On account of the research process and the grounded theory analysis, a gap in the food industry is identified. This gap is the probability of delivering poor quality food products and customer dissatisfactions caused by the existence of asset problems, communication problems and poor people management or leadership commitment to asset care. This gap will be closed when holistically considering all aspects supporting *Systems Integration*. If the implementation of *Systems Integration* is successful, it should lead to high-quality food products as well as customer satisfaction (refer to figure 5.1).

The above-listed propositions and the *axial coding paradigm* as well as its corresponding discussions serves as the baseline for the development of the theoretical guideline for managers presented in chapter 6.

5.3 Chapter Conclusion

In accordance with the requirements of the grounded theory methodology, this chapter holistically portrayed the expert opinions and inputs of senior managers in two developing phases, the early data analysis and the theoretical development. In the

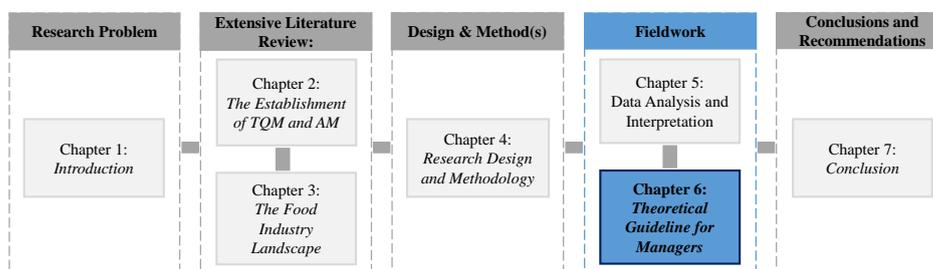
first phase, codes and categories were identified. In the second phase, data was analysed at a more abstract level for context for deriving the core phenomenon, named *Systems Integration*, which was investigated and documented in detail. All essential categories that caused the phenomenon to emerge (i.e. causal conditions), actions adopted in response of the emerging phenomenon (i.e. strategy), situational factors that influenced the strategy (i.e. intervening conditions) and the outcomes of using the strategy (i.e. consequences) were analysed and interpreted. These categories relate to, support and explain the, core phenomenon to which the *axial coding paradigm* (i.e. the visual representation of the theory in the form of a theoretical model) emerged. The *axial coding paradigm* served the purpose for assembling a story that retrospectively described the interrelationship between the emergent categories. The theory developed based on both the homogeneous and heterogeneous samples, therefore, the *axial coding paradigm* was interpreted in accordance to the expert opinions based on the perspectives of both food safety and food quality and engineering or maintenance. Contextual relevant literature was used to support and confirm findings between existing literature and emerging theory. Finally, this chapter provided a list of 20 propositions that summarised the developed theory and described the interrelationships between categories seen in the *axial coding paradigm*.

Chapter 5 has addressed the fourth sub-objective of this research study. Considering the outcomes of this chapter, it can be concurred that a theory was conceptualised to meet the fourth sub-objective (Refer to section 1.4). Moreover, the second and third sub-questions were addressed and answered accordingly (see section 1.3) through data analysis and interpretation presented in chapter 5. Chapter 5 served as the baseline for theoretical guideline development. The succeeding chapter, chapter 6, summarises the developed theory into a theoretical guideline for managers to use when considering the integration of the AMS with their existing TQMS.

With regard to the listed set of 20 propositions, it is viable to concur that chapter 5 has successfully addressed the grounded theory approach to *Systems Integration* and its corresponding theoretical guideline for implementation. Refer to section 1.5.

Chapter 6

Theoretical Guideline for Managers



The previous chapter conceptualised the detail of the emergent theoretical guideline for managers as developed in accordance with participants' expert opinions and inputs. In order to provide direction and clarity, the objective of this chapter is to summarise, and reflect on, the findings of the grounded theory analysis to develop a theoretical guideline for managers to consider when striving for an integrated approach. The theoretical guideline is documented in accordance with the *axial coding paradigm* and the conditions, coping strategy, and consequences of the integrated approach. The purpose of this guideline is to assist management to implement the integrated approach in order to achieve high-quality products and customer satisfaction. This chapter also considers additional recommendation and considerations required for the theoretical guideline. The extensive literature analysis (outlined in chapter 2 and 3) is used to supplement and affirm the findings established in chapter 5 and 6.

6.1 Introduction

This guideline provides guidance for the implementation of an integrated system for Asset Management System (AMS) and Total Quality Management System (TQMS), referred to as *Systems Integration*, in accordance with its conditions, coping strategy, and consequences. Various gaps, common to food industries, are identified across eight distinct food organisations within South Africa. The objective of *Systems Integration* is to improve the production of high-quality food products of the TQMS with a supporting system that addresses effective asset care and asset exploitation using the AMS. In turn, *Systems Integration* will close gaps found in food organisations to produce high-quality products and to satisfy its customers.

This guideline contains explanatory text necessary to clarify the prerequisites to, coping strategy for, and consequences of, *Systems Integration*, and provides an example of an integrated system.

This guideline provides guidance for use by:

- management involved in the establishment of *Systems Integration* in food organisations;
- management involved in delivering activities of *Systems Integration* in food organisations.

General information on Asset Management (AM) and Total Quality Management (TQM), and information on the terminology applicable to this guideline, are provided in chapter 2, chapter 3 and the glossary. The grounded theory methodology (see chapter 4) served as an approach for integrating two management approaches, TQM and AM. This provided the basis for developing the guideline to accomplish successful integration of the systems of these management approaches. In chapter 5, data is collected, analysed and interpreted to which the grounded theory analysis is summarised, contextualising the opinions and inputs of senior managers. Consequently, the context of their opinions are consolidated into a guideline to strategically address and overcome common issues that general food organisations encounter. For the purpose of this guideline, the terms and definitions given in chapter 2, chapter 3 and glossary apply.

Appendix A.2 provides additional information on areas related to AM. Appendix B.5 shows the results of the inputs of senior managers towards *Systems Integration*.

6.2 Scope

This guideline provides guidance for the implementation of *Systems Integration*, in accordance with its conditions, coping strategy, and consequences. *Systems Integration* can be implemented in all types and sizes of food organisations that are concerned with achieving high-quality and food safe products with the combined use

of asset care and asset exploitation. Take note that this guideline does not provide financial, accounting or technical guidance for *Systems Integration*. It also does not include guidance specific to other management systems, such as those particular to environmental management and occupational health and safety management. For the purpose of *Systems integration*, the term “AMS” is used to refer to the International Organisation for Standardisation (ISO) 55000 standard to provide guidance for effective AM and the term “TQMS” is used to refer to a set of multiple food standards designed according to customer demands and business objectives. The researcher apologises to the reader for the repetition of the figures illustrated in this guideline. The figures are repeated to ease the reading process simply because of the size of this document. All figures are based upon techniques commonly used in grounded theory. These include: coding; memoing; and visualisation.

From data analysis, the theoretical visual model, referred to as the *axial coding paradigm*, emerged. See figure 6.1 for the illustration of the *axial coding paradigm*. The guideline contains three sections that consolidate the six categories depicted in figure 6.1: conditions of *Systems Integration*; coping strategy for *Systems Integration* implementation; and consequences and integration implications of *Systems Integration*.



Figure 6.1: Theoretical model (*axial coding paradigm*) for integrating AM with TQM

6.3 Conditions of *Systems Integration* Implementation

This section discusses the conditions of *Systems Integration* implementation. Management will be able to comprehend how to introduce *Systems Integration* within the food organisation (section 6.3.1) as well as understand what the origin and need of its emergence (section 6.3.2) is. This section further enables management to understand the conditions that either led to the development of, or influenced the coping strategy for *Systems Integration* (section 6.3.3).

6.3.1 Creating *Systems Integration* Awareness

The context of *Systems Integration* emerged in perspective of senior managers. If senior management will be responsible for implementing *Systems Integration*, they are obliged to create *Systems Integration* awareness to top management. It is requested that senior management inform top management of the demand and need for *Systems Integration* during their yearly strategic session. Once senior management introduced the *Systems Integration* to top management, it is required that top management commit to *Systems Integration* and properly define, document and translate and communicate it throughout the organisation. Top management's commitment is continuously discussed in chapter 2 and is regarded as important to both TQM and AM approaches. Refer to sections 2.1.4.2, 2.2.4.5 and 2.3.2 to attain a holistic view of leadership when considering *Systems Integration*. A quotation that explains how a senior manager perceives *Systems Integration* to be introduced in a food organisation is as follows:

“Annually, a strategy meeting is held with executives. I believe that it will be the senior manager’s responsibility to introduce such an integrated approach on a strategic level, but the top manager will have to make the decision to establish an objective for the integrated system. As soon as it becomes an objective, it will become a goal which then is communicated through Key Performance Areas (KPA). On the yearly strategic session which executives and senior managers take part to discuss the future and determine gaps from which tools are identified to reach the future goals. This is where the senior managers introduce AM to the executives and explain to them how AM can be integrated into TQMS to yield high-quality and safe foods. At that point in time, I will propose the need for AM and provide them with a guideline (especially the ISO 55002 and mapping of it with Foundation for Food Safety Certification (FSSC) 22000)” (Laura: follow-up in-depth interview).

Evidently, the guideline is applicable for the strategic use by top management. Practically, senior management will be able to establish and operate the *Systems Integration* to accomplish its goals and objectives. With respect to the perspectives of senior management, this theoretical guideline also propose the need for *Systems Integration* to top management to address the importance of overcoming common issues that require attention. However, the main objective of this guideline is to assist management to effectively address the approach of implementing *Systems Integration*. A final quote to consider:

“*Systems Integration implementation must be driven from the top and collaboration sought from below to buy in*” (Garry: follow-up in-depth interview).

6.3.2 Understanding the Causal Conditions

When establishing *Systems Integration*, it is important that managers understand the elements associated to the causal conditions and its relation to *Systems Integration*. In section 5.2.1 it is identified that common issues exist within the general food industry. Among these are, but not limited to: asset problems; communication problems; people; and leadership (see figure 6.1). These conditions led to the need for AM, which in turn, led to the reason for *Systems Integration*. Refer to figure 6.2 for a representation of how the causal conditions interrelates. Figure 6.2 depicts the next level of detailed description of the first category, causal conditions, seen in figure 6.1. The causal conditions are discussed in section 6.3.2.1. Section 6.3.2.2 depicts how the causal conditions and the need for AM leads to *Systems Integration*.

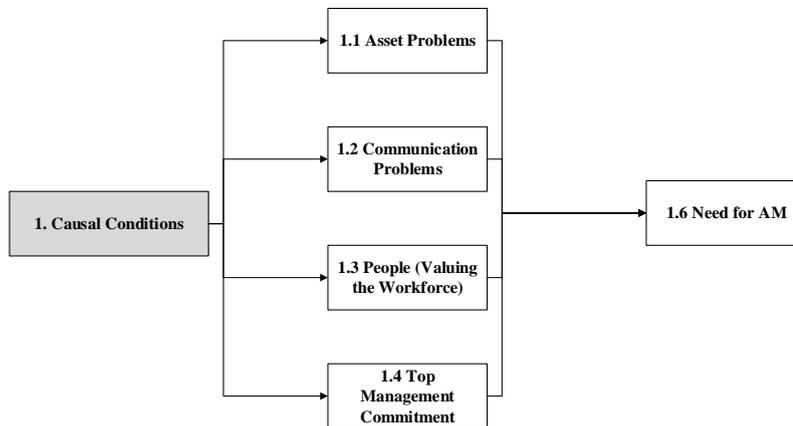


Figure 6.2: The interrelationship between causal conditions and the need for AM

6.3.2.1 Conditions Leading Towards the Need for AM

Based on input from eight food organisations, two asset classes exist: human assets (referring to the people of the organisation) and physical assets (referring to the machines and equipment used in the organisation). Asset problems are known as those issues related to human and physical assets that food organisations encounter regularly. Asset problems are perceived as uneducated or uninformed people as well as negligence relating to physical asset or poor operation of it. More specifically, asset problems refer to as any causal problem that influence or deviates from the definition of assets: anything that has potential or actual value to an organisation (see section 2.2.2.1). Asset problems causes final product implications that often leads

to poor final product quality and food safety. In turn, product quality inconsistency and deviations from standard product specifications lead to customer dissatisfaction and loss of business and reputation. In respect of asset problems, there exist a need for AM, since food organisations lack guidance for effective practice and management of assets (see figure 6.2).

People are the heart of any food organisation and are responsible for managing the successful implementation of systems, physical asset operation and care and establishing production performance. People are the cause of communication problems, which in turn, lead to asset problems. Communication is the cornerstone problem to many issues related to a food organisation's overall performance and quality of the final product. Take note that the level of severity of communication problems will differ from organisation to organisation, since it is dependant on organisational culture and leadership. Communication issues typically relate to the following:

- common misinterpretations of responsibilities;
- misinterpreting the importance of employee responsibilities and causes of it;
- miscommunication between distinct departments;
- conflict of interests amongst departments (e.g. distinct framework of reference or mentalities);
- differing level of competencies; and
- negative perception of “maintenance”.

These issues prevail within the quality and food safety, and engineering departments, since inter-departmental silos exists. Proper people management is, therefore, required to overcome communication issues and to prevent its silo effect, sequentially asset problems. People require the following factors to successfully accomplish their responsibilities: teamwork; engagement; motivation; recognition; knowledge; education; information; and training. These factors form part of proper people management. There exists a direct correlation between literature and theory that proper people management should not be ignored. Therefore, employee involvement is critical for establishing an effective work environment, and as part of effective TQMS and AMS implementation valuing the workforce is essential (see sections 2.1.4.6 and 2.2.3). It is further important to note that teamwork and collaboration for continuous improvement are essential. Thus, proper people management and the effective management of the human asset class are critical.

It is evident that AM will assist in changing the way people perceive and address the implications of everyday issues that relate to assets (see figure 6.2). It is critical to note that AM will not change all aspects relating to how engineers¹ perceive the implication of how their tasks critically influence the food quality and food safety

¹Engineers refer to those involved with maintenance or operation of physical assets.

of the final product. However, food quality and food safety will benefit from integrating AMS and TQMS since these are interdependent and integration will create interdependence preferences. On account of integrating AMS with TQMS, integration will create collaboration between departments which in effect will break down inter-departmental silos and align KPA's and Key Performance Indicators (KPI's).

In order to address people management and to support resolving everyday issues, leadership and top management commitment should be established. See sections 5.2.1.4, 2.1.4.2 and 2.2.4.5 for a list of responsibilities that top management should conform to. AM will assist leaders, senior management, and top management to resolve issues that food organisation encounter daily. Take note that it is not capable for AM to resolve all issues that food organisations encounter in isolation. Leadership and top management commitment are required to provide sustainable AM, which will, in turn, improve systems and overall business outcomes (figure 6.2). The main focus of South African food organisations is the production of high-quality and food safe products. Food organisations are lagging behind other industries that focusses on AM practices. Therefore, food organisations have to recognise that the focus of asset care and asset exploitation are equally as important as the focus of food quality and food safety, since a significant correlation between achieving high-quality and food safe products and AM incorporation exists. AM will assist improving overall performance and Overall Equipment Effectiveness (OEE) results. Sustainable AM, leadership and top management commitment to AM will contribute to increasing product quality and safety.

6.3.2.2 Need for AM Leading Towards *Systems Integration*

Based on the outcomes of the causal conditions and the realisation for the need for AM (see section 6.3.2.1), organisations have to understand how these lead to *Systems Integration*. Refer to figure 6.1 to recall the second category of the *axial coding paradigm*.

The South African food industry is experiencing high competitive pressure and stringent regulatory requirements in terms of quality and food safety. In comparison to other manufacturing industry types, food manufacturing is a complex process since it deals with seasonal and varying product types, and, therefore, the food industry is not capable of delivering precise² production. In order to continuously improve producing high-quality and food safe products, the food industry is willing to seek alternatives to remain competitive to ensure customers satisfaction. To be efficient in production – that concerns producing high-quality food products and to decrease cost of quality or production costs to better the market price – and to compete with the international market, food organisations have to incorporate AM in support of improving product quality. AM will administer a competitive advantage and at the same time generate improvement to many aspects related to the food industries' holistic system for achieving quality (i.e. TQM), since AM is collaborative to addressing common issues identified (see section 1.1). AM overlaps with various

²In context to this guideline, precision refers to the ability to manufacture consistently to which the production process can be reproduced almost to precision

elements of the TQMS, therefore, a strong correlation between the need for AM and its integration with TQM exists (see sections 2.3 and 5.2.1.5).

The relationship between causal conditions, the need for AM and food organisations' drive towards precision leads to the acknowledgement of *Systems Integration*. Figure 6.3 illustrates the interrelationship between causal conditions, the need for AM and *Systems Integration*.

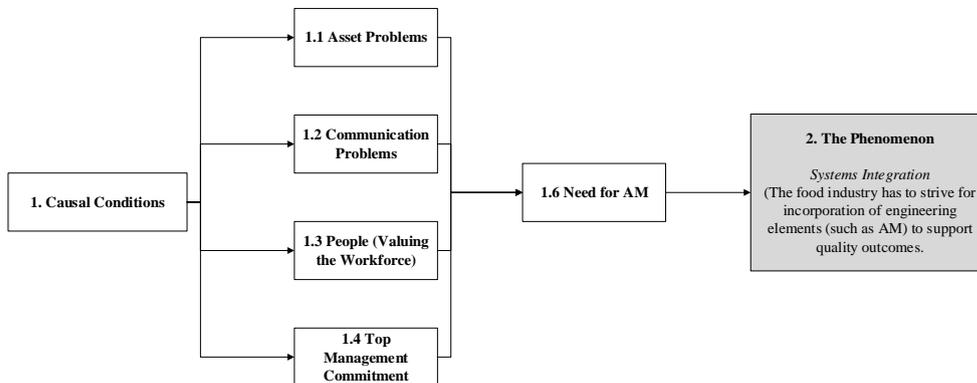


Figure 6.3: The interrelationship between causal conditions, the need for AM and *Systems Integration*

Systems Integration will provide positive inputs to food organisations' existing TQMS. Considering food organisations' main focus for achieving food quality and food safety, *Systems Integration* will serve the purpose of supporting the TQMS instead of changing its focus, especially since the TQMS is functioning effectively on its own. With the incorporation of AM, the South African food industry will outclass their competition since it will lead to improved quality of the product, efficiency of equipment and productivity of the people. In turn, *Systems Integration* will create improved asset care. It should be noted that *Systems Integration*, depending on the complexity of the system and the level of the outcome that is required from the AMS, will not be able to be accomplished overnight. It will take years to yield results. However, it is evident that integration will be the next step towards achieving improved organisational efficiency.

6.3.3 Understanding the Context of the Coping Strategy for Implementation of *Systems Integration*

Organisations should identify and review the conditions that either develops or influence the coping strategy for implementation of *Systems Integration*. In this section, managers will be able to comprehend how the coping strategy developed on account of the context to developing the coping strategy and the intervening conditions that

influences it. The coping strategy represents the integration process of *Systems Integration* implementation with two coping strategy activities. Figure 6.4 illustrates a detailed summary of the relationship between all factors that developed, intervenes and describe the coping strategy for *Systems Integration*. In section 6.4 two parallel coping strategy activities (see figure 6.4) that determines the process of achieving *Systems Integration* are discussed.

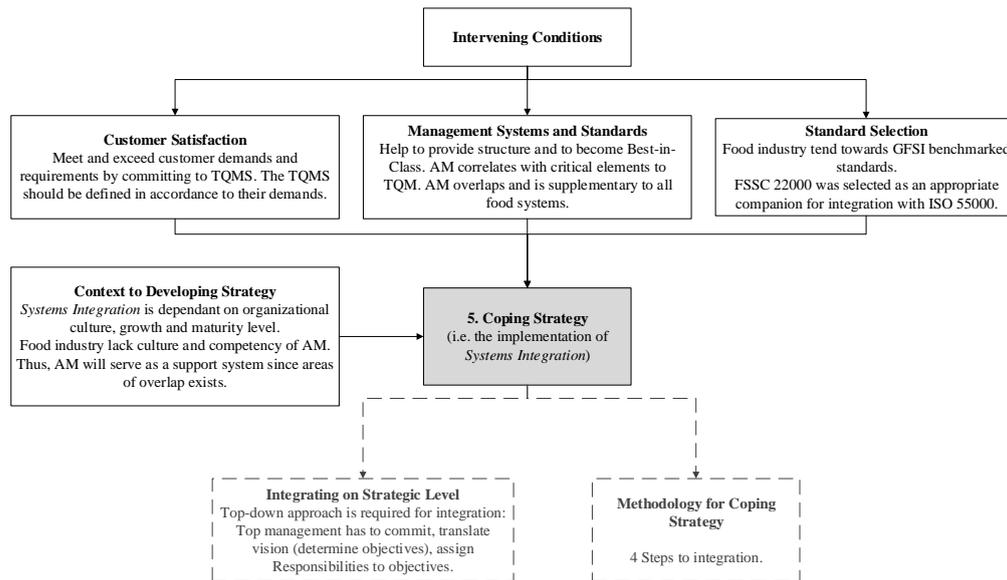


Figure 6.4: Summary of the coping strategy for implementation of *Systems Integration*

Figure 6.4 depicts the third, fourth and fifth categories of the *axial coding paradigm* (see figure 6.1). The contextual and intervening conditions, as well as the coping strategy activities are described in sections 6.3.3.1, 6.3.3.2 and 6.4 respectively.

6.3.3.1 The Contextual Conditions that Develops the Coping Strategy for *Systems Integration*

Prior to establishing the process for integrating systems, it is important to note that *Systems Integration* within food organisations is dependant on:

- its capability for growth;
- the holistic culture that it pursues;
- its maturity level and experience regarding systems integration; and
- its ability to implement systems successfully.

Since food industries have limited AM knowledge and training opportunities as well as a non-functioning AM culture, they are not capable of implementing an AMS

separately. Areas of overlap between TQMS and AMS, however, exist in food organisations. Therefore, for food organisations to survive with the competitive pressure and to cope with their current inability to implement and maintain AMS as a separate system, the AMS should be used as a support system to TQMS. This represents as the coping strategy for implementation of *Systems Integration*. Take note that it will be easier to manage systems that are aligned than managing systems separately. The development and establishment of a coping strategy for *Systems Integration* is, therefore, required prior to approaching the integration process. Figure 6.5 illustrates a summary of the next level of detailed description of the third category represented in figures 6.1 and 6.4. This figure clearly depicts the relationship between the contextual conditions and the coping strategy for *Systems Integration* implementation.

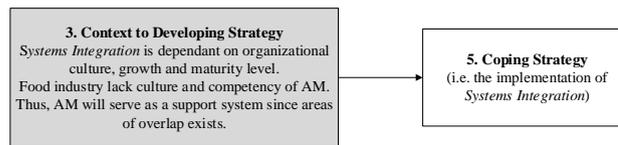


Figure 6.5: Context to developing coping strategy for *Systems Integration*

6.3.3.2 The Intervening Conditions that Influence the Coping Strategy for *Systems Integration*

Other conditions that influence the coping strategy need to be considered. These conditions are: customer satisfaction; management systems and standards; and standard selection. In figure 6.6, these intervening conditions are depicted. Figures 6.5 and 6.6 demonstrate the relationship between the contextual and intervening conditions that influence the coping strategy (see figure 6.4). The intervening conditions present category number four in figure 6.1.

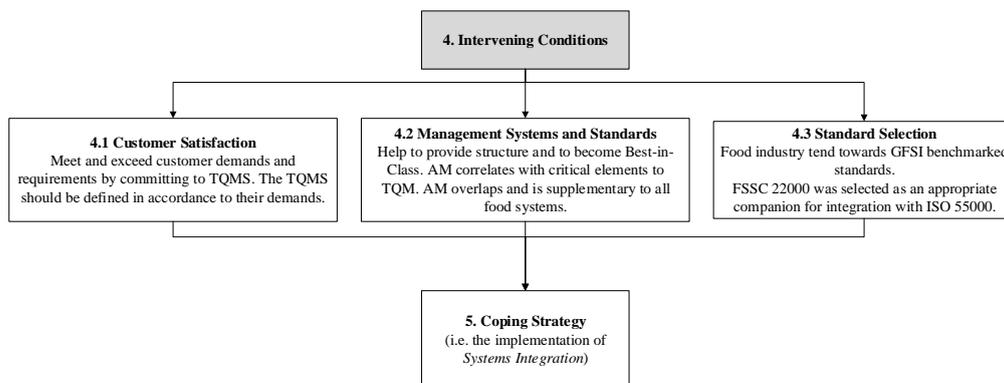


Figure 6.6: Intervening conditions influencing the coping strategy for *Systems Integration*

Customer Satisfaction

In order to keep customers³ satisfied, it is important for food organisations to provide them with proof of commitment for delivering high-quality and food safe products. To illustrate commitment, food organisations will pursue certification in certain systems. The TQMS is well developed within the food industry and, therefore, should be established since it provides a framework for achieving quality and food safe products. Prior to establishing the commitment of the TQMS, it is essential to understand the demands and requirements of the organisation's customers.

It is important to note that the structure of the TQMS will differ between food organisations in terms of its decision for organisational focus, market type and standard acceptance. Food organisations, therefore, should:

- decide if they will be focussing on food safety, quality, environmental issues, health and safety, etc. or a combination of these objectives;
- determine whether they will produce products privately, nationally or internationally; and
- decide which standard certification should be pursued prior to establishing their TQMS.

These preliminary requirements represent the business objectives of the food organisation (see section 3.4). Once the objectives have been properly defined, food organisations may proceed with selecting relevant standards to design their TQMS according to customer demands. Refer to table 3.1 for the representation of a selection tool for standards. Take note that the principles of a TQMS will remain the same, regardless of its design (see sections 2.1.3 and 2.1.4).

Management Systems and Standards

Management systems and its standards provide structure, to which the AMS framework will provide extending benefits to the TQMS. AM is known for its structure, which food organisations generally lack in management systems. Incorporation of the structured AMS will provide assistance with the realisation of good results. Sequentially it will contribute to allowing food organisations to out-perform their competitors and become Best-in-Class in the food industry. The AMS is compatible for the integration of food systems (see section 2.3.1), hence integrating AM with TQM is an applicable notion to consider. Refer to figure 5.7 to understand how AM overlaps with TQM and where in the TQMS it supports all types of food systems. The relationship between AM and TQM is (see section 5.2.4.2:

- both are focused on people and processes as well as decision-making;
- both are focused on continuous improvements;

³Customers represents either one or a combination of the following: clients; shareholders; stakeholders; retailers; buyers and consumers.

- both address maintenance issues, corrective and preventative maintenance as well maintenance schedules; and
- both are management systems that encompass similar management models and will follow similar processes.

6.3.3.3 Standard Selection

When designing the TQMS, take note that most customers value organisations who are Global Food Safety Initiative (GFSI) benchmarked. GFSI benchmarked standards are, therefore, deemed as appropriate for the purpose of *Systems Integration*. GFSI approve of five standards, namely (see sections 3.1, and 3.2 and 5.2.4.3):

- British Retail Consortium (BRC) – Global standard for food safety (Issue 6);
- International Food Standard (IFS) (Version 6);
- Safe Quality Food Standard (SQF);
- FSSC 22000; and
- Dutch Hazard Analysis and Critical Control Point (HACCP)-based food safety system.

In respect of the objective of *Systems Integration*, it is appropriate to incorporate the AMS with one of the five GFSI benchmarked standards. Regarding data and industry norm, FSSC 22000 is the most appropriate TQM standard for the integration with the AM standard, ISO 55000 (see section 5.2.4.3). It is, however, critical to note that it is possible to integrate ISO 55000 with any other relevant food system as shown in table 3.1. For the purpose of this study, considering the available resources, only the integration of FSSC 22000 and ISO 55000 will be performed as proof of how *Systems Integration* can be achieved.

6.4 Implementing *Systems Integration*

This section documents the coping strategy for *Systems Integration* and how its implementation will proceed. The process of the coping strategy is described using two activities, namely integrating on a strategic level and the methodology for *Systems Integration* (section 6.4.1). The methodology for *Systems Integration* is elaborated to which a brief discussion of the standards used for *Systems Integration* are given (section 6.4.2) and the results of the methodology is illustrated (section 6.4.3). Once management is familiar with the two coping strategy activities and the results thereof, they will be able to comprehend how to approach implementing *Systems Integration*.

6.4.1 Process of *Systems Integration* implementation

Based on the context and intervening conditions (see sections 6.3.3.1 and 6.3.3.2), the coping strategy is divided into two parallel activities namely; integration on strategic level; and methodology for *Systems Integration*. These activities determine the process of *Systems Integration* implementation and, therefore, should be considered as preliminary to *Systems Integration* implementation. Figure 6.7 illustrates these activities which describes the fifth category, represented in the axial coding paradigm (figure 6.1). Also refer to figure 6.4, which illustrates the interrelationship between all factors that either develop, intervene or determine the coping strategy.

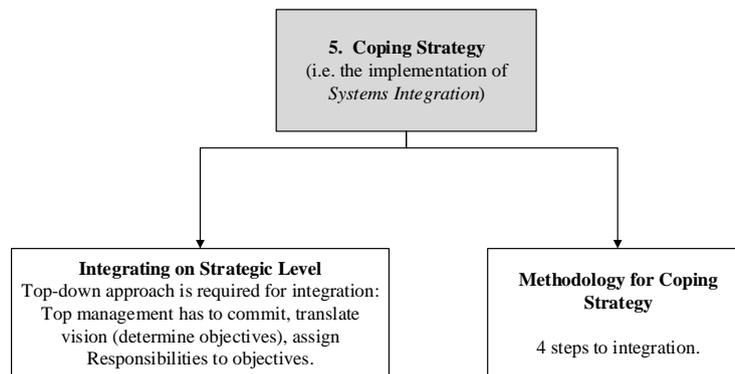


Figure 6.7: The activities parallel to the coping strategy for *Systems Integration*

The coping strategy activities are discussed in sections 6.4.1.1 and 6.4.1.2 respectively.

6.4.1.1 Integration on Strategic Level

Top management commitment is essential for the successful integration of systems on a strategic level. It is required of top management to commit to *Systems Integration* and to commit to supporting the integration of ISO 55000 with their organisation's FSMS, in this case, FSSC 22000. A "top-down approach" for successfully achieving *Systems Integration* is required. A "top-down approach" follows accordingly (see section 5.2.5.1):

- top management needs to translate and communicate the vision for *Systems Integration* to the entire organisation;
- once translated and communicated, those responsible will need to ensure that the objectives and goals of the vision are met.

6.4.1.2 Methodology for *Systems Integration*

For the process of *Systems Integration* implementation, the most appropriate structure for the methodology is in the form of a comparative mapping of clauses for the ISO 55000 and FSSC 22000 standards. The motivation for the process for *Systems Integration* (mapping) originates from section 5.2.5.2. The methodology for *Systems Integration* is as follows:

Step 1 *Introduction to standards:*

- a. Understand the outline of ISO 55000 standard.
- b. Understand the outline of FSSC 22000 standard.

Step 2 *Clause incorporation:*

- a. Identify the relevancy between each clause of ISO 55000 and FSSC 22000.
- b. Once the relevant clauses is identified, determine the appropriateness of its relevancy and decide whether to incorporate or to ignore the clause.
- c. If agreed to incorporate the clause, proceed with step 3; if agreed to ignore the clause, repeat step 2 until a relevant clause is identified.

Step 3 *Strategic development:*

- a. Incorporate the relevant ISO 55000 clause to FSSC 22000.
- b. Refer to Food safety management systems – Guidance on the application of ISO 22000:2005 document and ISO 55002 Asset Management – Guidelines for the application of ISO 55001 document if certain areas of overlaps requires further explanation.

Step 4 *Confirmation:*

- a. Repeat step 1 to step 3 for confirmation.
- b. If deemed necessary, incorporate appropriate revisions and improvements.

Using the above-mentioned methodology will assist managers to comprehend how to integrate (map) ISO 55000 with FSSC 22000. The result of using this methodology is presented in section 6.4.3.

6.4.2 Introduction to Standards used for *Systems Integration*

It is essential to understand the outline of the standards, ISO 55000 and FSSC 22000, used during the integration process. This allows managers to comprehend the process for *Systems Integration* holistically. This section, therefore, elaborates on step one of the methodology for *Systems Integration* implementation. ISO 55000 and FSSC 22000 are discussed in sections 6.4.2.1 and 6.4.2.2.

6.4.2.1 ISO 55000 and 39 AM Subjects

The ISO 55000 series of international standards consists of three documents (see section 2.3.1): ISO 55000 Asset Management – Overview, principles and terminology; ISO 55001 Asset Management – Management Systems – Requirements; and ISO 55002 Asset Management – Guidelines for the application of ISO 55001. In respect to the process of *Systems Integration*, the requirement standard, ISO 55001, is used for the purpose of the integration (or mapping) procedure. ISO 55002 is used to further guide deciding on which clauses to map.

It is important to note that the ISO 55000 series only specifies the management system to support AM and does not stipulate best practices for the discipline of AM (Jooste and Vlok, 2014). By definition, the AMS is a sub-set of AM (Pragma, 2015). Figures 2.8 and 6.8 illustrate the AMS in context to the holistic system of an organisation. It is essential to recall that ISO 55001 in isolation will not make an organisation more competitive or improve its AM practices. The six AM Subject Groups and its corresponding 39 AM Subjects in accordance to both the AM – An Anatomy (IAM, 2014) document and the AM Landscape (GFMAM, 2014) document should be considered during the integration procedure as it holistically covers all AM activities over the assets' lifecycle (see section 2.2.4). For a summary of all 39 AM Subjects, refer to appendix A.2.

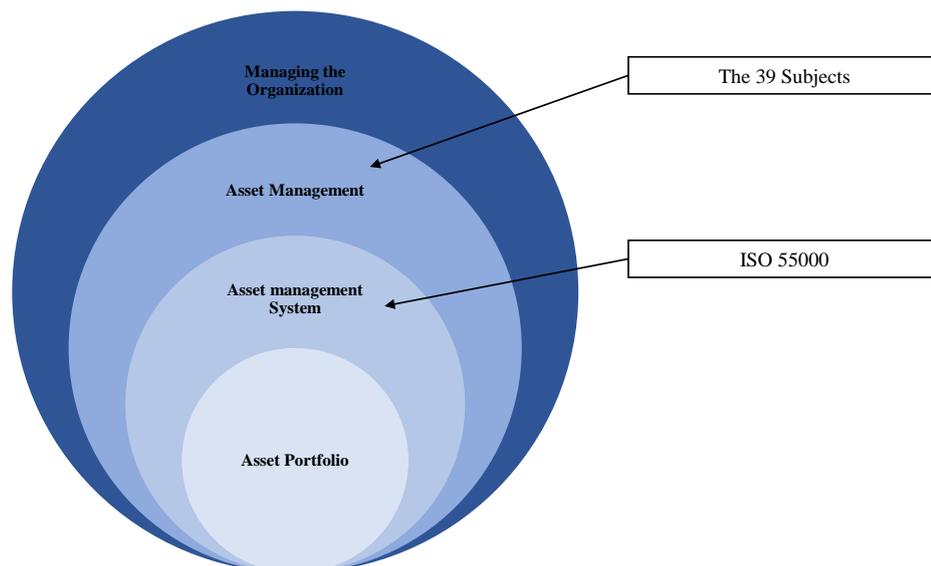


Figure 6.8: The holistic AM function and provision for AMS compliance (Adopted from International Standard Organization (2014a))

The ISO organisation has standardised the structure of the ISO 55001 to allow

alignment for all management systems, such as quality, safety and environmental standards (International Standard Organization, 2014a; Prajogo and McDermott, 2005). All ISO system standards consist of significant similar structures to ease the process of integration whenever integration is deemed necessary (see section 3.1). In order for the food organisation to be ISO 55000 certified, the following aspects should be formally documented in the form of processes and procedures and utilised in the form of providing records to show the history of their application (International Standard Organization, 2014a):

- **Clause 1:** Scope
- **Clause 2:** Normative reference
- **Clause 3:** Terms and definitions
- **Clause 4:** Context of the organisation
- **Clause 5:** Leadership
- **Clause 6:** Planning
- **Clause 7:** Support
- **Clause 8:** Operation
- **Clause 9:** Performance evaluation
- **Clause 10:** Improvement

Essentially, organisations should guard against a compliance mind set as benefits will only be realised from sustaining the best practices of AM. This will lead to reduced risks and costs, extended asset life, effective utilisation of resources, increased product or service delivery, and improved asset reliability and performance (International Standard Organization, 2014a; Prajogo and McDermott, 2005). The transition towards AM requires strong and committed leadership. Organisations should guard against fast-tracking the process of certification. It is advised that food organisations rather implement sustainable AM, establish a formal management system and collect records to provide commitment to, and prove of, compliance. To comprehend the holistic understanding of sustainable AM, refer to section 2.2 and appendix A.2.

6.4.2.2 FSSC 22000

The FSSC 22000 is a complete certification scheme for food safety systems which are in compliance with the publicly available FSMS standard, the ISO 22000 Food safety Management Systems – Requirements for any organisation in the food chain, and the publicly available specification for Prerequisite Programs (PRP) on food safety for food manufacturing, that is the ISO/TS 22002-1 Prerequisite Programmes on Food Safety – Part 1: Food manufacturing (Foundation for Food Safety Certification, 2013).

In order for the food organisation to be FSSC 22000 certified, the following aspects should be formally documented in the form of processes and procedures and utilised in the form of providing records to show the history of their application (Foundation for Food Safety Certification, 2013) (see section 3.1):

- **Clause 1:** Scope
- **Clause 2:** Normative reference
- **Clause 3:** Terms and definitions
- **Clause 4:** Food safety management system
- **Clause 5:** Management responsibility
- **Clause 6:** Resource management
- **Clause 7:** Planning and realisation of safe products
- **Clause 8:** Validation, verification and improvement of food safety management system

FSSC 22000 combines the benefits of a business management system linking food safety and business processes. It attains the ability to meet the growing global customer requirements for a GFSI recognised supplier food safety system certification. It further provides a flexible, risk-based global approach to drive continual improvement in FSM and provide confidence across the supply chain which represents both the public and private sector (FSSC 22000, 2015).

6.4.3 Results and Discussion of the Process for Implementation of *Systems Integration*

The mapping is performed according to the second coping strategy activity, the methodology for *Systems Integration*. Refer to section 6.4.1.2 and figure 6.7. This section, therefore, elaborates step two to four of the methodology for *Systems Integration* implementation. On account of the methodology, *Systems Integration* is accomplished. For the illustration of the integrated system, refer to table 6.1⁴.

The ISO 55001 is mapped with ISO 22000. It is not necessary to map ISO 55001 with ISO/TS 22002-1 since the ISO 22000 already contains a clause that represents PRP's. Management must, however, refer to ISO/TS 22002-1 when required (see table 6.1, clause 7).

The concept of integration, of different but similar in structure standards, within food organisations is common. Regarding the evolution of standards, food organisations are familiar with integrating systems to yield a system that is beneficial to their

⁴It is advised to consult the Food safety management systems – Guidance on the application of ISO 22000:2005 document and ISO 55002 Asset Management – Guidelines for the application of ISO 55001 document when referring to table 6.1

own organisation or to the general food industry (see section 5.2.4.2). For example, ISO 9001 integrated with HACCP to yield ISO 22000, ISO 9001 integrated with ISO 14000 and ISO 18000 to yield a Integrated Management System (IMS)⁵, and finally, ISO 22000 integrated with ISO/TS 22002-1 to yield FSSC 22000. Most of these integrated systems are further integrated into food organisations' TQMS (see section 5.2.3), which administrates all standards in unison. Integration of systems within food organisations are, therefore, plausible.

There does not yet exists any ISO 55000 accreditation within South African food organisations. Regardless of this, the AM 39 Subjects are utilised and are relevant to certain aspects within food organisations' TQMS without recognition (see sections 5.2.6.5, 6.3.2.2, 6.3.3.1 and 6.3.3.2). It is, therefore, inevitable that areas of overlap between ISO 22000 and ISO 55000 will exist. The ISO 55001 provides extending benefits to those areas of relevancy to the ISO 22000 (Laura: follow-up in-depth interview)⁶ and areas that require further assistance in asset care and asset exploitation.

Take note of the *referrals* and *participant comments* columns of the integrated system (see table 6.1) for the holistic understanding of it. Table 6.1 presents proof that most clauses of the ISO 55001 standard provide extending support and promote specific areas that the FSSC 22000 standard lack or require supervision when addressing the concern of assets. The ISO 22000 does lists and addresses the basic requirements for the effective functioning of human assets (refer to clause 6 of ISO 22000 and clause 7 of ISO 55001) and physical assets (refer to clause 7 of ISO 22000 and clause 8 of ISO 550002). It, however, does not elaborate on how to manage it properly (table 6.1). When comprehending the integrated system in its entirety (table 6.1), the FSSC 22000 lack guidance and structure with managing assets and hazards related to food products and processes. Therefore, FSSC 22000 requires the AMS to assist managing the organisation's assets in a proactive manner. Noticeably, the AMS provides extending support and benefits.

The integrated system illustrates the relevancy between ISO 55000 and FSSC 22000 and exemplify how *Systems Integration* will look like when approaching the integration of ISO 55000 with FSSC 22000. Table 6.1 provides significant clarification of what specific ISO 55000 clauses are required to support and promote its compatible ISO 22000 clause. Table 6.1 equips and guides management through the *Systems Integration* process. It further provides assistance during the strategic implementation of the FSSC 22000 standard to collaboratively consider the relevant and essential aspects of the ISO 55000 standard to obtain synergistic results.

Since other food standards are applicable for *Systems Integration*, table 6.1 serves as a good baseline and approach to developing other possible integrated systems (Laura: follow-up in-depth interview). It is critical to note that the integrated

⁵The IMS is a common term used in non-food manufacturing industries

⁶From here on forward, take note that if a participant is cited it means that data is collected during the process of integrating AMS with TQMS to either determine or confirm the process for *Systems Integration* implementation and its integrated system.

system (seen in table 6.1) should not be seen as the only solution to closing gaps within an organisation. It further cannot be considered as a solution to all food organisation types, since the results of the process for implementation of *Systems Integration* are based on management inputs from eight South African food organisations and, therefore, does not account for the general food industry (Fred: in-depth confirmation interview). All conditions that either caused *Systems Integration* (section 6.3.2), developed, intervened and described the coping strategy for *Systems Integration* (sections 6.3.3.1, 6.3.3.2 and 6.4.1) and their interrelationship presented in the *axial coding paradigm* (figure 6.2) as well as the 20 theoretical propositions listed in section 5.2.7 should be considered holistically.

Table 6.1: The integration of ISO 55000 with FSSC 22000

ISO 22000:2005	Clause	Clause	ISO 55000:2014	Referrals	Participant comments
Introduction					
Scope	1	1	Scope		
Normative references	2	2	Normative references		
Terms and definitions	3	3	Terms and definitions		
Food safety management system	4	4	Context of the organisation		
General requirements	4.1	4.1	Understanding the organisation and its context		
		4.2	Understanding the needs and expectations of stakeholders		
		4.3	Determining the scope of the asset management system		
		4.4	Asset management system		
Documentation requirements	4.2	7.5	Information requirements		
General	4.2.1	7.6	Documented information		
Control of documents	4.2.2	7.6.1	General		
		7.6.3	Control of documented information		
Control of records	4.2.3	7.6.2	Creating and updating		
Management responsibility	5	5	Leadership		
Management commitment	5.1	5.1	Leadership and commitment	Refer to TQM principles and 39 Subjects of AM in chapter 2	
Food safety policy	5.2	5.2	Policy		
Food safety management system planning	5.3	6	Planning		
		6.1	Actions to address risks and opportunities for the asset management system		
		6.2	Asset management objectives and planning to achieve them		
		6.2.1	Asset management objectives		
		6.2.2	Planning to achieve asset objectives		
Responsibility and authority	5.4	5.3	Organisational roles, responsibilities and authorities		

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Table 6.1 – Continued from previous page

ISO 22000:2005	Clause	Clause	ISO 55000:2014	Referrals	Participant comments
Food safety team leader	5.5			Refer to section 5.2.6.2 for the establishment of the person responsible for the integrated system.	
Communication	5.6	7.4	Communication	Refer to ISO 55002, clause 7.4.1, 7.4.2 and 7.4.3	
External communication	5.6.1				
Internal communication	5.6.2	8.2	Information requirements Management of Change		
Emergency preparedness and response	5.7	10.2	Preventive action		Depending on the definition of assets which the organisation choose to manage holistically. E.g., it could be the physical assets (the organisation buildings or structure), human assets or any other asset for that matter.
Management review	5.8	9.3	Management review	Refer to ISO 55002 (Guidelines for the application of ISO 55001), clause 9.3.1	
General	5.8.1			Refer to ISO 55002, clause 9.3.2 and 9.3.3	
Review input	5.8.2			Refer to ISO 55002, clause 9.3.4 and 9.3.5	
Review output	5.8.3				
Resource Management	6	7	Support		
Provision of resources	6.1	7.1	Resources		ISO 22000 does not elaborate on the importance of physical assets. This is exactly where AM could subsidise and better our system.

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Table 6.1 – Continued from previous page

ISO 22000:2005	Clause	Clause	ISO 55000:2014	Referrals	Participant comments
Human resource	6.2			Refer to ISO 55002, clause 7.1	Management of HR(s) in the FSMS often lacks the details needed to manage the HR as an asset. This is where AM can assist in approving the management of HR since the principle of the ISO 55001 can assist with proper HR management or manage HR in a better way. Top management should recognise or define HR as an asset. We do say that HR are our biggest asset, but we don't manage it in that way to allow people to work more efficiently and effectively and productively. This is an area which most food industries lack in. We want to obtain everything from the people, but are not prepared to listen to their needs and to invest in the people (e.g. We don't inform them where to the business drives to achieve objectives; we don't explain to them how to achieve the objectives; nor do we give them recognition if they have done something good.
General Competence, awareness and training	6.2.1 6.2.2	7.2	Competence	Refer to clause 7.2 and qualifying note on page 5 of ISO 55001 with regard to training	
Infrastructure	6.3	7.3 7.1	Awareness Resources	Refer to ISO 55002, clause 7.1	
Work Environment	6.4	7.1	Resources	Refer to ISO 55002, clause 7.1	
Planning and realisation of safe products	7	8	Operation		
General	7.1	8.1 8.2 8.3	Operational planning and control Management of change Outsourcing		

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Table 6.1 – Continued from previous page

ISO 22000:2005	Clause	Clause	ISO 55000:2014	Referrals	Participant comments
Prerequisite programmes (PRP's) refer to ISO/TS 22002	7.2	7.1	Resources		The PRP's is were the food safety system fall short on attention. This is were AM can assist with proper management of all physical resources. The ISO/TS 22002 do specify the aspects of assets to consider, but, it do not address how to properly manage it. This is another area where ISO 55000 can have a big impact on FSM.
Establish, implement and maintain PRP's	7.2.1	8.3 6.1	Outsourcing Actions to address risks and opportunities for the asset management system	Refer back to clause 6 to confirm if clause 7.2. of ISO 22000 was considered.	
Identify statutory and regulatory requirements	7.2.2	6.2.1	Asset management objectives		
Selection and establishing PRP's	7.2.3	6.2.2	Planning to achieve asset objectives		If PRP could be defined as assets and could be better managed, it will mean that we will yield higher quality and food safe products.
Construction and lay-out of buildings and associated utilities	a	7.5	Information requirements	Refer to ISO/TS 22002-1 for more detail on PRP's. The organisations will have to identify which PRP's they define as an asset. Then each asset should be managed in accordance to the ISO 55001 standard.	As I understand assets, the PRP's represent important assets to be managed, which we do recognise but do not manage it properly.
Lay-out of premises, including workspace and employee facilities	b				
Supplies of air, water, energy and other utilities	c				
Supporting services, including waste and sewage disposal	d				

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Table 6.1 – Continued from previous page

ISO 22000:2005	Clause	Clause	ISO 55000:2014	Referrals	Participant comments
Suitability of equipment and its accessibility for cleaning, maintenance and preventative maintenance	e				
Management of purchased materials	f				
Measures for the prevention of cross contamination	g				
Cleaning and sanitising	h				
Pest control	i				
Personnel hygiene	j				
Other aspects as appropriate					
Preliminary steps to enable hazard analysis	7.3	10.2	Preventive action		This clause entails HACCP to prevent the production of unsafe food product that can have an adverse effect (i.e. referred to hospitalisation or death) on the consumer. Hence, proper preventive management should be envisaged here.
General	7.3.1	7.5	Information requirements		
Food safety team leader	7.3.2				
Product characteristics	7.3.3				
Intended use	7.3.4				
Flow diagrams, process steps and control measures	7.3.5	6	Planning	Clause 6 of ISO 55001 must be considered during flow diagram establishment	

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Table 6.1 – Continued from previous page

ISO 22000:2005	Clause	Clause	ISO 55000:2014	Referrals	Participant comments
Hazard analysis	7.4			Refer to the ISO 55001 in general.	The HACCP plan is unique to the food industry, and by managing your assets i.e. the human and physical assets according to ISO 55001 principles will ensure controlling and reducing the hazards that they can introduce. Managing the assets in accordance to the ISO 55001 standard, we will be able to manage the hazards better at each step of the HACCP Plan. Hazards can be anything that is caused by humans or machines and equipment. If the ISO 55001 standard in general is used to manage assets, naturally it will reduce or eliminate hazards caused by human or physical assets.
General	7.4.1	6.1	Actions to address risks and opportunities for the asset management system		
Hazard identification and determination of acceptable levels	7.4.2	6.1	Actions to address risks and opportunities for the asset management system		
Hazard assessment	7.4.3	6.1	Actions to address risks and opportunities for the asset management system		
Selection and assessment of control measures	7.4.4	6.2.1 6.2.2	Asset management objectives Planning to achieve asset objectives		
Establishing the operational prerequisite programmes (PRP's)	7.5	8.1	Operational planning and control	This refers back to the management of the operational prerequisite programmes (OPRP's) considered in clause 7.2 of ISO 22002 in order to prevent cross contamination or introduction of hazards to the product.	

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Table 6.1 – Continued from previous page

ISO 22000:2005	Clause	Clause	ISO 55000:2014	Referrals	Participant comments
Establishing the HACCP plan	7.6			This refers back to the management of the critical control points (CCP's) identified in clause 7.4 of ISO 22002 in order to prevent cross contamination or introduction of hazards to the product.	
HACCP plan	7.6.1	6.2.2	Planning to achieve asset objectives		
Identification of critical control points (CCP's)	7.6.2	8 6.1	Operations Actions to address risks and opportunities for the asset management system		
Determination of critical limits for critical control points	7.6.3	8 6.2.1	Operations Asset management objectives		
Systems for the monitoring of critical control points	7.6.4	8 9.1	Operations Monitoring, measurements, analysis and evaluation		
Actions when monitoring results exceed critical limits	7.6.5	10.1	Nonconformity and corrective action		
Updating of preliminary information and documents specifying the PRP's and the HACCP plan	7.7	10.2	Preventive action		
Verification planning	7.8	9.1	Monitoring, measurements, analysis and evaluation		
Traceability system	7.9				
Control of nonconformity	7.10				
Corrections	7.10.1	10.1	Nonconformity and corrective action		
Corrective actions	7.10.2	10.1	Nonconformity and corrective action		

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Table 6.1 – Continued from previous page

ISO 22000:2005	Clause	Clause	ISO 55000:2014	Referrals	Participant comments
Handling of potentially unsafe products Withdrawals	7.10.3 7.10.4	10.2 10.1 10.1	Preventive action Nonconformity and corrective action Nonconformity and corrective action	ISO 22000 do not describe preventative actions in detail, refer to Clause 10.2 of ISO 55002 for clarity	
Validation, verification and improvement of food safety management system General	8 8.1	9 9.1	Performance evaluation Monitoring, measurements, analysis and evaluation		
Validation of control measures combinations	8.2	9.1	Monitoring, measurements, analysis and evaluation		
Control of monitoring and measuring	8.3	9.1	Monitoring, measurements, analysis and evaluation		
Food safety management system verification Internal audit Evaluation of individual verification results Analysis of results of verification results Improvement	8.4 8.4.1 8.4.2 8.4.3 8.5	 9.2 10 10.1	 Internal audit Improvement Nonconformity and corrective action		
Continual improvement Updating the food safety management system	8.5.1 8.5.2	10.2 10.3	Preventive action Continual improvement		

6.5 Considering Consequences and Integration Implications from using *Systems Integration*

On account of applying the coping strategy for implementation of *Systems Integration* in food organisations, management should consider its consequences and integration implications. In this section, management will be able to prepare their food organisation for *Systems Integration* implementation in context to its consequences.

Management should consult the sixth category of the *axial coding paradigm* (figure 6.1). This category represent the outcomes of using the coping strategy for implementation of *Systems Integration* which should be considered as a precautionary measure. The outcomes of *Systems Integration* are described in six categories of consequences and integration implications: certification and auditing; person responsible; education and training; change management (i.e. level of maturity and competency); management principles; and financial implications. Refer to figure 6.9 for an illustration of a summary and detailed description of the sixth and final category of the *axial coding paradigm* (figure 6.1). Figure 6.9 further illustrates the interrelationship between the coping strategy and the consequences and integration implications of using the coping strategy. Sections 6.5.1 to 6.5.6 discuss the consequences and integration implications in relation to figure 6.9.

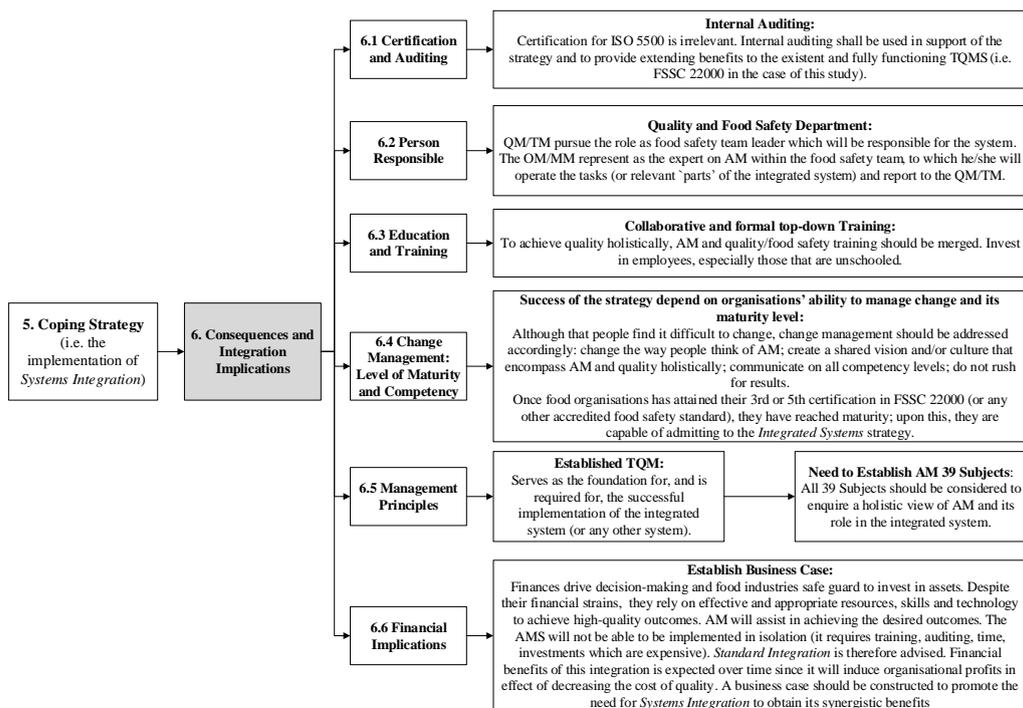


Figure 6.9: Summary of consequences and integration implications

6.5.1 Certification and Auditing

Certification is an important tool used by food organisations to out-perform their competitors, especially when competing globally. Certification for standards are used to conform to the demands of customers (see section 6.3.3.2) and are, therefore, based upon customer requirements. Food organisations generally strive for certification to increase client base profiles and organisational profitability. If certification for standards is a concern to food organisations, external auditing is required. External auditing is controlled by certification bodies such as: South African Bureau of Standards (SABS); Société Générale de Surveillance (SGS); Bureau Veritas (BV); ProCert; Technical Inspection Association (TUV); National Sanitation Foundation (NSF); SAIGlobal; and Certified Master Inspector (CMI). Organisations do attain some standards that are not audited for certification. In these cases the standards are used to the benefit of their holistic organisational focus and to comply with legislation. It is, however, important that food organisations pursue with internal auditing to ascertain compliance for continual improvements and compliance with legislation's minimal requirements.

In concern of the complexity for the application ISO 55000 and food organisations' inability to administer it separately at this stage (see section 6.3.3.1), certification for ISO 55000 is not necessary since *Systems Integration* is proposed. Internal auditing is required to ensure conformance with ISO 55000. Internal auditing will further support the implementation of *Systems Integration* while its focus for supporting the TQMS and the FSSC 22000 standard remains present. Take note that sustainable AM is required to ensure effective application of ISO 55000 and to attain benefits from incorporating it (see sections 2.2.3 and 6.4.2.1).

If ISO 55000 certification is considered, a proper analysis of costs and benefits of ISO 55000 certification is a precautionary measure to establishing full accreditation. This corresponds to establishing a business case which is discussed in section 6.5.5.

6.5.2 Person Responsible

AM is a broad and holistic approach to assuring sustainable assets. It also balances the optimum point between conflicting elements such as cost, risk, and performance (Woodhouse, 2006; IAM, 2014). Due to its complexity, one person should take responsibility for continuously improving and maintaining the AMS and its elements that relate to the integrated system (table 6.1). The person responsible should acquire adequate knowledge of AMS and should also be passionate for sustaining AM and *Systems Integration*.

The primary focus of food organisations generally is quality and food safety; and the focus of the *Systems Integration* is to support and improve the production of high-quality food products (see sections 6.3.2.1 and 6.3.2.2). Considering this focus, the quality and food safety department is responsible for *Systems Integration*. The responsibilities and authorities of key functions of *Systems Integration* within the quality and food safety department should be defined. This should include internal

roles and responsibilities. No external or outsourced roles and responsibilities are required. It should be clear which roles are responsible for which activity.

It is required to establish a multidisciplinary food safety team. The Quality Assurance (QA) manager, known as the administrative person or the systems administrator, will represent as the leader of the food safety team, which in turn, will also lead *Systems Integration*. The QA manager is responsible for administering the integrated system (table 6.1). The QA manager is responsible for keeping records and assigning activities or tasks to the members of the food safety team.

Take note that the responsibility for *Systems Integration* should be assigned to the technical manager, if present⁷. This is advised since the technical manager will be able to comprehend *Systems Integration* from a strategic point of view. The technical manager is accountable for both the holistic TQMS and for asset care. The technical manager should delegate the integrated system (table 6.1) and assign responsibilities to the QA manager, which remains the leader of the food safety team. The QA manager should report to the technical manager.

The food safety team leader should appoint an expert in AM to provide their expertise to the team. The engineering manager⁸ should ensue with this role. The engineering manager is responsible to ensure that the integrated system (table 6.1) complies to the relevant clauses of ISO 55000. The engineering manager should acquire any necessary knowledge of AM and its practices. It is required to provide the engineering manager with adequate information, education and training opportunities to ascertain that the employee can operate and maintain assets in accordance to the AM principles. The engineering manager should report to the QA manager or the technical manager.

It is not required of the QA manager or the technical manager to attain all the knowledge of AM, since the food safety team is multidisciplinary, which provides valuable insight in the daily tasks and operations regarding AM. The multidisciplinary team will, therefore, prevent work-overload to the quality department. Each representative of the food safety team should use one system, the integrated system (table 6.1), to achieve their daily tasks, which will be administrated by the systems administrator (i.e. the QA manager).

6.5.3 Education and Training

Education and training is required to provide support to the problems identified within the daily operation of food organisations (see sections 5.2.1 and 6.3.2) and the coping strategy for *Systems Integration* implementation (see sections 5.2.5 and 6.4).

⁷Technical managers are present whenever food organisations have QA managers whom lack a strong background of food science and technology, food factory machinery or good skills in manufacturing practices.

⁸The engineering manager represents as either the operations manager or maintenance manager within the food industry.

The food industry relies on employees to manually operate assets (whether or not they are physical or non-physical). This leads to product specification deviations. In contrast, the engineering industry relies on automated assets and does not require employees to operate assets continually (refer to table 1.1). This leads to more precise production which supports the need for *Systems Integration*. Due to the physical contribution of employees to assets in food industries, training and education is critical to ascertain collaboration in processes and departments to achieve quality holistically. Providing education and training opportunities for both the quality and food safety and engineering departments is obligatory. These departments should be equipped with the required tools and information regarding AM. Education and training is a precautionary measure for the engineering manager responsible for the AM part (see section 6.5.2) of the integrated system (table 6.1) as well as any other employee in direct contact with the assets. The food organisation, therefore, should invest in employees by providing them with “*top-down training*”. “*Top-down training*” follows accordingly (see section 5.2.6.3):

- provide primary training for top management;
- provide training for senior management;
- provide training for middle and junior management; and
- provide training for team leaders, operators and floor workers.

“*Top-down training*” affirms the “*top-down approach*” (see section 6.4.1.1) that is required to translate the vision of *Systems Integration*. *Systems Integration* and the “*top-down approach*” will induce the “*discretionary efforts*”⁹ within food organisations while providing structure and discipline in the essence of strong leadership and employee involvement or employee engagement. Refer to sections 2.1.4.6, 2.2.4.1 and 2.3.2.

6.5.4 Change Management: Level of Maturity and Competency

The successful implementation of *Systems Integration* is dependant on the food organisation’s capability for growth, the culture that they envisage and their level of maturity in terms of systems (see section 6.3.3.1).

Responding to the transition towards achieving sustained AM, food organisations need to devote to change management to change the way people perceive AM. *Systems Integration* implementation is, therefore, dependant on the organisation’s ability to manage change to which top management should take responsibility for it. Top management should define and envisage a collaborative culture that allows for the incorporation of the AMS with the TQMS which also enables flexibility, control, sustainability and continues improvement on all levels of competencies. Refer to sections 2.1.4.1, 2.2.3 and 2.2.4.5 for a comprehensive understanding of the difference between the TQM culture and the AM culture to achieve a culture that encompass

⁹“*Discretionary efforts*” are defined as the difference in the level of effort one is capable of bringing to an activity or a task, and the effort required only to get by or make due.

all elements of *Systems Integration*. During the transition for *Systems Integration* implementation, it is required of management to remain patient, since this complex system will take years of experience to yield desired results. Management should not fast-track *Systems Integration*. It is important to allow the workforce with the appropriate amount of time to understand and approve of the *Systems Integration*, especially since people are overworked and find it difficult to adapt to changing environments.

The level of maturity of *Systems Integration* within food organisations as well as workforce competency levels will influence the ability, effectiveness and efficiency of implementing the integrated system (see table 6.1). Organisations may admit to *Systems Integration* once they have reached a certain level of maturity of systems. Maturity is reached after the 3rd or 5th successful FSSC 22000 accreditation. Organisations may commence with *Systems Integration* once this level of maturity in systems is reached.

6.5.5 Management Principles

Twelve TQM concepts are identified as essential to business success amongst numerous researchers. Refer to section 2.1.4 to comprehend the detail of the 12 TQM concepts and to understand the essence of it. It is evident that food organisations, in general, execute and continuously address some of the 12 concepts, without formally addressing or admitting to it in a structured manner. Some concepts are recognised more dominantly than others. Therefore, TQM principles¹⁰ are established within food industries.

It is important that management principles should be regarded as critical, since it serve as the building blocks to achieve successful implementation of any other system. Management principles are, therefore, required for successful implementation of *Systems Integration* and should be established prior to approaching the integrated system (table 6.1). In order to achieve successful *Systems Integration* and effective AM, the 39 AM Subjects, whether or not all subjects are relevant, should be established. Refer to section 2.2.4 and appendix A.2 for a descriptive discussion and summary of the six AM Groups and its corresponding 39 Subjects. It is critical to note that all 39 AM Subjects will not necessarily be relevant to all functions within the TQMS, but, it is deemed necessary to consider these holistically in order to comply with the ISO 55000 standard and proposed integrated system. See table 5.4 for a list of Subjects to consider.

6.5.6 Financial Implications

South Africa is experiencing economic pressures, especially within the food market (see sections 1.1 and 5.2.6.6). Food industries are, therefore, experiencing high risk for resource scarceness, thus, the food market experiences the high economic pressure

¹⁰The TQM principles are translated into TQM concepts as described in section 2.1.3. Note that TQM concepts are also referred to as TQM principles, since concepts is merely a higher level of description of principles.

first hand. The food industry, therefore, relies on effective and appropriate resources, skills and technology to achieve the desired outcomes of high-quality food products. Achieving this is price intensive and in order for food organisations to compete with the increased prices and high quality demands, they need to adapt to these critical and continuously changing environments. AM will support food organisations to compete with these demands. It should, however, be noted that the establishment and incorporation of the AM culture will be expensive. As such, the incorporation of AM into the TQMS will create financial benefits in the long-term.

The food industry is a capital and asset intensive industry. Financial concerns are essential to the food organisation since financial availability influences all decisions driving asset investments and maintenance. It should, therefore, be noted that it will be difficult to persuade food organisations to implement *Systems Integration* as it contains some financial implications. These implications include, but are not limited, the following:

- possible employment of new or outsourced employees;
- training obligations and opportunities;
- auditing accreditations if appropriate; and
- investments in, and repair of, assets.

Although food organisations realise the importance of investing in proper assets, or proper maintenance of the assets, the crisis of financial instability and the influence of finances on decision-making and possible asset investments persist. When investing in assets, it is critical to properly determine the financial capability of the investment to ensure that the project is not rejected. In this case *Systems Integration* is referred to as being a project. It is, therefore, advised that a business case should be constructed to overcome organisations to safe guard financial issues and to promote the need for *Systems Integration* to obtain its synergistic benefits. Refer to section 2.3 to comprehend the need for AM and the benefits thereof in the context of the food industry. Section 2.3, therefore, prompts the need for AM as a preliminary to the business case.

When competing for high-quality food products on account of the customer-defined quality thresholds and the global market, take note of the financial constraints that could inhibit the organisation to achieve its outcomes. It is important to consider that some food organisations will lack the capital to make the necessary investments in assets to achieve high-quality food products. When experiencing these financial issues, food organisations should consider implementing *Systems Integration*, since its focus is to use the AMS as a supporting system to the TQMS to ensure the production of high-quality and safe food products. With the incorporation of the AMS into the TQMS, *Systems Integration* alongside effective AM, the effectiveness of both process management and organisational profits will be improved upon over time, since it will have a positive influence on cost of quality over time. It is evident

that *Systems Integrations* will create a more effective, efficient and productive production process that will prevent product scrapping, product rework, product recall and defect products from reoccurring. In turn, it will yield high-quality results, increased organisational profits and decreased cost of quality. Refer to section 2.1.4.12 and 2.3.3 to understand the concerns of cost of quality.

6.6 Chapter Conclusion

This chapter has simultaneously summarised the findings of the grounded theory analysis as depicted in chapter 5 and the extensive literature analysis as depicted in chapter 2 and 3. Contextual relevant literature was used to supplement and affirm the findings between existing literature and emerging theory. The theoretical guideline for managers developed on account of using chapter 5 and its *axial coding paradigm* as a baseline. The guideline for managers addressed all conditions, coping strategy activities and consequences to achieve successful implementation of *Systems Integration*. This chapter elaborated upon the coping strategy for *Systems Integration* implementation in respect of the expert opinions and inputs from participants. An example of an integrated system has emerged according to the methodology for *Systems Integration* that originated from chapter 5. A brief overview of the two standards (i.e. ISO 55000 and FSSC 22000) used for *Systems Integrations* was provided and the integration (mapping) results were deliberated to provide a complete and holistic understanding of the integration process. It is, however, critical to note that the integrated system indicates the relevancy between ISO 55000 and FSSC 22000 and should not be considered as the only solution to closing gaps within an organisation. It further cannot be considered as a solution to all food organisation types, since the process for implementation of *Systems Integration* results is based on senior management inputs from eight South African food organisations and, therefore, does not account for the general food industry. When consulting the theoretical guideline for managers, the integrated system alongside all other relevant emerging issues, strategies and propositions identified in both literature and theory should be considered holistically.

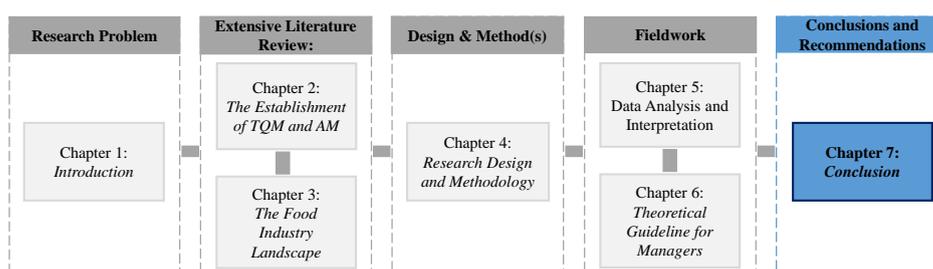
Considering the above-mentioned, this chapter undoubtedly contributed to achieving the fifth sub-objective and fourth sub-question, as defined in sections 1.4 and 1.3, of this research study. Consecutively, the following sub-objectives were addressed and established:

- The AMS (i.e. ISO 55000) was aligned with, and incorporated to, the TQMS (i.e. FSSC 22000); and
- The alignment was consolidated into a theoretical guideline for managers.

The next, and also the final, chapter of this study provides a brief overview of the study and discusses the study limitations and future recommendations.

Chapter 7

Conclusion



The objective of this chapter is to summarise and conclude the findings of this study. This chapter, therefore, consolidates the key findings of the literature and grounded theory analysis and elevates the key outputs of this study against the initial research objectives. An overview of the study is provided to which a discussion of the study limitations and recommendation for future research succeeds. Finally, this chapter concludes with concluding remarks.

7.1 Research Overview

It is widely known that the South African food industry, or the food industry in general, are determined to deliver only high-quality and food safe products in response to stringent regulatory and customer demands. It has been established that food industries in South Africa rely on high quality performance to regain and sustain their competitive advantage. Thus, they are susceptible to adopt any management system that would enhance their quality capability. In chapter 1, it was established that the food sector has to adopt and align their management approaches that are similar to those of the world-class performers in order to survive with globalisation. Asset Management (AM) was identified as an important management approach which could provide extending benefits to an already existing management approach, Total Quality Management (TQM), within food industries. Especially since the food industry is a capital asset intensive industry and completely relies on effective production processes to achieve desirable outcomes.

Both TQM and AM are currently widely recognised and implemented as management systems in discrete industrial environments. Due to their significantly similar management procedures and deliverables, it is viable to consider that both are applicable for integration. Although both management systems have been widely researched as separate concepts, their possibility for integration within food industries has not yet been explored. More specifically, its possibility remains unknown in South Africa, a developing country willing to improve organisational performance. On account of the unexplored predicament, it is inevitable that management will lack the understanding of, and the necessity for, integrating two managerial systems to achieve collaborative results especially since the Asset Management System (AMS) (ISO 55000) became publicly available only in 2014. For this reason, it was deemed necessary to explore the deeper understanding of the relationship between Total Quality Management System (TQMS) and AMS grounded in managements' inputs. In effect, management can focus their efforts on practices that ensure the firms' ability to establish a competitive quality management capability.

During the extensive literature analysis, a historical and holistic understanding of both TQM and AM was provided in chapter 2; to which all relevant definitions and fundamental management principles and concepts were discussed. In the context of the food industry, the need for AM was also holistically investigated which ultimately served as the baseline for a possible business case. Moreover, it was deemed necessary to attain a holistic understanding of the food industry TQMS. As such, chapter 3 concluded the extensive literature review to which all standards relevant to the TQMS was portrayed. Hence, the extensive literature analysis served as a preliminary to the holistic understanding of the emerging guideline and ultimately provided a good background for the very qualitative, grounded theory process. It is, however, critical to note that literature was used sparingly throughout the theory development process, concurrent with the spirit of the grounded theory process. The extensive literature review was only used to verify the relevance of theory with existing literature.

This research study provides a consolidation of the existing knowledge and emerging theory on AM integration with TQM in South African food industries based upon the extensive literature review and the systematic grounded theory analysis of a sample of nine professional senior managers across eight distinct organisations. Grounded theory allowed the development of a theory grounded in the views of participants which enhanced the descriptiveness of the integrated approach. The grounded theory methodology was described in detail in chapter 4 and the process was elaborated in chapter 5. The grounded theory analysis ultimately served as the approach to integrating AM with TQM from which results were used to derive a theoretical guideline for managers, as depicted in chapter 6.

Corresponding to the systematic nature of the grounded theory process, as described by Corbin and Strauss (2008), and the *constant comparison method*, an *axial coding paradigm*, also referred to as the visual representation of the theory in the form of a theoretical model, emerged (figure 5.1). The phenomenon, *Systems Integration*, was developed from five causal conditions: the asset problems, communication, people, leadership and the need for AM. In response to *Systems Integration*, participants developed a coping strategy for the implementation of *Systems Integration*. In this coping strategy, AMS served as a support system to TQMS. The coping strategy consisted of two parallel strategy activities, one achieving integration strategically that were concerned with top management commitment and the top-down approach and the other practically achieving integration by using the emergent methodology for *Systems Integration*, or otherwise known as mapping. The structure of this methodology was in the form of a comparative mapping of clauses for the International Organisation for Standardisation (ISO) 55000 and Foundation for Food Safety Certification (FSSC) 22000 standards. Other situational factors, also known as the intervening conditions, influenced the coping strategy; they are: customer satisfaction, management systems and standards and standard selection. During the phase of the *Systems Integration* process, the ISO 55000 standard was integrated with FSSC 22000 standard to represent the method of integration. Note that the AMS is compatible for the integration of any other TQMS; it was deemed appropriate to demonstrate only one integrated system as selected by participants and industry norm. The use of the coping strategy does not come without consequences. Participants conclude that the following integration implication should be considered: certification and auditing, the person responsible; education and training; change management; management principles; and financial implications. The grounded theory process ended with a discursive set of 20 propositions that summarised the developed theory and described the interrelationships between categories seen in the *axial coding paradigm*. During the grounded theory process, a gap within the food industry was identified, referred to as poor quality food products and customer dissatisfaction, which originated from the existence of asset problems, communication problems and poor people management or top management inability to commitment to asset care. When holistically considering all aspects that describes *Systems Integration*, it is proposed that these gaps can be closed. If these gaps are closed and considered holistically, high-quality food products as well as customer satisfaction will be achieved (see figure5.1).

Considering the discussion seen above, it is clear that a theory developed in accordance to the systematic approach to grounded theory which led to the development of the *axial coding paradigm*. The results of theory development were summarised to consolidate the theoretical guideline for managers seen in chapter 6. The guideline was constructed in relevance to the *axial coding paradigm* and contained explanatory text to clarify the prerequisites to, coping strategy for, and consequences of, *Systems Integration* and provided an example of the integrated system. The guideline described the process of achieving the successful implementation of *Systems Integration* in three primary sections which served to assist management to understand the conditions of *Systems Integration*, to comprehend how to proceed with implementing *Systems Integration*, and to consider the implication of *Systems Integration* prior to implementation. The guideline therefore has portrayed all aspects concerning AMS integration with TQMS, grounded in senior management's inputs, which ultimately served the purpose of assisting management to steer their focus and efforts on the practices that ensure the firms' ability to establish a holistic and competitive quality management capability.

It is evident that all sub-questions to the primary research question were addressed and answered, as seen in section 1.3 and illustrated in table 1.2. The first sub-question (a.) was addressed and answered in chapter 2 and chapter 3 which served the purpose for establishing the foundations of TQM and AM and the holistic quality system in food industries respectively. In chapter 5, the second and third sub-question (b. and c.) were addressed and answered in an attempt to conceptualise and develop the theoretical guideline for managers using the grounded theory approach. The final sub-question (d.) was addressed and answered in chapter 6 in which the theoretical guideline for managers was summarised and consolidated to assist management with *Systems Integration* implementation.

It is, therefore, viable to state that this research study successfully achieved all objectives listed in section 1.4. The following statements were met:

1. The fundamental management principles in relevant fields of study were established in chapter 2:
 - a. The historical background of TQM and AM were reviewed
 - b. The definitions for both TQM and AM were provided
 - c. The fundamental management principles required for both TQM and AM implementation were identified and discussed
2. The holistic quality systems in the South African food industry were established in chapter 3:
 - a. The historical background of relevant certificates and standards were reviewed
 - b. It was identified how quality is achieved holistically
 - c. A possible gap for AM in the existing TQMS was identified

3. A well-defined research methodology was constructed in chapter 4
4. The guideline was developed and conceptualised in chapter 5
5. The theoretical guideline for managers was developed in chapter 5 and was summarised and consolidated in chapter 6:
 - a. The AMS (i.e. ISO 55000) was aligned with, and incorporated to, the TQMS (i.e. FSSC 22000)
 - b. The alignment was consolidated into a theoretical guideline for managers

Grounded theory has provided valuable inputs to this study. With the use of the grounded theory methodology, it is viable to confirm that food quality and food safety are food organisations' main priorities. They are, therefore, able to comprehend new and innovative approaches that will add value or have the potential to add value to the FSMS, in turn the TQMS, to remain competitive. Throughout the analysis, it became apparent that AM and its AMS are supportive to the TQMS and should not be considered in isolation since the AMS is still considered as a “*nice to have*” as opposed to a “*must have*” such as FSSC 22000. For this reason, it is essential that the AMS should be used as a supporting system to prevent food organisation's from deviating from their main focus on food quality and food safety.

Since any food organisation with the full ISO 55000 accreditation does not exist as yet, the development of the guideline using grounded theory analysis provided a real life experience of how the integrated system could be portrayed whilst considering every-day problems, intervening conditions prior and during integration and consequences of its implementation. Analysis has indicated that South African food industries are closer to utilising effective AM than they currently realise, since some AM 39 Subjects correspond with their current operation. The existence of overlap between AM and the food industry's TQMS is inevitable. The developed guideline provides management with a holistic understanding of, and provides consideration for the benefits of as well as concerns for, establishing an effective integrated system. Upon integration, it is believed that the AMS incorporation will provide South African food organisations with a basis for improving to pursue the Best-in-Class in the industrial world. It may improve the quality of the product, efficiency of the machines and productivity of the people. Finally, utilising *Systems Integration* may create improved asset care.

A discussion of study limitations and recommendations for future research follow in section 7.2 and 7.3. Finally, concluding remarks of the content of the study will be elaborated on in section 7.4.

7.2 Study Limitations

Although qualitative research's, or more specifically grounded theory's, popularity persists throughout the past few decades, it has not been without its critics. Scholars have challenged the legitimacy of grounded theory and its methods used in the social

sciences in light of representivity and generalisability. This was taken into account during the grounded theory methodology. Therefore, this study did not claim for representivity of a sample, since the results may not be generalised to a population. It is critical to state that not all managers of food organisations will inevitably share the view that *Systems Integration*, as expressed in the views of the participants of this study, is a necessary predictor of overall organisational performance or success in South African food organisations. This study is limited to the capability of *Systems Integration* within a developing country, South Africa. It is, therefore, inevitable that the results and the developed theoretical guideline may vary from those of developed countries. Their asset care and asset exploitation issues or problems may also be explained in a different stance and perceived differently. Grounded theory, however, is a method that emphasises a general set of rules for data gathering and analysis, and due to its basic set of conditions, to some extent, a very similar theoretical explanation about *Systems Integration* should arise regardless of whether other samples conceptualise and integrate problems and issues differently. If the same theoretical perspective of the original researcher of this study is assumed, it is probable that findings will be consistent with explanations and emphasis on specific aspects of integration.

In addition to the concern of generalisability, the purpose of the grounded theory methodology was to build a theory to consolidate a guideline for managers, therefore, this study provides the predictive ability of explaining what might happen in given situations such as *Systems Integration*. Thus, in writing the theoretical propositions that evolved in this study, the researcher has specified the conditions that give rise to the phenomenon, *Systems Integration*, which includes problems, issues, and the use of strategies to manage these problems or issues and explained what consequences occurred as a results of these strategies. The latter do not suggest that the theory, developed from the study of one small area of investigation from one specific population, has the explanatory power of a larger, more general theory. Strauss and Corbin (1998) clearly states that it cannot because “it does not build in the variation or include the broad propositions of a more general theory”. The merit of this substantive theory (Strauss and Corbin, 1998) of this study lies in its ability to interpret and specifically speak for the population from which it was derived and applied back to them. Evidently, the systematic and widespread theoretical sampling – follow-up interviews and confirmation interviews – used in this study created more conditions and variations between the views of the participants, especially since the homogeneous samples, from a food quality and safety perspective, opinions and inputs were compared with the heterogeneous samples, from a maintenance and asset care perspective, opinions and inputs. Thus, to some extent, it created greater explanatory power and precision. Notwithstanding the rules of grounded theory, it is not safe to generalise beyond the sample and the context they operate in.

This study does not seek for an extensive level of analysis that considers empirical, quantifiable, generalisable and statistical significant outcomes into account. At this level of analysis the researcher can create a conditional matrix¹, which is how-

¹“An analytic device to stimulate analysts’ thinking about the relationship between macro and

ever optional. The researcher is not yet a trained sociologist, therefore the researcher has chosen not to include the conditional matrix. Also, with quantifiable outcomes fixed constructs that describes the statistical significance between variables can be generated, however it does not have meaning within the context of this study. The researcher has therefore chosen not to use fixed constructs since this study do not seek for an extensive level of analysis. This study only claims towards the development of a substantive-level theory² that could assist management with increasing the knowledge and understanding within the field of integrating AM with TQM in food industries.

For the purpose of integration and concerning limiting time of this present study, it was deemed appropriate to select a food standard that is Global Food Safety Initiative (GFSI) benchmarked. It is essential to note that other food standards of equal importance to the GFSI benchmarked standards could have been selected for the integration with ISO 55000. Therefore, in the context of this study, FSSC 22000 was selected to illustrate the result of an integrated system. The decision for refining the scope of the integration possibilities was to prevent the researcher from not being able to manage the complexity of integration. A more precise and detailed example could, therefore, be given and elaborated upon.

In respect of the emergent example of an integrated system, it is critical to take note that the system is an indication of relevancy and should not be seen as the only solution to closing gaps within the organisation. Also, the integrated system is based upon only one sample. It is, therefore, not viable to argue that this result should be implemented as a combined solution. The integrated system (represented in table 6.1) with all other relevant emerging issues, strategies and theoretical propositions identified in both the extensive literature analysis and grounded theory analysis should be considered holistically when referring to the developed guideline for managers.

Considering the food organisation's departmental structure, it typically consists of six different departments (which are operations, food quality and food safety, health and safety, environment and sustainability, and human resources) to which their TQMS encompass all elements of all departments. Without formally addressing AM, it became evident that many concepts of AM overlap with some activities in these departments and *Systems Integration* is applicable throughout the entire organisation. Considering the views of participants as well as the purpose and scope of the topic under investigation, the integration process was pursued within the quality and food safety department. The theoretical guideline may, therefore, only be perceived in the perspectives of food quality and food safety and any other department that has direct correlation with food quality and food safety.

micro conditions or consequences both to each other and to process (where macro is broad and micro is narrow in scope with possible impact)" (Strauss and Corbin, 1998).

²A low-level theory that is applicable to immediate situations which are closely related to the domain of practice and real-world situations. It differentiate from theories of greater abstraction and applicability, called formal or general theory.

These limitations were considered and dealt with throughout the progress of this study. Accordingly, validity was achieved using descriptive qualitative tools and techniques as discussed in section 4.2. Moreover, to address the above-mentioned limitations, recommendations for future research are discussed in the next section (see section 7.3).

7.3 Recommendations and Future research

The experience of the nine senior managers in this study have revealed that integrating the AMS with their TQMS is unique and is possible for consideration. In respect of management's experience towards integration, this study further revealed how the integration of two improvement programs could look like, which contributes to guiding management when attempting to incorporate AM and implementing *Systems Integration*. However, during the research process some considerations emerged which are worthy of investigating for future research purposes. Six suggestions are identified that should be recommended for future research as follow:

1. In respect of the coping strategy for *Systems Integration* implementation, and its methodology for integration described by participants in chapter 5 (section 5.2.5.2), further confirmation is required. Since this study could not find any participant within the food industry who led the organisation to ISO 55000 certification, full validation of the integration methodology and its result (section 6.4.3) cannot be claimed. It is recommended that step 4 be continued to verify validity of findings with the contribution of an expert on ISO 55000.
2. In support of the previous recommendation, the methodology for *Systems Integration* (section 5.2.5.2) could be used to further explore the integration of ISO 55000 with other relevant food standards in context with the TQMS. Therefore, another study could entail extending the feasibility or probability of AMS incorporation with other TQMS that are relevant to South African food organisations.
3. Management principles were identified as the building blocks for the successful implementation of any other system relevant to the food organisations' business objectives. TQM principles are established within food organisations; however, to successfully achieve effective AM incorporation with TQM, its 39 Subjects should be holistically understood. In chapter 5 (section 5.2.6.5), it was established that certain elements of the AM 39 Subjects are envisaged throughout the food organisations' way of doing things, hence overlapping is inevitable. It is, however, necessary to quantitatively establish what specific AM Subjects are relevant to South African food organisations. A study that necessitates quantitative analysis could, therefore, strengthen the argument of overlap and need for AM integration with TQM in South African food organisations.
4. In chapter 5 (section 5.2.7), a set of discursive propositions were summarised and listed. According to the grounded theory process, these propositions can further be empirically investigated to build valid social constructs. Further

investigation in the form of a longitudinal study is necessary to visually portray a conditional matrix that elucidates the social, historical, and economic conditions influencing *Systems Integration*. It is believed that these findings should increase the validity of this study to ultimately generate explanatory power and precision.

5. A stigma exists about the difference between AM and Hazard Analysis and Critical Control Point (HACCP) within food organisation. Unavoidably, the concern of whether or not the integration of a new system, such as AMS, to their existing and fully functioning TQMS will add value persists. It is advisable to change the perception of AM being a “nice to have” to a “must have” for assuring improved food quality and food safety. A business case is, therefore, proposed that organisations be assisted with to overcome safe guarding their financial issues and to promote the need for *Systems Integration* to obtain its benefits. This business case should also address the benefits, implications and outcomes of the integrated system. More specifically, although the grounded theory analysis axiomatically portrays how the integrated system could look like, the financial benefits and issues related to the integrated system remain unknown. Therefore, it should be quantitatively analysed to help convince top management of the benefits that the integration of a well maintained AMS (such as ISO 55000) with their TQMS will generate. Refer to section 2.3 for a preliminary to the possible establishment of a business case. It may serve as a good starting point for future research.
6. It is anticipated that AM will enhance food organisations’ competitive advantage particularly since it will strengthen their quality outputs. However, AM integration within food organisations still remains unknown since no ISO 55000 accreditation yet exists within food industries in South Africa. It is, therefore, recommended that further investigation be carried out on the competitive advantage that AM delivers to organisations that successfully implement and utilise all aspects of the ISO 55000 and are ISO 55000 certified, regardless of whether these organisations are within the food sector or not. Consequently, peer correlations are advised to provide an in-depth understanding of how the AMS provides improvements to their overall performance. This will ultimately enhance the understanding of AM integration with TQM in an attempt to provide food organisations with the opportunity to achieve business excellence.

These recommendations could provide interesting research opportunities for future research to help expand the understanding of, and need for, AM incorporation with TQM within food industries. The succeeding and final section concludes the research.

7.4 Concluding Remarks

Using the grounded theory methodology for exploring the possibility of integrating AM with TQM was both an educational and rewarding experience. As described throughout the research process, the grounded theory methodology has provided the

researcher with an opportunity to observe, reflect and attain essential feedback regarding two distinct fields of interests (i.e. food systems and engineering systems).

Furthermore, the grounded theory analysis procedure has equipped the researcher with specific and systematic guidance to successfully conduct qualitative research. It provided the researcher with tools and strategies to manage data analysis and interpretation. It is important to mention that the procedure of transcribing, coding and categorising the data was a very painstaking, tiresome and an overwhelming experience. Mostly since the latter yields a large quantity of textual data that should be interpreted and it is a time-consuming process. The existence of computer software, such as *NVivo* which was utilised throughout this research process, that explains how to synthesise and analyse data as well as ease the process of synthesis was an added advantage. However, researcher sensitivity and their engagement with data is inescapable. This study required immense researcher's sensitivity and analytic skills throughout the qualitative research process whilst strict adherence to the grounded theory procedure was ensured throughout research to contribute to its trustworthiness, credibility, reliability and validity of research outcomes. In addition, the grounded theory methodology forced the researcher to continuously step back and critically analyse situations, recognise the tendency toward bias, think abstractly, be flexible and open to helpful criticism, and to continuously be devoted to the work process.

A final remark, and to conclude this thesis, the researcher has devoted herself to understand and to describe how management experienced and perceived the process of *Systems Integration* within South African food industries. Hopefully, this study has inspired management in the food industry to use the results as a guideline to incorporate AM into their organisations. The researcher further anticipates that the integrated approach will influence food organisations in becoming the Best-in-Class.

Appendices

Appendix A

Extensive Literature Analysis

A.1 Implementation framework models for TQM

A.1.1 Malcolm Baldrige Criteria for Performance Excellence

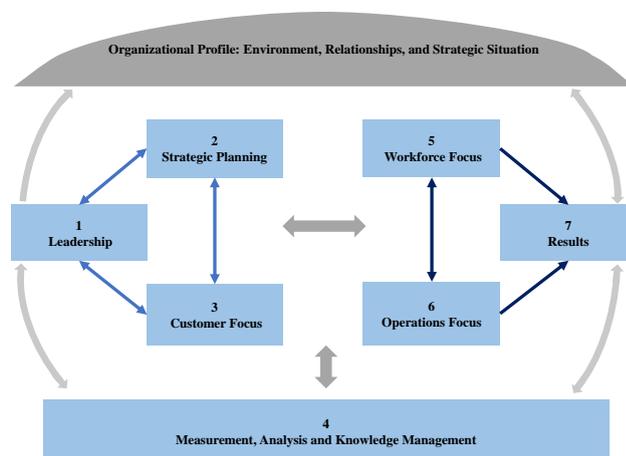


Figure A.1: The MBQA Model

A.1.2 European Foundation for Quality Management

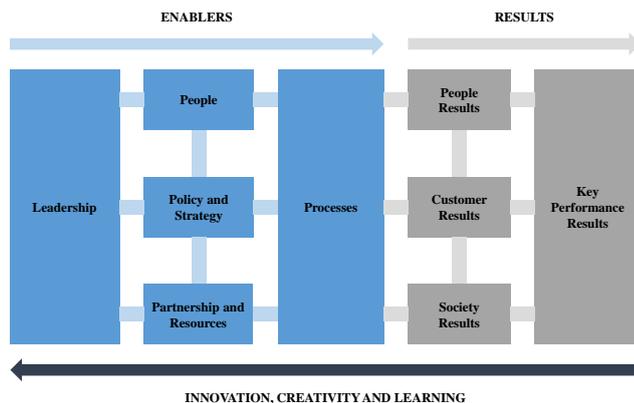


Figure A.2: The EFQM Excellence Model

A.2 Summary of the 39 AM Subjects

A.2.1 Subject Group 1: Strategy and Planning (Adopted from GFMAM (2014); IAM (2014))

	Definition	Context	Related Artefacts	Related Subjects	Relevant Standards
AM Policy	<i>“The principles and mandated requirements derived from and consistent with the organisational/corporate plan, providing a framework for the development and implementation of the asset management strategic plan and the setting of the asset management objectives”</i>	<p>The AM Policy should:</p> <ul style="list-style-type: none"> • Provide a set of principles and framework for the development and implementation of AM; • Provide principles that guide the development of the AM Strategy & Objectives; • Be consistent with stakeholder requirements and organisational objectives and constraints; • Be aligned with and consistent with other organisational policies; and • Be supported by top management, effectively communicated and continuously reviewed while committed to continual improvement. 	<ul style="list-style-type: none"> • AM Policy 	<ul style="list-style-type: none"> • AM Strategy 	<ul style="list-style-type: none"> • Clause 5.2 of ISO 55001
AM Strategy & Objectives	<i>“The strategic plan for the management of an organisation that will be used to achieve the organisational/corporate objectives”</i>	<p>The AM Strategy (i.e. describes the long-term approach to physical asset management) typically include:</p> <ul style="list-style-type: none"> • AM Objectives based upon scenario analysis (incl. expected economic, environmental, and social performance of the organisation’s asset portfolio); • Core accountabilities for both activities covered by the AM Strategy and for the implementation and continual maintenance of the AM Strategy’s; • The decision-making criteria – used to undertake lifecycle cost and risk analysis – to determine optimum asset interventions; • The manner of developing asset information and managing uncertainty in terms of asset information; • A reference to overall AM System (i.e. the description of the management system adopted by the organisation and a description for the alignment of the AM Strategy with the AM management system; • The procedure and methods for determining asset and network criticality. 	<ul style="list-style-type: none"> • AM Strategy • AM Objectives • Strategic Asset Management Plan (SAMP) 	<ul style="list-style-type: none"> • AM Policy • Stakeholder Engagement • Demand Analysis • Strategic Planning 	<ul style="list-style-type: none"> • Clause 4.4 of ISO 55001 • Clause 6.2.1 of ISO 55001
Demand Analysis	<i>“The processes an organisation uses to both assess and influence the demand for, and level of service from, an organisation’s assets”.</i>	<p>It normally includes product or service demand analysis (for the future) and the requirements for this demand. It also considers the use of non-asset solutions where demand exceeds supply. The following elements should be considered:</p> <ul style="list-style-type: none"> • Historic demand. • Drivers for demand. • Future demand and change in demand. • Changes in levels of service. • Utilisation and capability of assets (for current and future circumstances). • Impact on imminent condition, capability and performance. 	<ul style="list-style-type: none"> • Demand Forecasts • Historical Demand Analysis • Demand Scenarios • Demand Management Strategy • Service Level Specifications 	<ul style="list-style-type: none"> • AM Strategy • Strategic Planning 	<ul style="list-style-type: none"> • Clause 4.2 of ISO 55001

<p>Strategic Planning</p>	<p><i>“The processes an organisation uses to undertake strategic asset management planning”.</i></p>	<p>Strategic planning includes the consideration of the following elements:</p> <ul style="list-style-type: none"> • It consist of processes for determining enhancement and maintenance work volumes, long-term renewal, associated costs and risks to meet AM objectives. • It comprises of assessing the manner to which the organisation address requirements identified during Demand Analysis and how SAMP support the holistic organisational plan. • It involves the development of a Strategic Planning framework that describes Demand Analysis and required levels of service which are aligned with the organisation’s proposed maintenance, renewal and enhancement work volumes. • It have to assist organisations to develop costs for distinct scenarios and work volumes to imitate potential changes in risk, output requirements, demand or funding constraints from various stakeholders. 	<ul style="list-style-type: none"> • SAMP • Work volumes and costs 	<ul style="list-style-type: none"> • AM Strategy • Stakeholder Engagement • Demand Analysis 	<ul style="list-style-type: none"> • Clause 4.4 of ISO 55001
<p>AM Planning</p>	<p><i>“The activities to develop the asset management plans that specify the activities and resources, responsibilities and timescales and risks for the achievement of the asset management objectives”</i></p>	<p>AM Planning refer to the process of developing the detailed AM Plan that include the following elements:</p> <ul style="list-style-type: none"> • A review of previous AM Plan(s) alongside with recovery plans. • The activities the organisation adopt to deliver the AM objectives and service levels. • Costs related to the delivery of these activities • The expected outcome from the employment of these activities • The required resources to enforce AM Plans • Integrating AM Plans with other organisational plans (e.g. health and safety, financial, human resources) • The required activities to conform to statutory, regulatory, industry, and technical standards where applicable. 	<ul style="list-style-type: none"> • AM Plans • Work volumes and costs • Resource plans 	<ul style="list-style-type: none"> • Strategic Planning • Resource Strategy • Shutdown & Outage Strategy 	<ul style="list-style-type: none"> • Clause 6.2.2 of ISO 55001

A.2.2 Subject Group 2: AM Decision-Making (Adopted from GFMAM (2014); IAM (2014))

	Definition	Context	Related Artefacts	Related Subjects	Relevant Standards
Capital Investment Decision-making	<p><i>“The processes and decisions to evaluate and analyse scenarios for decisions related to capital investments of an organisation. These processes and decisions may relate to new assets for the organisation (e.g. Greenfield projects) and/or replacements of assets at end of life (CAPEX sustaining programs)”.</i></p>	<p>Within the perspective of an asset Life Cycle, it entails an evaluation of alternate investments that focus on long-term benefits which includes a procedure of definition, characterisation, evaluation and analysis. It would also typically include:</p> <ul style="list-style-type: none"> • Defining the scope of the investment; • The individual assumptions for investment options (incl. requirements for demands and service levels); • Contemplating on the required information to be collected or estimated for each option; • Considering all costs related to the lifecycle; • Considering the risk, how it changes over time and how it is valued and evaluated; • Performing Life Cycle cost analysis allowing the comparison of alternate options; and • Analysing present value and annualised costs and risks for each option. 	<ul style="list-style-type: none"> • Prioritising process for Capital Investments • Life Cycle Costing algorithms 	<ul style="list-style-type: none"> • AM Strategy • Demand Analysis • Strategic Planning • Operations & Maintenance Decision-Making • Lifecycle Value Realisation 	<ul style="list-style-type: none"> • ISO 15686 – Building and constructed assets – Service life planning
Operations & Maintenance Decision-making	<p><i>“The management activities and processes involved in determining the Operations and Maintenance requirements in support of the Asset Management objectives and goals”.</i></p>	<p>It determines the Operations and Maintenance activities required to meet the AM objectives. Operations & Maintenance Decision-Making considers the following:</p> <ul style="list-style-type: none"> • Customer quality requirements (in context of services and products). • Existing asset capability (i.e. quality, flexibility, throughput). • Practice of FMECA/RCM or other similar techniques to regulate maintenance activities. • The organisations balance point for cost and risk as well as asset and network criticality. • Estimating medium to long-term production/service requirements. • Executing financial analysis of production tactics (i.e. the production cost structure characterised by assets and its operations). • Documenting maintenance requirements • O&M impact of capital project proposal alternatives (e.g. Life Cycle costing, long- and short-term impact) evaluation. 	<ul style="list-style-type: none"> • Asset capability requirement • Maintenance Requirements Analysis documents • Maintenance standard and specifications 	<ul style="list-style-type: none"> • Capital Investment Decision-Making • Accounting Practices • Maintenance Delivery • Asset Operations 	<ul style="list-style-type: none"> • Clause 6.1 of ISO 55001

<p>Lifecycle Value Realisation</p>	<p><i>“The activities undertaken by an organisation to balance the costs and benefits of different renewal, maintenance, overhaul and disposal interventions”.</i></p>	<p>Lifecycle Value Realisation refers to the methodology used to ensure that the best total value is obtained (i.e. acquisition, creation, utilisation, maintenance, improvements, renewals and disposals). The interaction between these activities and determination of the preferred combination is required. The maximum total value (that relates to the contribution of organisational objectives) equates to the lowest whole life cycle costs of assets. Thus, Lifecycle Value Realisation would typically include:</p> <ul style="list-style-type: none"> • Evaluation processes and criteria for their usage (incl. its level of detail necessary in context of decision criticality and complexity); • Multi-disciplined approach and quantification of value, direct and indirect costs, risks, intervention, performance, operating and maintenance costs; • Deliberation of asset systems • System modelling to determine if lifecycle value deliver required demands and levels of service as the stakeholders expect it to be. 	<ul style="list-style-type: none"> • Methodologies for determining value • Criteria for decision-making • Lifecycle Value Analysis processes and application criteria 	<ul style="list-style-type: none"> • AM Strategy • Demand Analysis • Strategic Planning • Capital Investment Decision-making • Operations & Maintenance Decision-making 	<ul style="list-style-type: none"> • Clause 6.1 of ISO 55001 • Clause 6.2 of ISO 55001
<p>Resourcing Strategy</p>	<p><i>“Determining the activities and processes to be undertaken by an organisation in order to procure and use people, plant, tools and materials to deliver the Asset Management Objectives and Asset Management Plan(s)”.</i></p>	<p>Resourcing Strategy comprises of the following elements:</p> <ul style="list-style-type: none"> • Includes the analysis required to identify the most suitable manner to establish the essential resources to deliver AM objectives and activities as defined in the AM Plan(s). • Resource may include: spares; hardware and software; competent labour; tools and equipment; and plant and equipment. • It should consider costs and risks of out-sourcing resource supplies. • It should consider a suitable manner to integrate available resources throughout the entire organisation to deliver the AM Plan(s) cost-effectively. • If resources are procured externally, it has to include assessment of the costs and risks that relates to resource timing and quantities. 	<ul style="list-style-type: none"> • Resource Strategy • Procurement plans for the purchase of resources • Spares management strategy • Resourced project plans 	<ul style="list-style-type: none"> • AM Planning • Resource Management 	<ul style="list-style-type: none"> • Clause 7.1 of ISO 55001

Shutdowns & Outage Strategy	<i>“The activities taken by an organisation to develop a strategy for shutdown outages”</i>	<p>Shutdown & Outage Strategy (i.e. the procedures and requirements to enable organisation to reduce downtime and outages while considering related costs of activities) typically include:</p> <ul style="list-style-type: none"> • Shutdown or Outage objective that are agreed upon by all participants (incl. operations, engineering, central production planning, maintenance, projects, contractors or service providers) • Analysing trade-offs between the efficiency of smaller quantity of, but longer, shutdowns/outages (result in a higher impact on business production) vs. higher quantities of, but shorter, shutdowns/outages (result in a smaller impact on business but a reduced effect on work delivery efficiency); • Primary scope requirements to define the scope of work to be adopted with an insightful understanding of all parties towards relating risks and consequences; • Final scope and package that includes: final shutdown scope; schedule (incl. shutdown and start-up time for assets or facility required time); scope of work; manpower; necessary materials; contractors and other resources required. • Scope challenge exercises to certify a robust strategy. 	<ul style="list-style-type: none"> • Shutdown & outage strategy • A long-term planned outages schedule • Level of authorities in the organisation for all stages of shutdown and outage Shutdown and outage procedure and packaging requirements 	<ul style="list-style-type: none"> • AM Planning • Contract & Supplier Management • Shutdown & Outage Management 	<ul style="list-style-type: none"> • Not identified
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A.2.3 Subject Group 3: Lifecycle Delivery (Adopted from GFMAM (2014); IAM (2014))

	Definition	Context	Related Artefacts	Related Subjects	Relevant Standards
Technical Standards & Legislation	<i>“The processes used by an organisation to ensure its asset management activities are compliant with the relevant technical standards and legislation”.</i>	Within the AM context, this Subject includes processes for the identification, appropriate updating and compliance with assurance of standards and legislations.	<ul style="list-style-type: none"> • Register of applicable technical standards and legislation 	<ul style="list-style-type: none"> • AM Policy • AM Strategy • Strategic Planning • AM Planning 	<ul style="list-style-type: none"> • None identified
Asset Creation & Acquisition	<i>“An organisation’s processes for the acquisition, installation and commissioning of assets”</i>	<p>This Subject depict processes and policies for the acquisition, installation and commissioning of assets which also consists of elements of consent and releasing of funding, arrangements to present to operations, monitoring of costs and benefits. The following management activities are required:</p> <ul style="list-style-type: none"> • Application of Investment Policies and Processes • Development of Construction Processes • Implementation of Construction Processes • Project Management • Development of Commissioning Processes • Implementation of Commissioning Processes • Handback to Operations 	<ul style="list-style-type: none"> • Acquisition Strategy, -Request, -Agreement, -Agreement Change Request, -Communication Report • Project Management Procedures • Programme Management Framework • Project Schedules • Project Technical Management Plan • Work Breakdown Structure • Traceability Mapping • Project Budgets • Verification Report • Construction Progress Reports • Validation Reports • Acceptance Criteria Documents • Delivery Acceptance report 	<ul style="list-style-type: none"> • Capital Investment Decision-making 	<ul style="list-style-type: none"> • Construction code • Specific Commissioning Codes

Systems Engineering	<p><i>“An interdisciplinary, collaborative approach to derive, evolve and verify a life cycle balanced system solution which satisfies customer expectations and meets public acceptability”.</i></p>	<p>It defines processes and policies for the necessities of analysis, design and evaluation of assets. This Subject also relate to technical and managerial activities which include the following:</p> <ul style="list-style-type: none"> • Creation of Systems Engineering Policies. • Development and Implementation of Systems Engineering Processes. 	<ul style="list-style-type: none"> • Systems Engineering Management Plan • Systems Description Documents • Systems Engineering Performance Measures • Traceability Mapping Documents • System Analysis Plan • Systems Analysis Report • Documented Systems Engineering Processes • Verification Strategy • Validation Processes 	<ul style="list-style-type: none"> • Configuration Management 	<ul style="list-style-type: none"> • ISO/IEC 15288:2008 Systems and software engineering – Systems life cycle processes • MIL-STD-499 Military Standard Systems Engineering Management
Configuration Management	<p><i>“A management process for establishing and maintaining consistency of a product’s physical and functional attributes with its design and operational information throughout its life”.</i></p>	<p>This subject relate to descriptions of processes and policies for recording and monitoring of the asset’s physical, functional and support states. Its principles and requirements significantly aligns with Systems Engineering. The relevant management activities to consider, include:</p> <ul style="list-style-type: none"> • Creation of Configuration Management Policies • Development and Implementation of Configuration Management 	<ul style="list-style-type: none"> • CM Plan • CM Strategy • CM Records • Configuration Baselines and Agreements • CM Change requests • Configuration Evaluation Reports • Systems Release Reports and Approvals 	<ul style="list-style-type: none"> • Systems Engineering 	<ul style="list-style-type: none"> • AS/ISO 10007:2003 Quality Management Systems – Configuration Management • EIA-649-A 2004 National Consensus Standard for Configuration Management
Maintenance Delivery	<p><i>“The management of maintenance activities including both preventive and corrective maintenance management methodologies”.</i></p>	<p>Managing maintenance activities in context to an agreed policy that include definitions of maintenance specifications and implementation procedures, standards and schedules, and utilisation of maintenance and inspection measurements and results. The activities include:</p> <ul style="list-style-type: none"> • Establishing the required resources supporting maintenance assurance process. • Implementing responsibilities and accountabilities for asset maintenance delivery and improvement admitted to the AM system processes. • Everyday operation of processes that incorporate Maintenance Delivery process with engineering, IT, HR, finance, etc. • Fund sufficient resources and support systems to assist asset investment planning. 	<ul style="list-style-type: none"> • Maintenance tools and infrastructure requirements • Maintenance staff requirements • Maintenance strategy and tactics • Maintenance information systems infrastructure 	<ul style="list-style-type: none"> • O&M Decision-Making • Whole-life Cost & Value Optimisation • Reliability Engineering • Asset Operation 	<ul style="list-style-type: none"> • None identified

<p style="text-align: center;">Reliability Engineering</p>	<p style="text-align: center;"><i>“The processes for ensuring that an item shall operate to a defined standard for a defined period of time in a defined environment”.</i></p>	<p>Reliability Engineering consists of the following elements:</p> <ul style="list-style-type: none"> • Identification of required resources to support reliability assurance • Everyday operation of processes that incorporate Reliability Engineering processes with engineering, IT, HR, finance, maintenance and operations. • Perform in context of authorities, responsibilities and accountabilities for the improvement of asset reliability. • Specify and design these authorities, responsibilities, supporting measures and accountabilities admitted to the AM system and its processes • Adoption of predetermined methodologies for analyses to assist with AM Decision-Making during asset conception stages. • Implementation of Change Management authorities, responsibilities and accountabilities of the AM system (in relation to reliability). • Specify and design Change Management authorities, responsibilities and accountabilities admitted to the AM system and its processes. • Implementation of specified Reliability Engineering processes as well as the examination of information and data to assist with continuous improvement. • Specify and design Reliability Engineering competencies and supporting measures admitted to the AM system processes. • Developing and designing processes and plans that assists RAMS Modelling. 	<ul style="list-style-type: none"> • RAMS Modelling Output • RCM Analysis Output • Weibull Plots and Analysis • Completed Root Cause Analysis 	<ul style="list-style-type: none"> • AM Strategy • Capital Management Investment Strategy • Whole-life Cost & Value Optimisation • Asset Performance and Health Monitoring 	<ul style="list-style-type: none"> • None Identified
<p style="text-align: center;">Asset Operations</p>	<p style="text-align: center;"><i>“The processes used by an organisation to operate its assets to achieve the business objectives”.</i></p>	<p>This Subject involves those processes that provide instructions/guidance to Operators to instruct them how to operate the assets within the appropriate operational, maintenance and design parameters. Therefore, an Asset Operation strategy and plans that depict the approach, activities and resources concerning operations are required.</p>	<ul style="list-style-type: none"> • Required processes’ criteria • Control of processes • Documented information to provide confidence and evidence that processes are applied accordingly • Administer and monitor operational risks 	<ul style="list-style-type: none"> • AM Strategy • Strategic Planning 	<ul style="list-style-type: none"> • None Identified

<p>Resource Management</p>	<p><i>“Implementing the Resourcing Strategy to manage the use of funds, people, plant, tools and materials in delivering asset management activities”.</i></p>	<p>This Subject entails the management of all resources required for the implementation of each AM activity individually. Resources include: finances; spares; hardware and software; competent labour; tools and equipment; and plant and equipment; data and information; and training. The Subject also focus on integrating the resource utilisation throughout the entire organisation and all AM activities</p>	<ul style="list-style-type: none"> • Organisational Structure • Material Catalogue • Inventory and Training Records • Job Specifications • Tools • Performance appraisals 	<ul style="list-style-type: none"> • Resourcing Strategy • O&M Decision-Making • Configuration Management • Maintenance Delivery • Competence Management • Procurement & Supply Chain Management 	<ul style="list-style-type: none"> • None identified
<p>Shutdown & Outage Management</p>	<p><i>“An organisation’s processes for identification, planning, scheduling, execution and control of work related to shutdowns or outages”.</i></p>	<p>It outlines the processes and policies acquired to implement the Shutdown & Outage strategy to assure effective management of shutdowns and outages. This Subject comprises of processes that relate to the identification and filtering of planning and scheduling, shutdown work, work control and delivery, and the growth of lessons learned. It includes the following management activities:</p> <ul style="list-style-type: none"> • Development of Shutdown Management Processes and Policies • Implementation of Shutdown Management Processes • Project Management 	<ul style="list-style-type: none"> • Work Packages • Shutdown Task List • Shutdown Management Procedures • Shutdown Work Breakdown Structure • Shutdown Schedules, Budgets, Progress Reports • Acceptance Criteria Documents • Post Completion Reports 	<ul style="list-style-type: none"> • O&M Decision-Making • Resourcing Strategy • Shutdowns & Outage Strategy • Maintenance Delivery • Procurement & Supply Chain Management 	<ul style="list-style-type: none"> • None identified
<p>Fault & Incident Response</p>	<p><i>“Responding to failures and incidents in a systematic manner, including incident detection and identification, fault analysis, use of standard responses, temporary and permanent repairs as well as the taking over and handing back of sites”.</i></p>	<p>Within the context of this Subject, it requires of developing plans to respond to unexpected events and managing the resources necessary to adequately respond to the events. Typical resources include: competent labour; spares; special tools and equipment; data and information; communication; and intensification of criteria. This also includes integrating the response plans across the organisation and to ensure that the reason for cause of failure is understood to concede with succeeding analysis of failure data.</p>	<ul style="list-style-type: none"> • Risk register • Safety plan • Standby roster • Communication plan • Response plans • Skilled staff • Tools and equipment • Operating procedures • Emergency stores 	<ul style="list-style-type: none"> • Contingency Planning & Resilience Analysis • Risk Management 	<ul style="list-style-type: none"> • None identified

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Asset Decommissioning & Disposal</p>	<p><i>“The processes used by an organisation to decommission and dispose of assets due to ageing or changes in performance and capacity requirements”.</i></p>	<p>On account of ageing or changes in performance and capacity requirements of assets, this Subject develops and practice processes to decommission and dispose of assets. The Asset Disposal Plans are integrated with other organisational planning activities. During the decision-making process, this Subject must consider the impact of processes for disposal of assets on other infrastructure, costs and benefits realisation using a whole life approach and the impact of realisation on other infrastructure. Other factors to consider in these processes include:</p> <ul style="list-style-type: none"> • Land rehabilitation • Continued service delivery • Residual value of assets • Environmental impact of disposal 	<ul style="list-style-type: none"> • Environmental Impact Analysis • Land Rehabilitation Plan • Logistics Plan • Outage Management Plan • Asset Disposal Plan 	<ul style="list-style-type: none"> • Shutdown & Outage Strategy • Lifecycle Value Realisation • Risk Assessment & Management • Asset Information Management 	<ul style="list-style-type: none"> • Environmental • Service level • Legislation regarding asset disposal
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A.2.4 Subject Group 4: Asset Information (Adopted from GFMAM (2014); IAM (2014))

	Definition	Context	Related Artefacts	Related Subjects	Relevant Standards
Asset Information Strategy	<i>“The strategic approach to the definition, collection, management, reporting and overall governance of asset information necessary to support the implementation of an organisation’s asset management strategy and objectives”.</i>	<p>This Subject depict how asset information assists the delivery of the AM Strategy and objectives. It also describes the asset information systems and governance processes required to convey that asset information. The Asset Information Strategy consists of the following:</p> <ul style="list-style-type: none"> • Asset information policy. • Recognition of the required asset information to support organisational decision-making and operational processes (which also include considering of data quality and accuracy requirements). • Performing of gap analysis of current information availability vs. information requirements. • Required accountabilities and responsibilities for managing information and establishing corresponding processes to continuously align these requirements in accordance to the development of organisational requirements. • Analysing the costs and benefits that correspond to these asset information needs. • Identifying the information system business requirements to assist organisational business processes and information needs. • Application of processes to improve asset information and data quality and a description of these asset information improvement programmes. 	<ul style="list-style-type: none"> • Asset Information Policy, Strategy, Business Cases, and Systems Business Requirements 	<ul style="list-style-type: none"> • AM Strategy • Asset Information Standards • Asset Information Systems • Data & Information Management 	<ul style="list-style-type: none"> • Clause 7.5 of ISO 55001 • ISO 27000/1/2
Asset Information Standards	<i>“The specification of a consistent structure and format for collecting and storing asset information and for reporting on the quality and accuracy of asset information”.</i>	<p>Asset Information Standards comprises of standards and guidelines that are developed to ensure a consistent approach to recording asset information that meets the needs of asset information as defined in the Asset Information Strategy. It therefore includes definitions of universal methods for recording, they are:</p> <ul style="list-style-type: none"> • The asset hierarchy • Condition grades • Geographical position of assets • Categorising and recording of asset defect, causes of asset failure, and consequences of asset failure. • Utilisation of assets <p>The Management of Asset Information has to include defining quality and accuracy requirements for all asset information, as well as those universal methods attained to depict how it is defined and assessed.</p>	<ul style="list-style-type: none"> • Asset Information Standards and Guidelines • Asset Data Dictionary • Data Quality Definitions and Guidelines 	<ul style="list-style-type: none"> • Asset Information Strategy • Asset Information Systems • Data & Information Management 	<ul style="list-style-type: none"> • Clause 7.5 of ISO 55001 • ISO 27000/1/2

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Asset Information Systems</p>	<p><i>“The asset information systems an organisation has in place to support the asset management activities and decision-making processes in accordance with the Asset Information Strategy”.</i></p>	<p>Prior to delivering the asset information requirements defined in the Asset Information Strategy, this Subject aim to include the provision, operation and maintenance of all necessary Asset Information. It also involves the consideration of the following:</p> <ul style="list-style-type: none"> • The need of Asset Information System and architecture to convey the information system business requirements as defined in the Asset Information Strategy. • Analysing the costs and benefits of implementing innovative asset information systems to meet the demand of the business. • The approach that depict the manner to deliver the Asset Information System requirements according to the organisation’s IT strategy. • Evaluating the manner of which systems can be used to automate business processes. • Implementation plan for Asset Information Systems as well as governance arrangements. • A migration plan to transform from current Asset Information Systems to the required architecture. • Explicitly defined ownership responsibilities towards the system. 	<ul style="list-style-type: none"> • IT Strategy • Information Systems Architecture, Strategy and Business Cases, Implementation and Migration Plan, Governance and ownership arrangements 	<ul style="list-style-type: none"> • Asset Information Strategy • Asset Information Standards • Data & Information Management 	<ul style="list-style-type: none"> • Clause 7.5 of ISO 55001 • ISO 27000/1/2
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Data & Information Management</p>	<p><i>“The data and information held within an organisation’s Asset Information Systems and the processes for the management and governance of the data and information”.</i></p>	<p>Data & Information Management considers the following elements:</p> <ul style="list-style-type: none"> • It typically encompass all data relevant to the organisation’s Asset Information System as well as quality and accuracy of data in comparison to the defined requirements in the Asset Information Strategy and Standards. • It consists of processes for data management which include defining the data owners, consumers, validation processes, and the estimated life of data. This typically involve any data collection and maintenance plans in correspondence to whether the Asset Information Strategy indicated a gap in the organisation’s current asset information. • Includes governance processes to provide the organisation with a content level of assurance that the data and information (within the Asset Information System) is purposeful and is in alignment with the Asset Information Standard as well as quality and accuracy requirements. 	<ul style="list-style-type: none"> • Data collection plans • Data management procedures • Data governance procedures • Data assurance and audit reports 	<ul style="list-style-type: none"> • Asset Information Strategy • Asset Information Standards • Asset Information Systems 	<ul style="list-style-type: none"> • Clause 7.5 of ISO 55001 • ISO 27000/1/2

A.2.5 Subject Group 5: Organisation and People (Adopted from GFMAM (2014); IAM (2014))

	Definition	Context	Related Artefacts	Related Subjects	Relevant Standards
Procurement & Supply Chain Management	<p><i>“The processes used by an organisation to ensure that all outsourced Asset Management activities are aligned with the Asset Management objectives of the organisations and to monitor the outcomes of these activities”.</i></p>	<p>This subject entails those activities required to create, manage, maintain and carry out supplier management throughout the asset’s entire lifecycle. It also comprises of elements that are of high priority regarding the realisation of expected savings; they are: negotiations; adoptions; authoring; defining requirements; outsourcing-insourcing strategies; appraisal & selection of contractors; and claim management. It is important to align Procurement & SCM with corporate standards as well as to ensure that negotiated savings reach the bottom line. This subject focusses on:</p> <ul style="list-style-type: none"> • Warehouse management • Monitor & review supplier performance • Selection criteria for external contractors • Safety in design where applicable • Improved contract compliance • Standardised contract processes • Internal-external collaboration 	<ul style="list-style-type: none"> • Outsourcing-insourcing Policy • Procurement Policy • Contracts • Contractor selection criteria • Service Level Specifications • Supplier assessments, including review reports • Improvement plans 	<ul style="list-style-type: none"> • Strategic Planning • Asset Creation & Acquisition • Maintenance Delivery 	<ul style="list-style-type: none"> • ISO 28000/1/2/3/3 – Specification for security management systems for the supply chain • ISO 17365 – Supply chain application of RFID. Transport units • ISO 17364 – Supply chain applications of RFID. Returnable transport items (RTIs)
Asset Management Leadership	<p><i>“The leadership of an organisation required to promote a whole life asset management approach to deliver the organisational and Asset Management objectives of the organisation”.</i></p>	<p>Leadership can be defined as (GFMAM, 2014): “the exercise of power to influence people toward a vision and a purpose. Leaders have the ability to influence each other to achieve the objectives of the organisation, to encourage team work and to lead by example”. Leadership is a process (i.e. involving active leaders and followers) which translates teamwork into planned results to potentially achieve a level of excellence. Leadership are referred to as role models that guide people using values and belief of the organisation that are consistent with organisational culture and context. Considering this, leadership (within the context of AM) are confined with influencing people positively to deliver the AM Strategy and objectives. The AM Leadership focusses on the following elements:</p> <ul style="list-style-type: none"> • The planning and establishment of the organisational team, defining its responsibilities and accountabilities for AM, and defining the required leadership style to support the achievement of the organisational and AM objectives. • The necessity to identify AM’s interfaces with other organisational activities. • Employees has to clearly understand organisational and AM objectives as well as to understand their role in achieving them; Leadership from all levels of the organisation is therefore required. 	<ul style="list-style-type: none"> • Leadership Management Strategy • Leadership Competencies • Leadership Gap Analysis • Leadership Continuity Management Plan • Leadership Accountability Descriptions 	<ul style="list-style-type: none"> • AM Strategy • Organisational Culture • Organisational Structure • Competence Management 	<ul style="list-style-type: none"> • Clause 5.1 of ISO 55001

<p style="text-align: center;">Organisational Structure</p>	<p style="text-align: center;"><i>“The structure of an organisation in terms of its ability to deliver the organisational and Asset Management objectives”</i></p>	<p>The Organisational Structure design depicts the manner to which roles and responsibilities are assigned within the organisations. It also determines the requirements for information flows across different departments, functions and management levels. The design is dependent on influential internal and external elements to the organisational structure, they include:</p> <ul style="list-style-type: none"> • Size of the organisation • Type of industry, products/service • Ownership structure (i.e. private, government, listed company) • Objectives and strategies of the organisation • Diversity of the organisation (i.e. single site, single country or large multinational) • Maturity of the organisation (i.e. start-up or established business) • Cultural background <p>These elements have a great impact on organisational performance, organisational structure, leadership style and acceptable behaviours. The Organisational Structure design may also create divergence in behavioural and cultural outcomes. Thus, the organisation’s design has to be aligned with the desired leadership style and culture to prevent undesirable outcomes. Different organisational structures include: matrix; decentralised; and functional structures.</p>	<ul style="list-style-type: none"> • Organisational Chart • Organisational Roles, Responsibilities and Authorities • Job Descriptions or Position Descriptions 	<ul style="list-style-type: none"> • AM Strategy • Organisational Culture • AM Leadership • Competence Management 	<ul style="list-style-type: none"> • Clause 5.3 of ISO 55001
<p style="text-align: center;">Organisational Culture</p>	<p style="text-align: center;"><i>“The culture of an organisation in terms of its ability to deliver the organisational and AM objectives”.</i></p>	<p>According to GFMAM (2014), “culture is the lens through which individuals understand the world”. To completely understand the concept of culture, it’s important to note that human communication occurs through a system of symbols which are dependent on context and has no meaning if it deviates between cultures and contexts. Take note that every culture has its separate rules, values, behavioural patterns and myths maintained by rite and rituals. Culture gives meaning to experience and all knowledge is relevant to culture; thus, using the cultural lens inappropriately may lead to the inhibition of excellence. Culture represent a crucial factor that significantly structures human actions. Therefore, to be able to ensue excellence in workplace culture will enable excellence in AM. The culture within the organisation serves as a blueprint for decision-making and it is always dynamic that strives to identify and understand the cultural processes; do not try to change the culture directly, rather try to manage it.</p>	<ul style="list-style-type: none"> • Culture Management Strategy • Defined Organisational Values • Outputs from Culture Surveys • Behavioural patterns, Rites and Rituals 	<ul style="list-style-type: none"> • AM Leadership • Organisational Structure • Competence Management 	<ul style="list-style-type: none"> • Clause 4.1 of ISO 55001

<p style="text-align: center;">Competence Management</p>	<p style="text-align: center;"><i>“The processes used by an organisation to systematically develop and maintain an adequate supply of competent and motivated people to fulfil its Asset Management objectives including arrangements for managing competence in the boardroom and the workplace”.</i></p>	<p>Competent management entails managing individual’s ability within their AM roles to help perform their work activities well. Therefore, in the context of a particular activity, an integration of practical and mental skills, knowledge and understanding, and personal attributes, attitudes, behaviours and beliefs, is necessary. AM is multidisciplinary and cross functional, consequently, it requires people to work effectively in multidisciplinary teams, people that are open-minded to evidence, people from distinct departments to use appropriate methodologies and approaches, and people to integrate and interpret these during decision-making. The following elements should be considered:</p> <ul style="list-style-type: none"> • For the development of individual as well as organisational competence, a strategic approach should be developed to manage its behaviour and competence in entirety. • Those people (with different professional, technical, operational and commercial backgrounds) assigned to AM roles will deliver different results (varying concepts, perspectives, methodologies and networks) which should be integrated to arrange coherent and effective AM teams. This should be an essential factor of the AM Strategy and Planning. • Competence, those requirements describing the ability of, and knowledge and understanding of what people should do, are obliged to be transformed into frameworks which are personalised in accordance to the organisation or occupational group. Typically, best practice frameworks make a clear association for definitions of input requirements, output measures and desired behaviour. • Competence Management also includes: the periodic assessment of individuals against a competence framework; identifying the requirements for training and developments; and the approach to the required training and development, 	<ul style="list-style-type: none"> • Competence Framework and Assessment Processes • Training Needs Analysis and Course Specifications 	<ul style="list-style-type: none"> • AM Leadership • Organisational Structure • Organisational Culture 	<ul style="list-style-type: none"> • Clause 7.2 of ISO 55001
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A.2.6 Subject Group 6: Risk and Review (Adopted from GFMAM (2014); IAM (2014))

	Definition	Context	Related Artefacts	Related Subjects	Relevant Standards
Risk Assessment & Management	<i>“The policies and processes for identifying, quantifying and mitigating risk and exploiting opportunities”.</i>	<p>This Subject depicts processes and policies to identify, assess, analyse and mitigate risks and opportunities. It’s commonly utilised throughout all other Subjects within the AM Landscape. The management activities required for this Subject include:</p> <ul style="list-style-type: none"> • Creation of Risk Management policies • Development and Implementation of Risk Management processes • Aligning strategic, tactical and operational risks and risk registers • Risk mitigation approaches and strategies 	<ul style="list-style-type: none"> • Risk Management Policy, Strategy, Procedures • Risk Registers, Criteria, Profile, Action Requests, Profile Reports, Measures 	<ul style="list-style-type: none"> • AM Strategy • Lifecycle Value Realisation • Capital Investment Decision-Making • O&M Decision-Making 	<ul style="list-style-type: none"> • ISO 31000:2009 – Risk management – Principles and guidelines • IEC/ISO 31010 – 2009 Risk management – Risk assessment techniques • HB 327:2010 – Communicating and consulting about risk
Contingency Planning & Resilience Analysis	<i>“The processes and systems put in place by an organisation to ensure it is able to continue either to continue to operate its assets to deliver the required level of service in the event of an adverse impact or maintain the safety and integrity of the assets (whether or not the operate)”</i>	<p>Within the context of this Subject, it requires the organisation to establish procedures and documents to guide the person responsible for assets to make appropriate decisions during critical situations. All possible scenarios should be previously prepared, tested and evaluated. Generally, these documents include:</p> <ul style="list-style-type: none"> • Identification of scenarios (i.e. various events, incidents, disasters) • Establishment of the person responsible for, and level of command for each event type. • Identification of support organisations (including their specific responsibilities) necessary for each event type. • Classification of each event as well as mitigation of, or recommended actions to perform on, each event type. • Referencing of all contacts required during possible scenarios. 	<ul style="list-style-type: none"> • Reference to assets operating procedures • Written and approved contingency plan • Approved and signed agreements between all parties and expectation • Responsibility matrix and escalation policy 	<ul style="list-style-type: none"> • Faults & Incident Responses 	<ul style="list-style-type: none"> • None Identified

Sustainable Development	<p><i>“The interdisciplinary, collaborative processes used by an organisation to ensure an enduring, balanced approach to economic activity, environmental responsibility and social progress to ensure all activities are sustainable in perpetuity”.</i></p>	<p>Sustainable Development involves verifying that all AM processes are supportive to the organisation’s sustainability framework. This arises from the integration of the AM Strategy, Policy and Plan(s) with organisational strategic plans, activities and stakeholder requirements. This Subject ensures accurate collection and collation of information necessary to manage assets throughout its entire Life Cycle. Factors to consider during these processes are:</p> <ul style="list-style-type: none"> • Financial impact of AM • Environment impact of AM Plan(s) • Social impact of AM Plan(s) 	<ul style="list-style-type: none"> • Skills and social development plan • Environmental impact plan • Financial plan • AM Strategy and Policy 	<ul style="list-style-type: none"> • AM Policy and Strategy • Capital Investment Decision-Making • Lifecycle Value Realisation • Risk Assessment & Management • Asset Information Management 	<ul style="list-style-type: none"> • None identified
Management of Change	<p><i>“An organisation’s processes for the identification, assessment, implementation and communication of changes to people, processes and assets”</i></p>	<p>Change Management describes those processes and policies that correspond with any changes towards physical assets, its management systems or its supporting resources. Mitigation plans for impacts of changes is also included in this Subject. The required management activities to achieve this Subject include:</p> <ul style="list-style-type: none"> • Development of Change Management policies • Development and Implementation of Change Management Processes 	<ul style="list-style-type: none"> • Change Management Register and Plan • Documented Management of Change Process 	<ul style="list-style-type: none"> • Risk Assessment and Management 	<ul style="list-style-type: none"> • None Identified
Asset Performance & Health Monitoring	<p><i>“The processes and measures used by an organisation to assess the performance and health of its assets using performance indicators”</i></p>	<p>The following elements of Asset Performance and Health Monitoring should be considered:</p> <ul style="list-style-type: none"> • Defining critical measures across all stages of the asset lifecycle that link to organisational objectives • Establishment of appropriate monitoring programs to evaluate performance measures, analyse outcomes and to use these obtained information during the management of decision-making and action plans • Establishment of processes that provide critical information in attempt to determine if the asset performs in accordance with its management policies, standards, strategic plans, objectives, procedures and performance targets • Adoption of processes to monitor, measure and evaluate the performance of assets during its entire lifecycle • Monitoring if asset performance correlates with the prescribed criteria and identifying if any deviations from the standard level of performance occurs • Monitor and report to allow the prediction of future asset performance and health 	<ul style="list-style-type: none"> • Asset Performance Reports • Asset Health reports • Asset Performance Objectives • Asset Health Objectives 	<ul style="list-style-type: none"> • AM Strategy • AM Systems Monitoring 	<ul style="list-style-type: none"> • None Identified

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Asset Management System Monitoring</p>	<p><i>“The processes and measurement used by an organisation to assess the performance and health of its Asset Management System”.</i></p>	<p>This Subject considers the assessment of performance of the organisation’s AM System. AM System Monitoring primarily focusses on evaluating the extent to which the AM System fit the purpose of AM and if the organisation significantly delivers its expected AM objectives. Within the scope of this Subject, the following three aspects (which are usually assessed by a combination of assurance processes and audits) needs consideration:</p> <ul style="list-style-type: none"> • Assessing whether the AM System conforms to the purpose • Assessing the extent to which the organisation adheres to the processes, decision-making criteria and other identified guidance within the AM System • Assessing whether the outcomes from processes, decision-making criteria and other guidance are aligned with the expected outcomes. Typically, this will include the consideration of asset performance as well as evaluation of process and people performance in context to the AM system. 	<ul style="list-style-type: none"> • AM Steering Group meeting • Management Review meeting minutes 	<ul style="list-style-type: none"> • Asset Performance & Health Monitoring • Management Review, Audit & Assurance 	<ul style="list-style-type: none"> • Clause 9.1, 9.2 & 9.3 od ISO 55001
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Management Review, Audit & Assurance</p>	<p><i>“An organisation’s processes for reviewing and auditing the effectiveness of its Asset Management processes and Asset Management System”.</i></p>	<p>This subject involves describing processes and policies which are confined with: internal assurance processes; audit policies and procedures; processes for reviewing audit findings and corrective action; internal and third party audits; and external benchmarking. Relevant management activities for this Subject include the following:</p> <ul style="list-style-type: none"> • Audit policy • Documented audit procedures • Audit schedule • Documented audit methodologies and results 	<ul style="list-style-type: none"> • Audit policy • Documented audit procedures • Audit schedule • Documented audit methodologies and results 	<ul style="list-style-type: none"> • Asset Performance & Health Monitoring • Asset Management System Monitoring 	<ul style="list-style-type: none"> • ISO 19011:2011 – Guidelines for auditing management systems
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Asset Costing & Valuation</p>	<p><i>“An organisation’s processes for defining and capturing ‘as built’, maintenance and renewal unit costs and the methods used by an organisation for the valuation and depreciation of its assets”</i></p>	<p>Asset Costing refers to a structure/framework that aim to define the composition of all costs related to the asset. It also enables the organisation to match the assets’ decomposition (i.e. asset portfolio of individual assets and asset systems) with the accounting decomposition. Asset Valuation is those accounting/econometrics rules that ensure the value estimation/prediction for assets throughout their entire lifecycle using the variation of Asset Costing across their operating life.</p>	<ul style="list-style-type: none"> • Expenditure reports • Asset valuation register • Documented valuation methodology • Documented costing processes 	<ul style="list-style-type: none"> • AM Planning • Capital Investment Decision-Making • Lifecycle Value Realisation • Asset Information Systems • Data & Information 	<ul style="list-style-type: none"> • Accounting Standards

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Stakeholder Engagement</p>	<p><i>“The methods an organisation uses to engage with stakeholder”.</i></p>	<p>This subject depicts those processes and policies acquired for scenario development with, identifying of, communication and interacting with, AM stakeholders. This subject comprises of the following management activities:</p> <ul style="list-style-type: none"> • Development of Stakeholder Policies • Application and Implementation of Stakeholder Processes • Elicitation of Stakeholder requirements 	<ul style="list-style-type: none"> • Documented stakeholder analysis • Stakeholder management plan • Documented stakeholder scenarios for approval 	<ul style="list-style-type: none"> • AM Policy and Strategy • Demand Analysis • Strategic Planning • AM Planning • Capital Investment Decision-Making • O&M Decision-Making 	<ul style="list-style-type: none"> • Clause 4.2 of ISO 55001
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Appendix B

Grounded Theory Analysis

B.1 Research Ethics Committee Approval



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Approval Notice New Application

24-Aug-2015
Van Heerden, Milandi MA

Proposal #: SU-HSD-000698

Title: Development of an integrated total quality management implementation framework to achieve asset management in South African food industries.

Dear Miss Milandi Van Heerden,

Your **New Application** received on **22-Jul-2015**, was reviewed
Please note the following information about your approved research proposal:

Proposal Approval Period: **13-Aug-2015 -12-Aug-2016**

Please take note of the general Investigator Responsibilities attached to this letter. You may commence with your research after complying fully with these guidelines.

Please remember to use your **proposal number (SU-HSD-000698)** on any documents or correspondence with the REC concerning your research proposal.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Also note that a progress report should be submitted to the Committee before the approval period has expired if a continuation is required. The Committee will then consider the continuation of the project for a further year (if necessary).

This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki and the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health). Annually a number of projects may be selected randomly for an external audit.

National Health Research Ethics Committee (NHREC) registration number REC-050411-032.

We wish you the best as you conduct your research.

If you have any questions or need further help, please contact the REC office at 218089183.

Included Documents:

DESC Report - Ficker, Tanya
REC: Humanities New Application

Sincerely,

Clarissa Graham
REC Coordinator
Research Ethics Committee: Human Research (Humanities)

Investigator Responsibilities

Protection of Human Research Participants

Some of the general responsibilities investigators have when conducting research involving human participants are listed below:

1. Conducting the Research. You are responsible for making sure that the research is conducted according to the REC approved research protocol. You are also responsible for the actions of all your co-investigators and research staff involved with this research. You must also ensure that the research is conducted within the standards of your field of research.
2. Participant Enrollment. You may not recruit or enroll participants prior to the REC approval date or after the expiration date of REC approval. All recruitment materials for any form of media must be approved by the REC prior to their use. If you need to recruit more participants than was noted in your REC approval letter, you must submit an amendment requesting an increase in the number of participants.
3. Informed Consent. You are responsible for obtaining and documenting effective informed consent using **only** the REC-approved consent documents, and for ensuring that no human participants are involved in research prior to obtaining their informed consent. Please give all participants copies of the signed informed consent documents. Keep the originals in your secured research files for at least five (5) years.
4. Continuing Review. The REC must review and approve all REC-approved research proposals at intervals appropriate to the degree of risk but not less than once per year. There is **no grace period**. Prior to the date on which the REC approval of the research expires, **it is your responsibility to submit the continuing review report in a timely fashion to ensure a lapse in REC approval does not occur**. If REC approval of your research lapses, you must stop new participant enrollment, and contact the REC office immediately.
5. Amendments and Changes. If you wish to amend or change any aspect of your research (such as research design, interventions or procedures, number of participants, participant population, informed consent document, instruments, surveys or recruiting material), you must submit the amendment to the REC for review using the current Amendment Form. **You may not initiate** any amendments or changes to your research without first obtaining written REC review and approval. The **only exception** is when it is necessary to eliminate apparent immediate hazards to participants and the REC should be immediately informed of this necessity.
6. Adverse or Unanticipated Events. Any serious adverse events, participant complaints, and all unanticipated problems that involve risks to participants or others, as well as any research related injuries, occurring at this institution or at other performance sites must be reported to Malene Fouch within **five (5) days** of discovery of the incident. You must also report any instances of serious or continuing problems, or non-compliance with the RECs requirements for protecting human research participants. The only exception to this policy is that the death of a research participant must be reported in accordance with the Stellenbosch University Research Ethics Committee Standard Operating Procedures. All reportable events should be submitted to the REC using the Serious Adverse Event Report Form.
7. Research Record Keeping. You must keep the following research related records, at a minimum, in a secure location for a minimum of five years: the REC approved research proposal and all amendments; all informed consent documents; recruiting materials; continuing review reports; adverse or unanticipated events; and all correspondence from the REC
8. Provision of Counselling or emergency support. When a dedicated counsellor or psychologist provides support to a participant without prior REC review and approval, to the extent permitted by law, such activities will not be recognised as research nor the data used in support of research. Such cases should be indicated in the progress report or final report.
9. Final reports. When you have completed (no further participant enrollment, interactions, interventions or data analysis) or stopped work on your research, you must submit a Final Report to the REC.
10. On-Site Evaluations, Inspections, or Audits. If you are notified that your research will be reviewed or audited by the sponsor or any other external agency or any internal group, you must inform the REC immediately of the impending audit/evaluation.

B.2 Letter of Consent



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**STELLENBOSCH UNIVERSITY
CONSENT TO PARTICIPATE IN RESEARCH**

TITLE OF THE RESEARCH PROJECT: Development of an integrated approach to total quality management and asset management to achieve collaborative improvements in South African food industries.

REFERENCE NUMBER: SU-HSD-000698.

RESEARCHER: Milandi Annette van Heerden.

ADDRESS: Department of Industrial Engineering, University of Stellenbosch, Private Bag X1, Matieland, 7602, South Africa.

CONTACT NUMBER: 083 566 2956.

Dear Participant

My name is Milandi Annette van Heerden and I am a Masters in Engineering Management student from the Industrial Engineering Department at Stellenbosch University. I would like to invite you to participate in a research project entitled *Development of an integrated approach to total quality management and asset management to achieve collaborative improvements in South African food industries*.

Please take some time to read the information presented here, which will explain the details of this project and contact me if you require further explanation or clarification of any aspect of the study. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Humanities Research Ethics Committee (HREC) at Stellenbosch University** and will be conducted according to accepted and applicable national and international ethical guidelines and principles.

The purpose of the study is to develop an integrated framework approach to two improvement management programs (total quality management and asset management) to achieve extended benefits of the total quality philosophy which could serve as a possible next step to contribute to the success of the food industry's business excellence. Whilst valuable research has been performed on total quality management and asset management as distinct management concepts, their effective and practical integrated application has been limited due to the fact that the integration of it in the food sector has not yet been of interest. Thus, this study will address an integrated management system approach to successfully develop an integrated framework which will ultimately provide elements of collaborative improvements in the food industry's current strategic total quality management system.

From initial research, total quality management and asset management has been studied as distinct management concepts from which their implementation principles was listed. Also, the food industry's management system was theoretically investigated. However, the integration of these management philosophies parallel to the food industry's strategic management system is unclear and needs to be explored with senior managers familiar with quality and maintenance systems. Therefore, this study seeks to close this gap, by providing guidance to senior management that aspires in achieving business excellence. For this reason, your participation towards this identified gap would be gratefully appreciated. This gap closure will proceed using semi-structured interviewing as a data collecting technique which consists of unlimited interviews until a point of

information saturation has been reached. You as participant will be asked open-ended questions central to the theme of finding a proposed relationship between asset management and total quality management and are allowed to respond to each question independently. This study seeks your expert opinion. Please note that the time to complete the interview may vary between participants, but should range in approximately 60 to 90 minutes.

Individuals involved in the data collection will be the researcher (principal investigator) and participants with the knowledge of food quality and safety systems as well as those with the knowledge of maintenance systems. Please take note that no known risks and/or discomforts, inconvenience, psychological stress and stigmatisation are associated with this study. You are also assured that you will not be treated as objects nor be manipulated in any kind. However, if you should experience any discomfort or have any complaints during or after the interview, you have the right to stop the interview at any time necessary or contact the researcher and supervisor personally. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so. We cannot promise the study will benefit you as an individual, however, your participation will contribute to the gained knowledge and relevance of asset management (and its supporting series of international standards ISO 55000) to the food industry, the opportunity to participate in a qualitative research study, and the possibility of implementing the integrated framework within your own organization. If submitted for publication, an acknowledgement will be indicated for the participation of all participants. Unfortunately, you as participant will not receive any payment for participation, but you will receive the researcher's and supervisor's gratitude.

With your permission only, voice recording will be used during the interview for research purposes. If you would feel uncomfortable with it, do not hesitate to inform the researcher to exclude voice recording during the interview. The researcher will solely have access to the recordings and handwritten notes obtained during the interview. Both the recordings and handwritten notes will be converted to an electronic document that are safely stored on a personal computer with a password (no third party will be able to access these documents, it will only be accessible to the researcher). Upon this, the recordings and handwritten documents will be confiscated and disposed of to certain confidentiality post completion of the study.

Any findings post completion of the research would be gladly shared with you if you would be interested and requested to do so. Hence, your personal details, documents and records will be kept confidential for research purposes only and your identity as participant will only be known to the researcher while you will remain anonymous to the other participants throughout the interviews. Your participation to the findings will be accessible to the researcher, supervisor and examiner solely where no data sharing is envisaged. Also, any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law.

If you have any questions or concerns about the research, please feel free to contact the following:

M.A van Heerden (Principal Investigator)	Cell: 083 566 2956 E-mail: milandi.vanheerden@gmail.com / 15988678@sun.ac.za
Dr. J.L. Jooste (Supervisor)	Tel: 021 808 4234 E-mail: wyhan@sun.ac.za

RIGHTS OF RESEARCH PARTICIPANTS: You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact Ms Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] at the Division for Research Development. You have right to receive a copy of the Information and Consent form.

If you are willing to participate in this study please sign the attached Declaration of Consent and e-mail it back to the principal investigator.

Yours sincerely
Milandi Annette van Heerden
(Principal Investigator)

DECLARATION BY PARTICIPANT

By signing below, I agree to take part in a research study entitled and conducted by
(Name of Researcher).

I declare that:

- I have read the attached information leaflet and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.
- All issues related to privacy and the confidentiality and use of the information I provide have been explained to my satisfaction.

Signed at (place) on (date) 2015.

.....

Signature of participant

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to [*name of the participant*]. [*He/She*] was encouraged and given ample time to ask me any questions. This conversation was conducted in [*Afrikaans/*English/*Xhosa/*Other*] and [*no translator was used/this conversation was translated into* by].

.....
Signature of Investigator

.....
Date

B.3 Pilot Test Results

In order to evaluate the prompt questions, the verbal probing technique was used with a subject excluded from the sample. The results of each prompted question will be discussed in five consecutive parts which are listed accordingly:

- A. The question in its original form.
- B. Simple observing questions to observe the response of the subject.
- C. A lists of cognitive probes appropriate to the particular question. In general, the probes are based on five cognitive probing questions which serve as a guide to evaluate each question separately. They are stipulated as follow:
 2. What do you understand from this question? / Can you repeat his question in your own words? (To test how well the respondent comprehend the question)
 3. Was it easy or hard to answer the question? (To determine comprehension, and overall ability to recall)
 4. What, to you, does ‘this term’ mean to you? (Test comprehension/interpretation of the alignment)
 5. What were you thinking when I prompted the question? (To determine the overall cognitive strategy used)
- D. A short description of the problems found.
- E. A suggested resolution to the problem presented, based on the testing results.

Researcher (R) and Tammy (T): Welcoming and introduction...

Prompt Question 1

A. Original form of the question:

Do you think AM could possibly help overcome the competitive pressure of producing high-quality food products and would it be beneficial to the food industry?

B. Observing questions:

Observing questions	Yes	No
Did the respondent need me to repeat any part of the question?		✓
Did the respondent have any difficulty answering the question?		✓
Did the respondent ask for clarification or qualify their answer?		✓

B. Probes:

R: Can you repeat the question in your own words? (To test how well the respondent comprehend the question)

T: Die vraag is ‘n bietjie te lank ((giggle)). Maar elkeval, die vraag gaan daaroor of dit voordelig sal wees om AM in die voedsel bedryf te implementeer en om die kwaliteit van voedsel te verbeter.

R: What were you thinking about when I prompted the question? (To determine the overall cognitive strategy used)

T: Ek het gedink, definitief, ((pause)) waar kan AM in pas - omdat ek in die bedryf is, weet ek daar is 'n gaping vir die behoorlike bestuur van bates en ek besef die effek wat dit het op 'n besigheid se "bottom line" asook die kwaliteit van die produk wat dit probeer uitset teen die beste prys. M.a.w. dit is die "face value" wat jy het om daar buite te gee.

R: How sure are you of your answer? (To determine overall level of confidence)

T: Nee ek is doodseker.

R: Why do you say that?

T: Om die besigheid na die "Next Level" te vat sal dit van ons verwag om beter na ons bates te kyk. Dit sal ook verseker dat ons meer produktief, effektief en kwaliteit in die besigheid sal verseker.

B. Results:

At first, the subject found it difficult to repeat the question in her own words, due to its length and technical nature. However, considering the observing questions and the further response of the subject, this question was understood. It is clear that the subject interpreted the question accurately and are sure of the provided answer at the end. This implies that the subject has the appropriate knowledge to the theme under questioning and clearly understood the introduction to asset management. Nevertheless, the comprehension problem should not be ignored, therefore, the original question should be revised and shortened.

B. Suggested revision:

It is evident that the question is too long, thus, the question is divided into two separate questions to make it easier to understand and answer:

Do you think AM could possibly help overcome the competitive pressure of producing high-quality food products?

Do you think AM would be beneficial to the food industry?

*Prompt Question 2***A. Original form of the question:**

When concerned with the holistic system of food quality and food safety, where would you suggest AM to be integrated within the existing TQM system of food industries?

B. Observing questions:

Observing questions	Yes	No
Did the respondent need me to repeat any part of the question?		✓
Did the respondent have any difficulty answering the question?		✓
Did the respondent ask for clarification or qualify their answer?		✓

B. Probes:

R: Was this hard to answer? (To determine comprehension and overall ability to recall)

T: Nee.

R: How sure are you of your answer? (To determine overall level of confidence)

T: 100% seker.

R: Why would you say that?

T: Dit kom weer terug na die eerste vraag. Ek kan sien hoe belangrik dit is om na AM ook in diepte te kyk, en nie net gewone "maintenance" te doen nie. As ek na die operasionele kant kyk kan ek sien hoe belangrik en wat se invloed die "equipment" (masjinerie) op die kwaliteit en voedselveiligheid van die produk het.

B. Results:

With regard the observing questions and the response of the subject, this question was understood. Moreover, the subject is competent with the theme under questioning and could provide a concise and firm answer. The subject clearly understood the question, as well as the brief introduction to asset management.

B. Suggested revision:

It may be concluded that the question should remain in its original form:

When concerned with the holistic system of food quality and food safety, where would you suggest AM to be integrated within the existing TQM system of food industries?

*Prompt Question 3***A. Original form of the question:**

What would you classify as a suitable asset with regard to the food industry?

B. Observing questions:

Observing questions	Yes	No
Did the respondent need me to repeat any part of the question?		✓
Did the respondent have any difficulty answering the question?		✓
Did the respondent ask for clarification or qualify their answer?		✓

B. Probes:

R: What, to you, is an “asset” (To test the comprehension/interpretation of a specific term)

T: ‘n Bate is iets waaruit n mens of besigheid voordeel kan kry. ((pause)) Dit sal wees soos ons werkers, masjinerie, strukture en geboue.

R: Was this hard to answer? (To determine comprehension, and overall ability to recall)

T: Nee.

B. Results:

Regarding both the observed questions and the subject’s response, it is evident that this question was clearly understood since the subject had no difficulty understanding the question as posed. Subsequently, it is prominent that the subject is competent with defining an asset in relation to the food industry. From this, it may be concluded that the subject did understand the question as well to the brief definition of asset management and the term ‘asset’.

B. Suggested revision:

There is no need to revise the question, therefore, the question may remain in its original form:

What would you classify as a suitable asset with regard to the food industry?

*Prompt Question 4***A. Original form of the question:**

Do you think management find it difficult to connect maintenance management with quality performance?

B. Observing questions:

Observing questions	Yes	No
Did the respondent need me to repeat any part of the question?		✓
Did the respondent have any difficulty answering the question?		✓
Did the respondent ask for clarification or qualify their answer?		✓

B. Probes:

R: What were you thinking about when you answered this question? (To determine the overall cognitive strategy used)

T: Dit is heeltemal reg, dit is 100% 'n ware feit. ((pause)) Kom ek stel dit vir jou so. Dit is 'n algemene ding wat gesien word in die bedryf - as jy instap in 'n voedselafdeling dan sal jy dit onmiddellik raak sien - daar is maintenance, hier is produksie, en daar is kwaliteit. En ongelukkig werk hulle nie altyd goed saam nie. Jy sal somer kan sien dat die mense verskillend van kultuur is. Asook, die maintenance afdeling word baie keer verwys na 'n departement wat geen agtergrond het van voedselkwaliteit en voedselveiligheid nie omdat hulle net daar is om hulle werk te doen, m.a.w. hulle pas en draai masjiene. Hulle verstaan nog nie hoe belangrik hulle werk en watter invloed hulle werk op masjinerie en die finale produk het nie, a.g.v. hulle agterstand kan dit die voedselkwaliteit en voedselveiligheid van die finale produk belemmer.

R: How sure are you of your answer? (To determine overall level of confidence)

T: Ek is 100% seker.

R: Why do you believe this? (To determine comprehension, and overall ability to recall)

T: Want daar is 'n kommunikasie gaping tussen die verskillende dissiplines in die besigheid.

B. Results:

These probing questions and answers revealed that the subject had no difficulty in understanding the question. The subject could answer the questions without any hesitation. Also, considering the observing questions, it seems that this question is well formulated and no problems are related to it. It is clear that the subject have a high level confidence and comprehension towards this question.

B. Suggested revision:

As seen above, it is not necessary to change the original form of the question since the subject was competent in answering it. Thus, the question may remain in its original form:

Do you think management find it difficult to connect maintenance management with quality performance?

*Prompt Question 5***A. Original form of the question:**

How should managerial principles and responsibilities relating to an integrated management systems align to the holistic system of food quality and food safety?

B. Observing questions:

Observing questions	Yes	No
Did the respondent need me to repeat any part of the question?		✓
Did the respondent have any difficulty answering the question?	✓	
Did the respondent ask for clarification or qualify their answer?	✓	

B. Probes:

R: How do you remember this? Why are you so sure of your answer? (To study recall strategy)

T: Ek sukkel nou bietjie met hierdie vraag. Maar ek weet ek het op die ou end reg gekom.

R: Dit is doodreg, ek herhaal gou die vraag weer vir jou. Ja jy het, ons het 'n gesprek gehad oor dat dit die besluit is van die CEO en dat hy dit dan oordra na sy onderdane toe.

T: Ja, ja.

T: Omdat ek al met baie stelsels gewerk het, en enige stelsel wat jy implementeer volg dieselfde roete. As jy gaan kyk na al die verskillende standaarde, hulle almal volg dieselfde roete.

R: Was it hard to answer this question? (To determine comprehension, and overall ability to recall)

T: Nee. Dit was net moeilik om te verstaan wat jy vra, maar het verstaan toe ons bietjie praat daaroor. Dit is wanneer dit vir my maklik was om die vraag te antwoord.

R: What were you thinking while answering this question? (To determine the overall cognitive strategy used)

T: Ek het gewonder of ek die vraag reg verstaan en of ek dit reg gaan kan beantwoord ((giggle)).

B. Results:

Simple observation of subjects made it clear that the question was difficult to answer. The subject required a long time to respond to the question and requested that the researcher should repeat the question. As soon as the researcher explained the question again and phrased in differently, the subject could recall to the probing and answered it without any other further difficulty. However, the final probing revealed that the subject was more concerned about answering the question correctly rather than answering it naturally. This may suggest a problem of recall of information since the subject recalled to the answer only after additional information was given. Moreover, it appeared that the subject's decision processes were excessively burdened by the phrasing of the question.

B. Suggested revision:

The original question is rephrased to make it easier to understand. The revised question is constructed as follow:

In what manner does management align their managing principles and responsibilities to the holistic management system of food quality and safety?

Prompt Question 6

A. Original form of the question:

If the alignment between TQM and AM are successfully achieved on a strategic level, how would you suggest it to be practically achieved on an operational (day-to-day basis) level?

B. Observing questions:

Observing questions	Yes	No
Did the respondent need me to repeat any part of the question?		✓
Did the respondent have any difficulty answering the question?		✓
Did the respondent ask for clarification or qualify their answer?		✓

B. Probes:

R: Can you repeat the question in your own words? (To test how well the respondent comprehend the question)

T: Hoe sal jy ((pause)) AM in TQM integreer op 'n operasionele vlak?

R: Was this hard or easy to answer? (To determine comprehension, and overall ability to recall)

T: Dit was maklik ek moes net mooi dink hoe ek dit sal stel.

R: What, to you, is achieving the alignment on an operational level?(Test comprehension/interpretation of the alignment)

T: M.a.w. as jy die doel of prinsiep van die AMS kan oordra aan middel management (dit is mos jou operatiewe afdeling) en af op so 'n wyse dat hulle dit sal kan verstaan. Dan sou ek se het jy 'n alingmnet bereik in verskillende dissiplines op die vloer. Net soos jy HACCP sou implementeer, die vermoÃ« wat jy het en hoe jy daai boodskap oor dra aan vloer vlak is belangrik, want dit is waar dinge gebeur.

B. Results:

With regard to the simple observing questions, the subject could answer this question without any difficulty. Furthermore, the probing questions revealed that the subject had no difficulty in understanding the question and interpreted it correctly. It may therefore be concluded that this question is accurately formulated and no problems are related to it. Also, it appears that the subject accurately comprehended the questions and were competent with the answer.

B. Suggested revision:

It is therefore not necessary to revise the original form of this question. The original question will remain the same:

If the alignment between TQM and AM are successfully achieved on a strategic level, how would you suggest it to be practically achieved on an operational (day-to-day basis) level?

The pilot test interview ends with formalities; thanking the interviewee for her time and insight.

B.4 Interview Protocol

Table B.1: Interview Details

Interview protocol:	
Name of Interviewee:	(The interviewee's name is arbitrary to ensure confidentiality)
Occupation:	
Date:	
Time:	
Place:	

Introduction

Industry trends forces organisations to adopt management practices with supporting tools and techniques that are incessantly focussed on the continuous improvement of quality holistically. Thus, TQM (a holistic management philosophy) has emerged as a critical trend for management movement which are currently in use in wide-ranging sectors to encompass all certificates and standards related to quality; in which the food industry is successfully implementing. However, from a maintenance perspective, the production process of food industries requires continues operation of automated production line equipment since product scrapping, product recalls and stopping a production line caused by equipment failure will induce serious organisational financial implications, production rate variation as well as quality problems related to the product. Statistics shown that food industries generally underperforms with regard to the manufacturing or insurance industries. Thus, they should align their management strategies with those of the manufacturing industry and their drive to implement new manufacturing programmes and organisational structures to enhance their competitive position. This has led to proposal of AM, an effective and holistic approach that are concerned with maintenance activities, which could significantly contribute to production efficiency, plant availability, reliability and profitability as well as equipment/resource availability to produce high levels of food product quality.

Need for AM

AM is still a young discipline for many industry sectors and its supporting ISO 55000 series of International Standards has only been published in South Africa in 2014. Since AM is still new to most and limiting literature of AM within the food industry exists, integrating this approach with the existing and typical programmes (such as TQM) of food industries within South Africa is of interest and deserves further exploration.

The relationship between TQM and AM is as follow:

- Both are practices which comprises of goal-orientated decision-making and production- and people-based systems to effectively and efficiently manage the expectations and delivery of quality.
- Both are applicable for the integration of other relevant management approaches.
- Both are flexible to be manipulated as the organisation sees fit.

Therefore, it is significant to investigate the implication of integrating these holistic disciplines as well as its alignment to the food industry. The significant correlation between the holistic disciplines, TQM and AM, could be beneficial to the food industry if they are considered for simultaneous implementation. In

attempt of advancing their competitive potential in context to their quality performance, the integration of these management approaches are a possible solution as it would induce synergic effects.

Purpose Statement

From initial research, TQM and AM has been studied as distinct management concepts from which their implementation principles was listed. Also, the food industry's management system was theoretically investigated. However, the integration of these management philosophies parallel to the food industry's strategic management system is unclear and needs to be explored with senior managers familiar with quality and maintenance systems.

Once this relationship of integration has been identified and verified, an integrated implementation framework to assist senior management of food industries in implementing asset management at both strategic and operational level of the total quality management system will be developed.

Practical Issues of Consent

This gap identification and verification will proceed using semi-structured interviewing as a data collecting technique which consists of unlimited interviews until a point of information saturation has been reached. You as participant will be asked open-ended questions central to the theme of finding a proposed relationship between AM and TQM and are allowed to respond to each question independently. This study seeks your expert opinion.

The interview time frame will vary with each participant since open discussions are allowed, however, an interview are approximated to range between 60-90 minutes.

Please take note that no known risks and/or discomforts, inconvenience, psychological stress and stigmatisation associates with you partaking in this study. However, if you should experience any discomfort or complaints during or after the interview, do not hesitate to stop the interview at any time necessary or contact the researchers at the contact details given in the letter of consent after the interview. You are free to withdraw at any time without any consequences of any kind.

The researchers cannot promise the study will benefit you as an individual, but your participation will contribute to the gained knowledge and relevance of AM (and its supporting series of international standards ISO 55000) to the food industry, the opportunity to participate in a mixed method research study, and the possibility of implementing the integrated framework within your own organisation. If submitted for publication, an acknowledgement will be indicated for the participation of all participants.

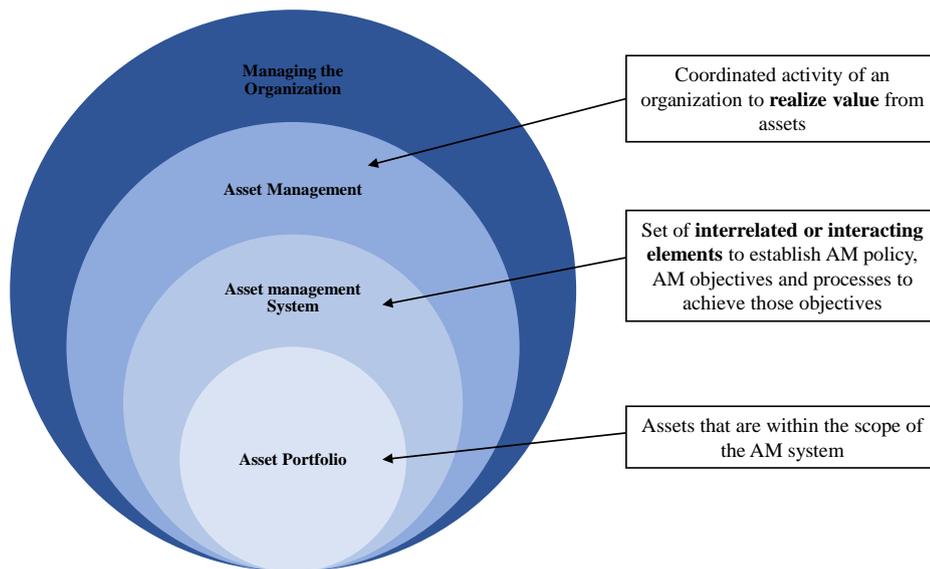
Any findings post completion of the research would be gladly shared with you if you would be interested and requested to do so. Hence, your personal details, documents and records will be kept confidential for research purposes only and your identity as participant will only be known to the researcher while you will remain anonymous to the other participants throughout the interviews. Your participation to the findings will be accessible to the researcher (principal investigator), supervisor and examiner solely where no data sharing is envisaged. Also, any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law.

Introduction to AM

Before we continue with the interview discussion, important matters regarding AM should be introduced to you to support your holistic understanding of it. AM has become an invasive topic amongst many manufacturing industries who are striving for overall improvement and business excellence. Thus AM will be illustrated using four diagrams.

Illustration 1

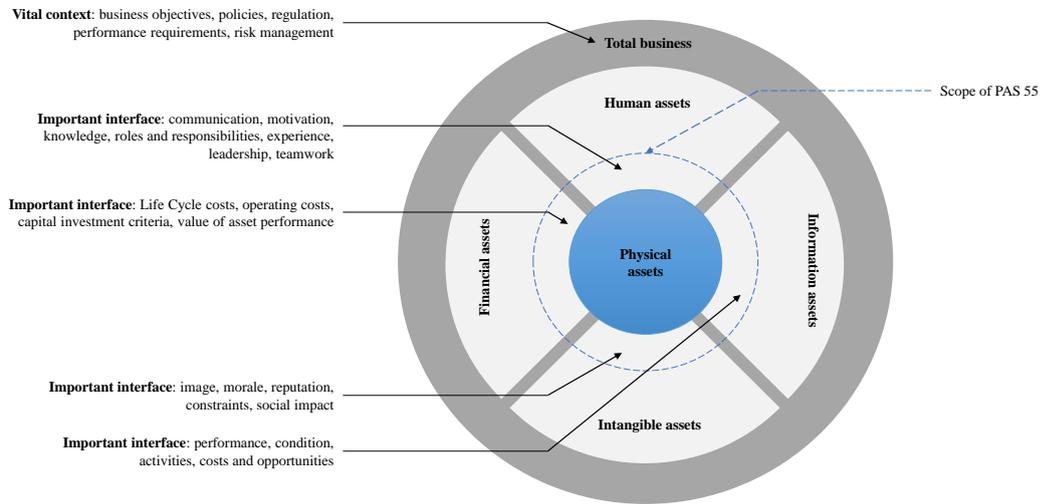
When considering AM holistically, the liaison between core AM terms should be considered first.



AM forms part of the organisational management system, from which an asset portfolio and AM System is required. ISO 55000 defines Asset management as the “coordinated activity of an organisation to realise value from assets”. Which in turn, define an Asset as an “item, thing or entity that has potential or actual value to an organisation”. This definition is deliberately widely defined to consider different types of organisations with their varying organisational objectives and aims which are not only focussed on physical assets. The term “value” suggests that it can be tangible or intangible, financial or non-financial, and includes consideration of risks and liabilities. It also can be positive or negative at different stages of the asset life. Physical assets usually refer to equipment, inventory and properties owned by the organisation. Physical assets are the opposite of intangible assets, which are non-physical assets such as leases, brands, digital assets, use rights, licences, intellectual property rights, reputation or agreements. A grouping of assets are referred to as an asset system which could also be considered as an asset.

Illustration 2

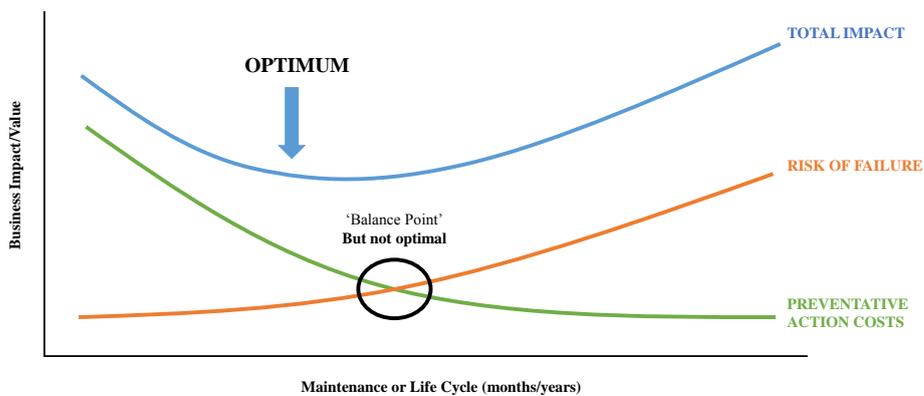
More specifically, assets are categorised into different classes. This figure here represent the different types of assets.



It can be seen here that AM focus on a holistic management perspective of its assets, mainly aiming to manage physical assets to achieve the organisational strategic plan. The other important interface asset types are human, information, financial and intangible (e.g. morale, property, reputation, etc.) assets. ISO 55000 classify asset types as “the grouping of assets that interact or are interrelated”. For example: “Physical assets, information assets, critical assets, enabling assets, linear assets, Information and communication technology (ICT) assets, infrastructure assets, moveable assets”.

Illustration 3

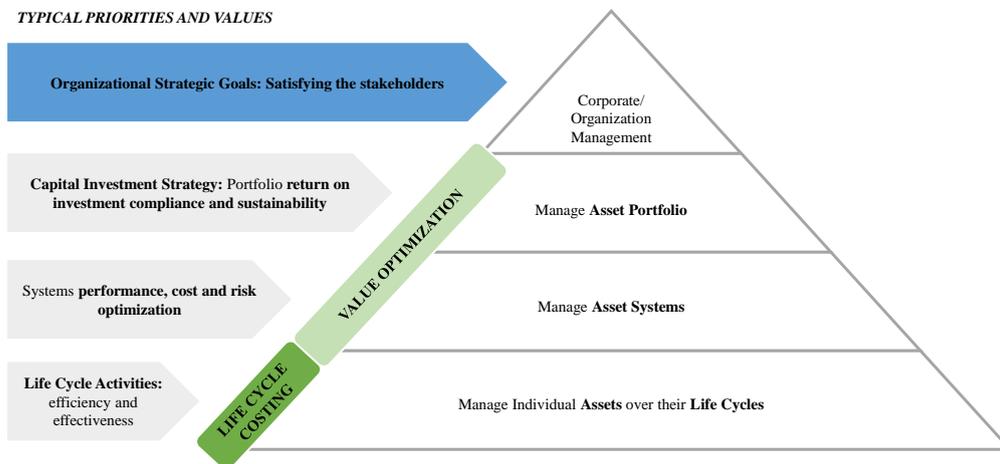
At the heart of the AM approach, it entails managing assets with the ability (both at the individual asset level and the whole portfolio) to find the optimal mix of asset care (i.e. investments, maintenance and risk management) and asset exploitation (i.e. the use of the assets to meet corporate objective and/or achieve performance benefits).



Seen in this diagram, AM involves the balancing of costs, opportunities and risks against the desired performance of assets to achieve the organisational objectives. This balancing might need to be considered over different time-frames. AM regulates this balancing point, however, it strives to achieve the optimum

point which involves trying to find the most attractive combination (or combined effect) of the conflicting elements seen in the diagram. AM also enables an organisation to examine the need for, and performance of, assets and asset systems at different levels.

AM is often misunderstood by various individuals. It is important to consider that assets can be identified at different or multiple levels of the organisational system which leads to the layered integration of essential principles required during the implementation of AM. This ranges from the life cycle optimization of discrete component or equipment items to the ‘value-for-money’ sustained using the organisation’s holistic portfolio of information, people, systems, networks, etc.



Although each layer increases with system complexity and perceive problems and goals differently. The underpinning challenges of optimizing the elements of costs, risks, sustainability and performance remain. Good AM therefore require those interested to be aware of such system integration and should manage assets at their desired level of ‘granularity’ to add value contribution or business criticality.

Illustration 4

For our last illustration, we consider the holistic management of assets throughout its entire life cycle.

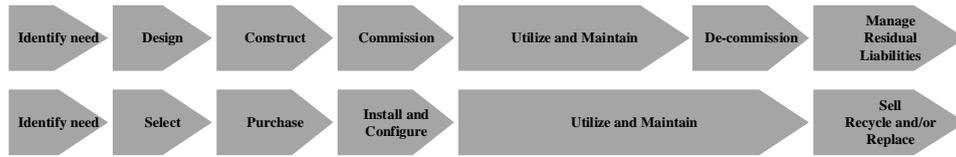
AM enables the application of analytical approaches towards managing an asset over the different stages of its life cycle. The life cycle can start with the conception of the need for the asset, through to its disposal, and includes the managing of any potential post disposal liabilities. In this diagram you will see two different example variants to managing the asset life cycle.

A final remark to leave you with, AM is the art and science of making the right decisions and optimising the delivery of value. Take note that a common objective is to minimise the whole life cost of assets but there may be other critical factors such as risk or business continuity to be considered objectively in this decision making.

CORE ASSET LIFE CYCLE STAGES



EXAMPLES OF VARIANTS



Is there any questions or uncertainties regarding this brief introduction of AM which I should know of?

B.5 In-depth Interview Results

B.5.1 Interview with Laura

Researcher (R) and Laura (L): Welcoming and introduction...

R: Is daar enige vrae of enige onsekerheid rakend die kort inleiding van AM wat u het of graag daarop sal wil uitbrei?

L: Nee. Ek het geen vrae of onsekerheid rakende die inleiding van AM nie. Uitstekende inleiding!

Researcher continues with the interview...

R: Dink u AM sal die voedselindustrie help om hoë gehalte voedsel produkte te lewer, om by te bly by die mark neigings?

L: Ja verseker.

R: Hoekom sê u so?

L: As mens kyk na jou operations, die belangrikste maatstawe in operations is, jy moet jou OEE kan meet en dit bestaan uit jou availability, lost over, down time, jou yields wat jy kry en ook die kwaliteit van jou produk. Dit alles saam is in die formule om jou konsentrasie OEE te bereken. Die world-class OEE is omtrent 85%, maar die industrie waan ek nou al was het ons selde 60% OEE. So deur jou assets beter te bestuur, en soos jy genoem het is assets nie net noodwendig die masjiene nie, maar dit is die mense ook. So as jy daai twee saam kan beter laat perform ((dink diep)) wat 'n management skill is. Jy moet jou masjienerie en mense en material op so 'n wyse kan bestuur dat jy die beste uit mense en equipment kan haal om die beste kwaliteit produk te kan lewer. Die kwaliteit van jou produk hang af van hoe jou masjiene en mense operate.

R: Baie dankie vir daai antwoord. ((Onderbreuk))

L: Ek wil ook net nog by sê, dit is een van die ((uhm)) meetings metodes wat nog die swakste ontwikkel is in meeste maatskappy in die voedselbedryf.

R: As ek dit nou reg verstaan, praat ons nou van die OEE meetings metodes?

L: Ja. ((Pause)). Maar as 'n mens dit as 'n management styl kan inkorporeer in jou sisteme in dan kan jy die mense wat fisies werk op die vloer beter laat verstaan op die ou eind van die dag hoe al hierdie goed kan in mekaar in slot om 'n beter profitability te kry op die ou end. Soos byvoorbeeld, as jy net na TQM of ISO 22000 te prober implementeer, dan is dit management commitment van bo af wat die stelsel maak werk. So as die voedselindustrie net kan kyk na die ander been, en dit is masjiene en mense, as dit net beter kan bestuur dan sal jy automaties 'n beter kwaliteit produk lewer.

R: Okay ek verstaan. Enige iets anders wat nog wil byvoeg?

L: Nee.

R: Okay goed, dankie. ((Onderbreuk))

L: AM is nog glad nie in die voedsel bedryf as bestuurstyl nie. Almal wil so ietsie daarvan weet, so hulle meet nou net OEE's, maar hulle weet nie die philosophy agter dit nie, wat die bestuurstyl agter dit en wat dit werklik kan betken in die voedselbedryf nie.

R: Wat is die rede daarvoor?

L: Ek dink dit is totaal nog net onbekend in die voedselindustrie. Maar dit raak wel alhoebelanger. ((uhm)). Die voedselindustrie is defnintief besig om daarna te begin kyk. Hulle voel voel daaraan. Maar ek dink as dit as 'n bestuurstyl van bo-af ((uhm)) in jou TQM stelsel in kan inbring word, sal dit net soveel meer voordelig wees.

R: Julle stem saam dat die TQM sisteem is reeds in plek? Hoe sien julle julle TQM sisteem?

L: Ja. Kyk, As jy vir jou kliente en stakeholders en jou shareholders tevrede wil stel, dan moet jy een of ander commitment wys dat jy die beste kwaliteit en veilige voedsel sal vervaardig om daai drie te kan bevredig. Of om happy te hou. So in die voedselbedryf is stelsels defnintief goed ontwikkel al, want die besef

is daar dat jy op een of ander logiese manier te werk gaan om 'n kwaliteit en 'n veilige voedsel produk vir die klient te sal verskaf. Dit is maar waarom al jou ISO's gaan.

R: Enige iets anders wat u wil graag byvoeg?

L: Nee.

R: Met verwysing tot die holistiese sisteem van julle voedselkwaliteit en voedselveiligheids sisteem, waar dink u sal AM goed in pas?

L: Ek dink dit moet defintief vanaf top management af kom. So dit is heel eerste management commitment en dan vat jy dit van daaraf. Dit is dan basies op dieselfde prensiep as wat hy enige ander ISO standaard sal implementeer.

R: Ek verstaan nie so lekker wat bedoel word met die 'prensiep' nie, asb kan jy bietjie uitbrei op dit?

L: Die prensiep is nou basies ((uhm)) dat die commitment moet nou eers daar wees van management dat hulle wil, behalwe dat hulle nou se hulle kyk na die kwaliteit van die produk en die food safety gedeelte van die produk, moet hulle ook kyk na hoe hulle hul resources kan aanwend om nog beter kwaliteit en nog meer veiliger produk te kan vervaardig. Want ek dink die verstaan is nou daar dat jou hulpbronne om daardie produkte te maak is netso belangrik ((pause)) om kwaliteit produk en voedsel veilige produk te vervaardig. Want jou masjiene en jou mense het die grootste invloed, ek weet ek herhaal nou, op die kwaliteit en voedselveiligheid van die produk. So as jy 'n ordentlike stelsel implementeer wat jy presies kan meet hoe jou masjiene en jou mense perform om daardie produk te kan maak; as jy die kwaliteit daar kan verbeter dan gaan jy automaties jou uitset gaan 'n beter kwaliteit produk en 'n meer veilige produk, sowel as 'n meer bekostigbare produk as 'n uitset hê.

R: Okay.

L: So wat my betref, dink ek die voedselbedryf is eintlik baie agter want hulle het nou eers net gekyk voedselkwaliteit en voedselveiligheid, maar hulle het nooit gekyk na hoe hulle nou die assets bestuur om al hierdie goed koste effektief te maak nie, so hulle het dit eintlik verkeerd om begin. So as 'n mens eers meskien gekyk het na jou assets, en jou assets goed bestuur, ((Pause)) dit is hoekom ek se dit is 'n top management system wat van bo-af bedryf moet word, m.a.w. die CEO moet besef hoe belangrik sy assets is en dat dit 'n direkte invloed het op die kwaliteit en voedselveiligheid van die produk.

R: Goed ek verstaan.

L: So ek dink dit is die belangrikste beginsel wat 'n mens moet kan oordra aan jou chief executive officer of jou chief financial officer dat as hulle die assets goed bestuur, dink ek, een van die automatiese uitsette wat jy gaan kry is beter kwaliteit, beslis veilige voedel (m.a.w. sonder enige hazards) teen 'n beter bekostigbare prys, want jy wend net alles meer effektief aan.

R: Okay goed. Met verwysing tot die holistiese sisteem van julle voedselkwaliteit en voedselveiligheids sisteem, waar dink u sal AM goed in pas?

L: Wel, ((uhm)) as ek nou kyk na senouma na operations, dan tipies jou doelwitte of jou objectives wat daar gestel word is mos maar gewoonlik jou assets, eintlik net asset care op hierdie stadium, m.a.w. ons kyk nog net na ons assets, maar dit is nog nie om hulle effektief te bestuur nie. Dit is die een been, dan kyk jy na jou produksie uitsette, byvoorbeeld jou throughputs, en plant availability, downtimes, breakdowns en daai goed. Dan is daar quality, kwaliteit wat na gekyk moet word, dan kyk ons na health and safety, maar nie van die produk nie, maar na die mens die werkers, en dit is ook 'n sisteem op sy eie, ISO 18000, en die ander een waarna ook nou na kyk deesdae is ((uhm)) environment and sustainability, ISO 14000. En dan die laaste been waarop 'n mens moet focus is human resources, m.a.w. teenwoordigheid, afwesigheid, awol (absency with out leave), siek leave en al daai goeters. En al daai ses, is sisteme op hulle eie. Want asset, daar kan jy dan nou vir ISO 55000 inbring, dan kyk jy na health and safety (wat ISO 18000 is), dan kyk jy na quality en voedselveiligheid (waar jy kyk na ISO 22000 of deesdae FSSC 22000), dan kyk jy na jou environment (wat ISO 14000 is) en dan kyk jy na human resources (dit is die labourer act). So al die ses wat ek nou genoem het is op 'n sisteem op die oomblik. So die asset care ene gryp hulle nog maar net aan die lug, hulle kyk nog net na die basiese OEE's en sulke tipe van dinge. So as 'n mens 'n meer gestruktureerde sisteem daar in plek kan sit wat aanhak by die ander, want as jy gaan kyk na al die standaarde, al die standaarde begin by management commitemt, so jy stel 'n TQMS op wat se management commitment, dan sal jy sê: "management is committed to health and safety of the people, to the environment, dit is jou policy dan, to your assets, to quality and food safety en jy kyk najou mense en sustainability". So in jou scope van

jou TQMS, include jy ook nou net AM. En elke clause dan daarna sit jy net AM ook by.

R: Wat bedoel u met die clauses daarby?

L: As jy gaan kyk na die Standaard het hy mos verskillende klausules die eerste een is mos management, commitment, ek kan nou nie presies onthou hoe volg dit nou nie, maar elke paragraaf, elke requirements in die standaard se spesifikasies wat gevolg moet word, dan hak jy in daai clousule spreek jy dan ook net AM aan. Soos bv in FSSC, klosule 7 gaan oor product realization, m.a.w. dit is produksie, so in daai clousule praat hulle dan net oor voedselveiligheid en kwaliteit van die produk, maar daar kan jy nou sekere aspekte van (as jy nou die standaard langs mekaar sit) ISO 5500 daarby in slot wat dieslfde goed aanspreek. Dit is eintlik baie maklik, elke standaard begin met sekere requirements as jy so na die klosules kyk, en dan slot jy nou maar net jou hele stelsel van AM in by die klosules wat reeds bestaan.

R: Dink u AM sal voordelig wees vir die voedselindustrie?

L: Dit kom weer terug op die eerste vraag, ek kan sien hoe belangrik dit is om na AM ook te kyk in diepte, en nie net gewone maintenance te doen nie. En ek kan sien hoe in operations, die invloed wat masjienerie en equipment het op die kwaliteit en voedselveiligheid van die produk.

R: Wat klassifiseer u as 'n bate 'asset' in konteks met die voedselindustrie?

H: Op die oomblik is dit maar net die masjiene en equipment. ((pause)) En die geboue en strukture. Die top bestuur mag dalk ander assets he, maar op my level is dit om te kyk dat my masjiene efficiently kan loop. Ek is seker dat meer op in die hierargy, dan begin kyk hulle na life cycle en al daai tipe dinge. Die waarde daarvan, of die afskryf waarde daarvan.

R: Ons het ook vroër genoem dat AM kultuur nog nie so bekend is in die voedselindustrie is nie; Dink u dat bestuur vind dit moeilik om 'n konneksie te maak tussen die onderhoud bestuur van masjienerie en verbeterde kwaliteit prestasies?

L: Ja. Baie beslis. Want die rede hoekom ek dit sê is ((uhm)) op die oomblik wat tipies in die voedselindustrie gebeur is, maintenance management en operations management en quality en food safety management is in twee aparte silos. Hulle is glad nie geïntegreer met mekaar nie. ((pause)) Hulle moet eintlik geïntegreer wees om 'n beter kwaliteit (met kwaliteit bedoel ek nou die fisiese kwaliteit van die produk maar ook die kwaliteit van die hele proses), m.a.w. dit moet efficient wees. En al daai geodjies by. As jy weet wat ek bedoel. So op die oomblik hardloop ek in silos, kwaliteit en produksie wil niks met mekaar te doen he nie en nog minder maintenance. So eintlik drie silos wat jy het, produksie in die middel, kwaliteit en voedselveiligheid aan die een kant, en maintenance aan die ander kant. En hulle is nie so lekker geïntegreer om saam te werk nie. So daai verstaan moet nog eers by almal in-geplant word.

R: Is daar dalk moontlik 'n voorbeeld hiervan wat jy kan gee in so tiepe geval?

L: ((Pause))

L: Okay jy het produksie, nou breek daar 'n masjien of die kwaliteit parameters val buite spesifikasies, so kwaliteit (ons se nou in terme van produksie) is verkeerd, met die brix van die produk of watokal. So produksie moet nou iets doen om dit reg te stel, maar partykeer kan produksie kan niks doen nie, iets het fout gegaan met die masjien, so nou is dit 'n gesukkel om maintenance daar te kry en om hulle te laat verstaan dat daar het iets fout gegaan met die kwaliteit van die produk, waar maintenance (pause) hulle dink glad nie aan die kwaliteit van die produk nie - vir hulle gaan dit net oor dat die masjien moet operate 24/7, maak nie saak wat aan die anderkant uitkom nie. Dit is 'n groot gap in die industrie.

L: Dit is 'n 100% ware feit. ((pause)) Omdat in die bedryf kan jy dit sien - as jy instap in die voedselabriek dan kan jy fisies sien - daar is maintenance, hier is produksie, en daar is quality. En hulle is glad nie geïntegreer met mekaar nie. Jy kan sommer sien hulle is verskillende kultuur mense ook. Op die oomblik is maintenance net 'n klomp grease monkeys ((lag kliphard)). En verstaan glad nie die belangrike werk wat hulle moet doen om die produk volgens voedselveilige en voedselkwaliteit standaard te produseer nie ((Lag)). Daar is 'n kommunikasie gap tussen die verskillende dissiplines in die besigheid.

R: Glo u dat die bestuursbeginsels (soos genoem in die ISO 9001 as 'n voorbeeld) is belangrik vir die implimentering en onderhoud van 'n bestuurstelsel?

L: Verseker, sonder die bestuursbeginsels kan mens nie stelsel implementeer en onderhou nie!

R: Hoe stel u voor word hierdie beginsels geïntegreer met julle huidige voedselkwaliteit en voedselveiligheids bestuurstelsels?

L: Weereens, ek glo dit is 'n besluit by die CEO. So hy gaan besluit maar hy wil graag baie graag ISO 55000 gepimplementeer hê in sy fabriek, want hy kan sien wat is die positiewe uitsette. So hy neem die besluit en dan sal hy sy verskillende onderdane bymekaar roep en vir hulle sê: "okay elke ou het sy eie responsibility om hierdie sisteem dan te implementeer". Wat dan obviously dan uitryk tot op die vloer, die basiese dinge soos die SOP's, polities en die rekords ens geskryf word.

R: Indien die integrering van TQM en AM op 'n strategiese vlak suksesvol bereik word, hoe stel u voor kan hierdie integrasie bereik word op 'n operasionele vlak?

L: Wel dit sal defintief eers formele training moet ondergaan om die stelsel te implementeer en dan moet 'n schedule op getrek word, van se nou ma oor 'n tydeperk van 'n jaar, twee of drie, wat jy dan die stelsel implementeer. En obviously dit inskryf in jou TQMS. Jy wil dit mos nie appart doen nie, jy wil al ses daai goed waarvan ons netou gepraat het inkorpereer in een sisteem. En dit is dan nou tipies 'n adminastratiewe persoon, soos 'n quality assurance manager wat dit sal dryf op die ou end. Dit is hoe ek dit sien. Maar obviously top down training eerste, dit moet die heel eerste ding wees. En dan is dit maar meetings op meetings op meetings wat jy die verskillende mense bymekaar trek om die procedures te skryf. En dan op die ou end raak dit dan maar net 'n objective in die vision en mission van die besigheid. En uit die objectives word daar goals opgestel vir die senior management, dit word dan afgedwing tot die middelmanagement en dan uiteindlik tot op die vloer. So AM word dan nou nog 'n goal waarteen jy presteer om dit te maak werk. Dit sal seker so 1 to 3 jaar vat vir die implementering en dan obviously, neem ek aan, word 'n mens geaudit teen die standaard om te kyk hoe effektief dit geimplementeer is. Uit die audit reports is daar findings en dan werk jy aan die finding, en so continually improve jy jou stelsel. En dan improve jy net aanmekeer.

Researcher concludes the interview with concluding probes...

R: Is daar enige verdere kommentaar wat u wil byvoeg of is daar enige iets anders wat u vermoed ons nie bespreek het nie? (To contribute to the validity of the interview)

L: Nee. Al wat ek kan sê is dat, ek dink dit is 'n baie positiewe approach wat 'n mens kan implementeer in die voedselbedryf en kan net sien dat dit 'n mens beslis sal help om 'n beter kwaliteit produk maar ook al die ander aspekte van kwaliteit, soos die kwaliteit van die masjiene, kwaliteit van die mense, efficiencies wat verbeter. En dit is belangrik, want jy moet 'n produk op die mark kan sit wat competitive is. Wat competitive is in sy kwaliteit en competitive is in sy prys. Hoe meer effektief jou fabriek produseer, hoe teen 'n beter prys kan jy in die mark in kom. En as 'n mens byvoorbeeld net dink aan deursette, dink net aan al die resources (mense, krag, elektrisiteit, produk, alles), die hoe kostes daaraan verbonde - so as jy net deur goeie bestuur en spesifiek ook kyk na jou masjienerie en equipment, kan jy dit in plaas 24 ure produseer, kan jy dit in 12 ure produseer. So jy halveer jou inset kostes. Wat baie belangrik is. Ek kan net 'n voorbeeld noem van ons pouch afdeling sodat jy die beginsel net kan verstaan.

R: Enige tyd. Baie dankie.

L: Die masjien vul die pouch, dan is daar 'n cap shoot wat die caps afbring na die pouches toe en dan sit dit op elke pouch en dan gaan dit na die capper toe waar die capper die caps vasdraai. Nou daai shoot is op die oomblik oneffektief, hy wil nie lekker die proppies op die pouches nie. Hy werk net nie lekker nie. So in plaas van dat die masjien op 'n spoed van 12 loop, nou sit hulle twee mense daar om proppies met die hand op te sit, en dit bring die spoed van die masjien af na 9 toe. So inplaas daarvan dat ons 21000 pouches vervaarding in 8 ure (daar is 8 ure in 'n skof), haal ons op die oomblik net 14000 in produksie in 8h. So ons is op die oomblik net 66% efficient. So as ons net beter na daardie stukkie equipment na gekyk het ((pause)) of as on dit net beter kon maintain het of vinniger daarop gereageer het om dit te maintain het kan ek nou nie dink hoeveel ons oor 3 maande kon gespaar het nie. En onthou, nou maak ons omtrent ons produk met 1/3 duurder omdat ons net 2/3 efficient is en dit vreet dat 30% van ons profit. Jy kan nou net dit imagine ((klem hierop gele)), as mens kyk na die voedselveiligheid, hoe hierdie problem van swak capping die voedselveiligheid van hierdie produk effekteer, die hygiene daarvan. Omdat dit stadiger loop, veroorsaak dit ook fluktuering in temperature, dit perform nie spot on elke keer op 80 grade nie. Dan moet jy onthou die produk blaas op ook a.g.v. dit. So, dit is 'n goeie voorbeeld vir my van 'n masjien wat beter gemaintain kon gewees het, want dit beïnvloed beide die kwaliteit en voedselveiligheid van die produk, en jy kom ook nie by jou bottom line uit nie. Om eerlik te wees, in so 'n geval is dit eintlik beter vir ons om nie produksie te hê nie, want die produk is te duur, ons maak nie meer wins nie. Maar as daai prensiep net kon ingeprent gewees het by die produksie bestuurder en sy supervisors, ((Pause)) jy verstaan, maar hulle verstaan net nog glad nie daai prensiep nie. Dat die produk nou duurder is nie. In fact dat dit nou te duur is om netsowel nie produksie te doen.

R: Wie stel u voor kan ek kontak vir verdere data insameling in verband met die integrasie van AM en TQM? (To contribute to the validity of the interview)

L: Defnintief die persone wat jy moet target is tegniese bestuurders en engineering manageners, maar nie maintenance managers nie, die ingenieurs van die fabriek en die tegniese bestuurders wat 'n bietjie meer verstaan as net die quality systems of net maintenance systems.

R: Is daar enige kontakte wat ek kan skakel vir die studie?

L: Ja ek sal voorstel jy kontak vir Garry, Peter, and Renee. The names and organisation names that Laura provided remains arbitrary.

The names and organisation names that Laura provided remains arbitrary.

The interview ends with formalities; thanking the interviewee for her time and insight.

B.5.2 Interview with Garry

Researcher (R) and Garry (G): Welcoming and introduction...

R: Is there any questions or uncertainties regarding this brief introduction of AM which I should know of or you would wish to elaborate upon?

G: No. We can fire way with the interview.

Researcher continues with the interview...

R: Do you think AM could possibly help overcome the competitive pressure of producing high-quality food products?

G: I think that ((Pause)) what formal systems do, or help businesses to do - doesn't matter whether it is a QMS or FSMS or in this case an AMS - is that they are structured. Standards are structured, which forces you to comply in very specific ways. I think, in that respect, it's always a good thing, because it is providing a guideline of Best-practice - although you are responsible for implementing your interpretation of the standard but standards are really there to guide you in a way to conform against that. I think, to answer your question, yes I think it can help. Perhaps it is not the right part to discuss about this, but what in your introduction you mentioned about the food industry perhaps lagging behind other industries in optimal use of assets, I think there could be an explanation or possible explanations to one of the reasons why - if you think of an engineering industry, you are dealing with much more precise specifications and control, and if you think of about things like the insurance industry, it is similar; it is well defined, its limits are well defined, specifications can be well defined. When you are looking at different aspects of the food industry, the closer you are to primary production, the more varied the probability of your specifications. The more processed you become, the more defined (should we say, the more engineered) your product becomes, and therefore, more precise specifications can apply. At our end of the production - on fruit processing for example - we are at the end were we are dealing with raw-natural products, which is incredibly variable, its seasonal (it varies from year to year), the ripening process (respirations continues after picking a fruit). So, there is a constant change and this makes our...((Thinking)) settings for raw materials' standards very wide and we try and do our best to run fruit at an optimal time. But often it is actually difficult to achieve that, especially if you have got constraints on production or capacity constraints. Sometimes those things are not the main priority.

R: Do you think AM would be beneficial to the food industry?

G: If the question apply to a financial person, the answer would always be "of course" because what you are seeking to do in financial management is that you are typically looking to justifying the expense of an asset to different methods of interest rates, or internal or discount cash flows, net present values and things like that and often the justification for an asset acquisition can be very fuzzy (sometimes on paper the justification is not necessarily proven) in a financial aspect. But, in terms of the business needs for example in this industry ((referring to the food industry)) you need to have an aseptic filler if you want to do aseptic processing that, you know, is a given. I suppose the use of AM - I think it would be beneficial to the food industry, particularly where you got to consider the life cycle of an asset, you know, how long the asset is supposed to last, because that would change our view on how we should write it down. So, yes, one of the thing that you've mentioned in your introduction that was quite interesting is that you need to look at the different approaches businesses take in managing their seasonal operation, you know that is a different

model, I think. And my view was more in line with looking at a continuous plan for a preventative maintenance program, rather than we run for six months and then we're off for six month to do maintenance. To me that approach is ((uhm)), I mean if you have a failure during that period because you are working hard and you know that a particular item fails within four months and you try to run in six month then actually that is not a good approach to do manufacturing in that way, and certainly within this industry. Because food are seasonal, there is a tendency for an on season and off season and if you bring it into that issue of capacity and capacity is a strength, so you build capacity to satisfy a short period of time, like a summer period to us (three or four months) and for the rest of that year, what does that asset do? It is sitting and not adding value, just costing. So, my view on our type of industry is always to try to do something with the asset 12 months of the year and therefore you need to develop your maintenance or your maintenance program to fit in with the continuous approach to planning maintenance and not the seasonal one. That view is not necessarily shared, so if you think of in Rhodes for example, they've got a purée operation, but they also got the long life food to doing canning, so the canning of the fruit - if you go to the canning factory now, there is no canning going on, it is all finished. So that is then off from now until November/December. But, if you look at the equipment involved, they believe that it runs continuously for the four or five month period and then it's off because it takes that long to get the maintenance program through. So different for us, and I think we might be used to following a slightly different approach to this type of production.

R: When concerned with the holistic system of food quality and food safety, where would you suggest AM to be integrated within the existing TQM system?

G: I would roll back to look at the evolution of QMS and how they were always quite separate - to me they always felt quite separate. So if you think of a food company, they would have a QMS, then they would have a HACCP system, and then in the past the people had a system called BSI 5750 that became ISO 9000. And my view, this approach was not holistic at all, it was creating these violins of control. So the QMS had its things, the HACCP system had its things (GMPs and those things) and ISO was an engineering standard that was ported on to the food industry (or the industry in general) until the food industry adopted it and then later on they sort of realised that actually we don't make nuts and bolts, we make food. So the standard needs to be relevant to food. When the latest generation of standards came along, they integrated. So ISO 22000 or FSSC 22000 integrate, I think in a great way, QMS and FSMS (including HACCP) - in a very nice way. If you then take AM, I would then want to ask, how is this going to work in with my existing certified FSM system? Look I'm no expert on ISO standards, but am I right that with the environmental standard (ISO 14000) you can incorporate it within the FSMS (you can lock it in)?

R: Yes.

G: I know you can do it with the ISO 9000 standard. So you can kind off join it in or lock it in the existing systems, so I would say yes. If AM ((Pause)) if there is areas of overlap, then I wouldn't want to have to create something to satisfy another standard if its already incorporated into what I'm doing in FSSC 22000. Now there is a small part in the FSSC which is on maintenance, but not on assets as such, so if you can bring something that improves or adds value to the FSMS in general, then I would say "yes".

R: So you would suggest to use FSSC 22000 or ISO 22000 as foundation, am I following you correctly?

G: No. I'm not necessarily saying that. I'm saying that, that current standard is sort of the "Rolls Royce" of FSM, but bear in mind as a bare minimum, that's HACCP. That's not a QMS, that's really one part of the system. If you look at food manufacturing, we talk about it on a daily basis and sometimes in companies they don't drill down far enough into the root cause of failures. From my own experience, if you do that, quite often you're having this link with your plant equipment and your assets that are used to manufacture your product until you're finding something that you haven't maintained properly or you have forgotten about or you should've put it into place. So perhaps, an AMS will assist in helping to improve those situations. In the end of the day if your assets failing because you are not maintaining it then its reducing the value, maybe reducing the cycle life of the asset unnecessarily.

R: With what relevant food quality and safety standards do you suggest AM should be aligned with?

G: I think if you look at the global food safety initiative, GFSI, (this is really a little bit of history on the evolution of the QMS) if you look at what they are set out to do, they look at world-wide, hence global, the fragmentation of Food Safety standards if you like. This is driven by the big corporates such as Coke, Unilever, Danone and all of these companies. With a view to saying "well we need to have certain food safety standards in our industry and from our supplier". What standards are we happy with, what standards can we say that we are happy for our suppliers to have. So they did the industry a big favour, globally, and went into a huge amount of research and said "well, this is not good enough, ISO 22000 on its own is actually not good enough and BRC we like. So they made a list of the approved standards in FSM. FSSC 22000 is one of

those standards, one that we see as the “Rolls Royce” of FSMS. But there is others which are not so good. But the likes of Coca Cola they are driving world-wide that all their suppliers must have; they are actually saying they want customs to have the best supply of FSSC 22000 specifically (then there is a reason for it). I think it is one of the important standards, it's not the only one, I mean...((elaborating)) BRC which was put in place by British Retail Consortium - apparently, I don't know whether this is really true, but I was told by a UK company a couple of year ago that the very people that sat down to create the BRC are actually moving away from it. But the BRC has become a ‘super HACCP’ if you'd like. Very detailed. If we got FSSC in place throughout the Rhodes Company I would be very happy - so we have got it here at our company (in Wellington), we've got it up in Tulbagh, and we've got it at our other company as well. So within the three sites that I'm crawling all over at the moment, there is the same standard, but we need to have some alignment. So to align that with another type of standard I would say yes. I don't know who is responsible for actually looking at how to bring them together, probably driven by certification bodies such as SGF.

R: What would you classify as a suitable asset with regard to the food industry?

G: To me everything that you've put in your asset classes. I'm not sure how your standard would work with human assets, I assume it becomes quite qualitative?

R: Yes it does, it typically would include aspects such as culture, enforcement of the top down approach, communication throughout the entire organisation etc.

G: The elements of human assets are included or are necessary in the functioning of other standards, so, quite often companies can fail in certain aspect of communicating the message of what are our targets this year. Your whole intellectual properties things are those intangibles which in some companies have very high values of goodwill write downs. You know, what isn't an asset at the end of the day? An asset can be anything that adds value to an organisation. It's not just machines and equipment. ((Pause)) For instance, in corporates it is very different the control of the intangibles. For examples, the IT where they are setting up shared drives and the storing of information in laptops and what type of software's you are allowed to install - you can't do it yourself. So, everything I work on I sign over to Rhodes - it is not mine. That is managed by them. If you think about what happens when I leave the company? So I take with me everything that I've learned, everything that I've done, everything is stored up here ((point to his head)). So the Company can't have that, but what they can do is they can then take that and put it in a server somewhere. But what they don't do is how they seek to retain everything that I've delivered to them through my brain. And for some people that can be quite a big value of an asset and to others it's not so important. You know, you come in day in day out doing the same thing and operating the machines, so basically you are paid to bring in innovation and to bring in new ideas, solutions.

R: Do you think management find it difficult to connect maintenance management with quality performance?

G: Absolutely a 100%. That is a constant fight. Everywhere I've ever worked, from my earliest days from the age of 18 until now, it's the constant battle. There never seems to be any alignment between engineering and ((Pause)) - I wouldn't want to box it into quality as much - but anything related to quality production. There is just a constant fight. It almost like the one side just doesn't understand the other. One side sees the other side as a hinderness or as an annoyance. If you think of engineering it is concerned about reliability and making things work and often get a bit upset if you are saying something is not working right or it has broken down or they blame the operator. And often actually it can be a combination of all. If you think of the three areas that I've mentioned (engineering, quality and production) - production is carrying out the act of using the equipment, the quality side of QA will be looking and saying but look this is not delivering the right output, I found everything to be out of specification, there must be something wrong. So they are naturally looking at two things what's the operator doing, and he says “look I'm trying my best but the machine is not delivering what it's supposed to do” and then somebody goes and tells the engineering department. So yes, it is a constant fight and I think at the end of the day (out of my own experience) the best way, the ONLY way, of moving that aspect over is through leadership. And applying all of the softer skills, the interdependent skills towards people, the understanding how the other side is thinking. Seeing their side of the story in order to help create the right environment for improvement. At the end of the day, you can't have continuous improvement in any industry, without EVERYONE agreeing on a common goal. Yes, sometimes it's our fault, sometimes it's somebody else's fault, but at the end of the day it's not your fault. It's OUR fault. The non-performance of an asset is a company problem, not an engineering problem, it's not a quality problem - It's a BIG WE! And that's just about people...((thinking)) you can put any certified standard in place, but it's the pole that make it work. It like here at our company (in Wellington), they've got FSSC 22000, we've had FSSC 22000 at my previous organisation, but ours ((referring to were he previously worked)) have worked a lot better than here. You know, it's on paper, it's not necessarily reflecting what and how people are working. It's about people.

R: So what you are basically referring to is that it is a management style that is important?

G: ((Uhm)) it's about leadership. 'Management' implies command and control. Command and control on its own is not the answer as much as collaboration is not always the only answer, there has to be a balance of structure and working together. And perhaps the alignment of standards like AM standards on FSM standards is a way of helping the structure because that is the nature of standards, they are structured.

R: Do you believe that management principles (as outlined by ISO 9001) should be evident in the implementation and maintenance of a management system? In what manner does management align their managing principles and responsibilities to the holistic management system of food quality and safety?

G: I think in standards you have to yes, because they are structured. I suppose the logical steps would help you to build your system in the way that they want the system to be built and conform to the standard. It's the same logical approach to the seven steps to building a HACCP system for an example, it's really to structure you. The ISO 9000 standard is an engineering standard and it's about structure.

R: Do your management implement those type of principles?

G: I think, generally, people are especially those lower down on supervisor level tend to be a lot more structure orientated. I think it is incredibly individual, it depend on who you are, hoe you've crafted your expertise how you've learned through experience (bare in mind that you could go to a business school like I did where in time I've learned all about leadership) or you can just be hands on and learn by experience and get promoted through the ranks - and each is perfectly relevant. There's no way in the world that you can say you are a better leader or manager than somebody who hasn't done a MBA. You can't say that. I think those management principles would help, but they are not the "beagle or the eagle".

R: If the alignment between TQM and AM are successfully achieved on a strategic level, how would you suggest it to be practically achieved on an operational (day-to-day basis) level?

G: ((Thinking hard)) In reality, it is, it has to be to a degree, because any business has a bunch of assets and they use those assets and they have to control and manage them, so they are. So how does it fit in? The standard would help it fit in with how people are using their assets in their workplace in any case - surely that it is the objective of the standard anyway. It can't be so isolated...if it is so isolated then it's not relevant. Perhaps sometimes in their inferences some standards are bit isolated and sometimes that's why companies fail implementing it because they too far from reality. I felt that with ISO 22000's launch as a standard, I didn't want to implement it because I felt it was not well aligned with the QMS, it seemed to be a bit too clumsy, it didn't seem to be relevant enough. And I think when the GFSI looked at their review, and they decided no but actually ISO 22000 on its own is not enough and need additional aspect of the GMP's standards that resulted on making FSSC 22000. So, yes, I think sometimes in the early adoption of standards they are not as relevant as they should be. ((Change of subject)) Basically, you can make a standard for anything.

Researcher concludes the interview with concluding probes...

R: Is there any further comments that you would wish to add or is there anything that you think that I have missed but should be considered? (To contribute to the validity of the interview)

G: In the make-up of your questions, I don't think so ((Laugh)). It is incredibly comprehensive and its extremely high level I would say. It certainly makes people like me think very hard in how to answer the questions ((Chuckles)).

R: Thank you for that answer. With regard to the food industry, would you wish to add a last note about AM?

G: No. ((Pause)) I'm not surprised by your comments about the food industry, because of the things that I've mentioned. Perhaps, from examples I do know further along the value chain companies properly are better at it - I know in companies that are producing formulated products (the retail) are measuring things like FMEA analysis. And at this ((suggesting their organisation)) level, I don't think people are.

G: What could I advise you to look at? ((Talking to himself)) Probably to try and encompass across the value chain. You are really looking at stuff here that is first transformation, to give one up for primary production. Perhaps look further along the value chain.

R: What do you specifically mean further along the value chain?

G: We as a producer would say nobody uses our product - it doesn't go to retail, it's an ingredient in something else ((He is referring to their own products)). You could look at companies who are making a

product, a final packaged product that's going to go to the consumer, like Pakmar's juices for example. You know, FMCG. Our organisation is Business-to-business. But you could look at B-to-B and B-to-C.

R: To whom should you suggest I talk to further explore the possibility of integrating AM with TQM? (To contribute to the validity of the interview)

G: You could consider the manufacturing industry. You are talking specifically about food, but I think you also ((pause)) are you just limiting your study to the food industry for just now?

R: Yes, just for now.

G: It makes the scope properly way to broad, but it would be interesting to look at those classes that I've mentioned just now were companies are specifically dealing with whether it's going to B-to-B or B-to-C, whether its FMCG (fast moving consumer goods) or Bulk Industrial (like we are). Interesting change, if you think about the acquisition that the company that has bought and took control of our current organisation in Wellington. Now, we was at first a puree producer - so they were really dealing with B-to-B - and then they've added on the other types of products and now they are making a formulated product using their own ingredients - so B-to-C. So they've got their own selling arm, their own engineering thing, they've got their own NPD thing. Now Rhodes came along, and a lot of these departments had to move to head office. But this becomes a manufacturing facility, this is all about driving improvement, driving efficiency, and driving quality. Perhaps in a way, this makes more relevance to the corporates to align all those standards together, including the AM because it's all about best optimal use of on site and all of those resources and things like that.

The interview ends with formalities; thanking the interviewee for his time and insight.

B.5.3 Interview with Renee

Researcher (R) and Renee (N): Welcoming and introduction...

R: Is daar enige vrae of enige onsekerheid rakend die kort inleiding van AM wat u het of graag daarop sal wil uitbrei?

R: Nee.

Researcher continues with the interview...

R: Dink u dit is moonltik dat die voedselindustrie voordeel kan trek deur AM te gebruik om hoë gehalte voedsel produkte te lewer?

N: Ek dink dit is krities dat ons dit moet doen. Suid-Afrika is baie agter met die Europese maatskappy wat dit aanbetref. As ek dink aan 'n klompie jare gelede toe ek met 'n maatskappy in vriesland campina gewerk en elke apparaat en elke verbetering in hulle maatskappy moes hulle gese het van die assets "dit is die koste binne soveel jaar word sy koste verval en dit is die verbetering in kwaliteit". Daar is niks gedoen sonder 'n doel waar kwaliteit saam werk met die bestuur van assets nie (dit was kwaliteit en deurset wat saam betrokke was aan die die koste van die apparaat). ((Pause)) Die koste wat die apparaat sou gekos het moes hulle bewys wat is die verbetering op kwaliteit en voedselveiligheid en dan nou ook deurset. Wat jy moes altyd die kruispunt kry van voedselveiligheid voedselkwaliteit en deurset. As die een verder trek as die ander een, dan sal die ander een agter bly. Jy moes altyd die optimum punt bereik waar voedselveiligheid en voedselkwaliteit sny met deurset. Hulle het daai punt bepaal en dan gesê "hierdie apparaat kan hierdie verbetering gee (en dit is gemeet oor jare afhangend van wat hulle doen was). Die meeste Europese maatskappye hanteer verbetering en die meet van assets op daardie manier. ((Pause)) Ons sit baie keer met assets of nuwe apparate maar weet nie of dit altyd effektief werk nie en of dit verbering kan lewer nie. Dit gebeur baie keer as 'n nuwe maatskappy begin wat nie 'n groot formele groep is nie.

R: Dink u AM sal voordelig wees vir die voedselindustrie?

N: Ja verseker.

R: Hoekom se u so?

N: Die konsep van die asset word op die oomblik gesien as iets wat net moet gedoen word om gedoen te word. Dit word nie gemeet as deel van die hele maatskappy struktuur en beplanning en om dit te meet van die asset se voordeel tot die kwaliteit en dan uiteindelik bydrae tot die produksie nie. So dit word nooit as 'n eenheid gesien nie. Die asset is net iets wat gedoen moet word. ((Pause)) Ek dink dit is baie belangrik, veral as ons kyk na die koste van die apparaat, dat AM baie beter bestuur moet word en die waarde daarvan

gesien moet word in 'n maatskappy.

R: Met verwysing tot die holistiese sisteem van julle voedselkwaliteit en voedselveiligheids sisteem, waar dink u sal AM goed in pas?

N: Ek dink AM ((Pause)) moet deel raak van jou voedselkwaliteit en voedselveiligheid sisteme se afdelings van corrective and preventative aksies. Dit moet terug getrek word na jou assets toe. ((Pause)) Kom ek gee jou 'n voorbeeld. Ons het 'n asset wat 10 jaar oud is - 'n aseptiese aanleg - die temperatuur is nie meer so lekker beheerbaar nie. A.g.v. daarvan begin die temperature wissel en die kleur en die smaak van die produk van drom tot drom verander. En nou se ons "oraait, ja dit is 'n kwaliteit probleem, maar die asset word nie aangespreek nie". So in verband met die waarde van die asset en die rakleef tyd van die asset - moes ons eintlik geweet het hierdie apparaat is alreeds 10 jaar oud en ons het hom nie 80% van sy kapasiteit gedruk vir 10 jaar nie, ons het hom 100% of 110% bewerk. Eintlik het hierdie asset geen waarde meer nie want dit veroorsaak groot kwaliteit probleme. So jy moet jou kwaliteit probleme en voedselveiligheids probleme terug trek na jou asset toe of die asset deeglik ondersoek vir moontlike kwaliteit en voedselveiligheids probleme voor produksie.

R: Dit is baie interessant, bedoel u dit moet eerder bestuur word op 'n operasionele vlak ('n daaglikse basis)?

N: Ja, kyk jy moet jou voedselveiligheid en voedselkwaliteit op 'n daaglikse basis bestuur. En dan enige probleme wat dan daagliks ervaar word in verband met die produk, moet terug gewerk word tot die asset en AM betrek. Ek wil amper sê, soos wat ons op 'n maandelikse of jaarlikse basis 'n vergadering het wat aanspreek die lyste van probleme van kwaliteit en lyste van voedselveiligheid probleme, wil ek hê die ingenieurs en bestuur moet ook eenkeer 'n jaar aanspreek die vordering van elke apparaat, soos bv. "ons is nou by 90% van sy raklewe en is dit nog vir ons die moeite werd om hierdie asset te bewerk? - of moet ons begin ernstig kyk na hierdie asset - veroorsaak hierdie asset dat baie voedsel verwante probleme opduik?". Want ek het die al baie gesien waar die ambagsmanne (alpa) nie meer die masjien wil diens nie, want hy is verby sy raklewe-en nou het ons kwaliteit probleme wat intern gehanteer word. Maar ek het 'n kundige nodig wat die asset moet oppas, maar nou kan hulle dit nie oppas nie wat dit is al "out-dated" en die maatskappy hou hom ((klink frustreerd)). So ek sal graag AM van elke apparaat wil sien as 'n bestuur om te kan se "okay ja hierdie apparaat is so ver van sy rakleef tyd, dit is die probleme wat dit veroorsaak, is dit nog winsgewend, veroorsaak dit kwaliteit probleme, kan dit lei tot die risiko dat dit verder in die mark probleme sal veroorsaak?" Ek wil die bestuur hê van my assets. ((Pause)) Enige produkte wat jy vervaardig het ook 'n raklewe en op 'n gereelde basis is daar 'n korente vooraf stelsel wat elke maand wys hoeveel produkte jy het en hoeveel rakleef tyd hulle oor het (soos bv. dit het 25% rakleef tyd oor) waarvan jy moet besluite maak, soos "gaan ons 'n special laat gaan?" Jy gaan moet kyk na jou raklewe en voordele daarvan, is daar iets wat jou asset al vervang het wat 'n beter tegnologie is want omdat ons klou aan ons huidige een kos dit ons maatskappy eintlik baie. So ek wil die bestuur hê van die assets maar ek wil hom saam met die voedselkwaliteit en voedselveiligheids stelsels tenminste eenmaal 'n jaar hersien en bestuur. ((Pause)) Bv. jou verhitting en verkoelings apparate van 20, 30 jaar terug is nou baie oneffektief. 20, 30 jaar terug was energie goedkoop, vandag is energie nie meer goedkoop nie. Ons sit met die krisis van energie en water verbruik vandag, maatskappy moet dalk terug sit en kyk waar word die meeste energie verbruik en waar kan ons dit meer effektief bestuur. Ek dink meeste maatskappy gaan aangenaam verras wees om te sien wat dit hulle kos, omdat hulle aanhou vaskyk aan een groot koste en hulle sien nie al die ander kostes wat eintlik daardie apparaat binne 'n paar maande of in 'n jaar sou afbetaal het nie.

R: Met watter spesifieke voedselkwaliteit en voedselveiligheid standarde stel u voor moet AM mee geïntegreer word?

N: Ek sal se met ISO 9000 wat kwaliteit is.

R: Hoekom stel u so voor?

N: Ek dink daar is 'n groter fokus nou daarop. Die groot fokus 'n klompie jare terug was voedselveiligheid en daar is baie CCP's geïdentifiseer wat nie eintlik CCP's is nie, dit is eintlik ou PRP's. Ons gaan terug en ons se "hier is die CCP's en hier is die ou PRP's en ons moet meer gaan kyk waar is jou kwaliteit risiko". Verlede jaar het Obama mos die nuwe wetgewing van Amerika goedgekeur, toe het hulle meer begin weg beweeg vanaf net die CCP's almal wat hulle blootstel om risikos te bepaal en dan meer hulle risiko's bestuur as hulle CCP's. Ek sien assets saam met die kwaliteit, want kwaliteit word meer beïnvloed deur die asset as die voedselveiligheid. Food safety kan 'fail' en dan is dit nou verby, maar kwaliteit ("ja die produk is bietjie bruiner en die smaak 'n bietjie af, maar ons gaan nog aan"), m.a.w. mense is meer 'leneant' oor voedselkwaliteit as oor voedselveiligheid waar dit begin afwyk.

R: Wat klassifiseer u as 'n bate 'asset' in konteks met die voedselindustrie?

N: Ek sal sê dit is enige apparaat waarmee die produk in aanraking kom wat die kwaliteit of die voedselveiligheid kan beïnvloed. 'Daardie apparaat' praat ek nou van die ontwerp, die onderhoud, die effektiwiteit, die aanpasbaarheid. Dit help nie ek het 'n plant wat 10 000 L per uur kan deursit, maar as ek twee appaarte wat 'n produk lewer wat nie voldoen aand die standaard nie - die vloei is te stadig, en dit brand, en die smaak wyk af - so dit is 'n hele apparaat, jou asset, dan praat ons nou van jou physical assets. Die mense aspek is so wyd, wat ons nie nou hier gaan bespreek nie.

R: Dink u dat bestuur vind dit moeilik om 'n konneksie te maak tussen die onderhoud bestuur van masjinerie en verbeterde kwaliteit prestasies? m.a.w. dink u daar is 'n kommunikasie gaping tussen die twee departemente?

N: Nee dit is waar die groot leemte in ons voedselbedryf is. Die ingenieurs ontwerp en doen onderhoud wat vir hulle maklik is en wat in hulle raamwerk pas. En dan kom die kwaliteit na die tyd en se dit werk nie. Sodra jy dan die kwaliteit begin betrokke raak dan kom jy agter dat dit goed in 'n ingenieurs konteks gewerk het, maar in 'n kwaliteit konteks werk dit glad nie goed nie.

R: Kan u dalk dit verduidelik in die vorm van 'n voorbeeld asb.?

N: Dit is tipies soos produksie lyne wat sproei balle het in 'n tenk invat. Reguit lyne van die ingenieur pas presies in en dan is dit aan die agter kan van die tenk waar dit nie by uitgekome kan word om uit te skroef en te inspekteur nie - en dit is net eenvoudig onmoontlik om skoon te maak, tensy iemand in die tenk klim om dit skoon te maak. Dit is regtig waar wat gebeur.

R: As mens dit aan die ambagsmanne wat onderhoud doen op die masjiene, verstaan hulle die belangrikheid van die kwaliteit van die voedsel produk?

N: Nee. Ek het groot simpatie met die maintenance mense, ek het regtig vir hulle 'n soft spot. Ek het vir twee jaar konsultasie werk gedoen en opleiding gedoen vir voedselkwaliteit en voedselveiligheid. Dan vra jy die mense "waar is maintenance" dan antwoord hulle "nee hulle is nie nodig nie". Ek kan dit nie verstaan nie. Die maintenance afdeling is die mense wat presies moet weet waar die roerder moet wees, wat die afstand van die pyp moet wees, wat die lengte T-stuk moet wees, wat is die afstand wat die masjien moet wees van die muur af. Maar maatskappy of maatskappy waar ek al gewerk het, as jy hulle vra "wat moet die maksimum lengte wees van die T-stuk" dan kan hulle nie die vraag beantwoord nie - baie reageer so "nee ons sit hom sommer maar net in". Nog 'n voorbeeld, wat baie keer gebeur is hulle weet nie altyd hoe ver vanaf die vloer af die tenk moet inkom nie, en nou, as die jy die tenk se deksel oopmaak dan kan dit nie oop nie want dit sit teen die dak. Hoe gaan jy inkom in die tenk? Die bestuur betrek die maintenance NIE by voedselopleiding NIE, nie by voedselveiligheid nie en dit is 'hulle' wat die belangrikste is. Want elke aksie wat hulle op die vloer het beïnvloed die kwaliteit en voedselveiligheid. ((klem hierop gelê)) En hulle is die mense wat die meeste nagelaat is. As ek mense kan aanbeveel, dan sal ek vir hulle se hulle moet die "hygienic design" doen van Andrew Murray. Dit is basiese goeters wat die maintenance mense moet doen (hulle is gesê om dit 'so' te doen) maar hulle weet nie die agtergrond daarvan nie - hulle weet nie daar is 'n wetlike maksimum vir 'n T-stuk nie. Eerlik waar, hulle weet nie ((klink gefrustreerd)).

R: So u stel dus voor dat die maintenance mense moet opgelei word met agtergrond van kwaliteit?

N: Ja. Ek dink die instansies wat die ambags mense oplei, moet 'n module inbring oor voedselveiligheid en voedselkwaliteit. Ek dink, vandag, kan jy nie 'n opleiding doen en 'n sertifikaat van bevoegdheid uitreik as daardie persoon nie die regte kennis het van voedselkwaliteit en voedselveiligheid het nie. Want elke aksie kan die kwaliteit en veiligheid van voedsel beïnvloed, en dit is iets wat hulle nie weet nie. Dit kan ek nou van almal sê.

R: Glo u dat die bestuursbeginsels (soos genoem in die ISO 9001) is belangrik vir die implimentering en onderhoud van 'n bestuurstelsel? Hoe stel u voor word hierdie beginsels geïntegreer met julle huidige voedselkwaliteit en voedselveiligheids bestuurstelsels?

N: Daardie is belangrik ja, maar voor jy begin by die onderhoud van die bestuurstelsel, moet die PRP's geadresseer word. Daar is een wat praat oor maintenance, en daar se hulle "maintenance people should be trained regarding food safety and quality". Dit is 'n deel wat moet bykom maar wat nog nie beoefen word nie. Hierdie bestuursbeginsels is belangrik, dit is wel baie buitentoe gefokus, maar daar moet ook 'n fokus wees meer binnekant toe.

R: Indien die integrering van TQM en AM op 'n strategiese vlak suksesvol bereik word, hoe stel u voor kan hierdie integrasie bereik word op 'n operasionele vlak?

N: ((Pause)) Ek dink die onderhoud van die assets word op 'n daaglikse basis aangespreek sonder dat dit besef word. Daar sal genoem word dat die pomp is stukkend of ons sit sonder 'n roerder vir 'n dag of twee. Ek dink dit moet sy eie identiteit kry, dit raak weg tussen al die ander goeters - netsoos wat daar van die voedselkwaliteit en voedselveiligheid stelsels nie meer verwag word nie kan net in jou weeklikse vergadering se dit is jou management review - jy moet 'n voedselveiligheids vergadering hê, jy moet 'n voedselkwaliteits vergadering hê, en dan sou ek se jy moet 'n AM vergadering ook hê (of AM in bring). Op die oomblik dink ek dit is ons maintenance gedeelte en ons breakdowns gedeelte. Maar ek dink mens moet die word gee 'AM' wat dan breakdowns, koste van assets, beplanning van assets en verbeterings adresseer. Dat mens AM 'n formele naam gee wat dan nie verwar word met die maintenance gedeelte of probleem nie (want anders sal dit maklik verwater). M.a.w. dit moet 'n beter status kry. Soos bv. " 'n huisvrou word nou genoem 'n tuisteskepper" en dan in die geval van AM, moet maintenance nie "maintenance" of "breakdowns" wees nie, die moet "AM" wees. Dit moet 'n verhoogde status kry, want dit behoort eintlik prioriteit te hê. Want sonder ordentlike assets kan jy niks maak nie. So dit moet basies van "huisvrou" verander na "tuisteskepper".

Researcher concludes the interview with concluding probes...

R: Is daar enige verdere kommentaar wat u wil byvoeg of is daar enige iets anders wat u vermoed ons nie bespreek het nie? (To contribute to the validity of the interview)

N: Nee. Ek dink ons het al die goeters bespreek.

N: Ek wil wel net byvoeg, ek is baie bly jy doen sulke studies, want ek dink dit is baie belangrik. Ek hoop regtig dat die voedselbedryf dit in die toekoms kan gebruik. Daar moet 'n balans gevind word tussen die bestuur van assets en kwaliteit om meer koste effektief te word. Strategiese beplanning van die fisiese assets is baie belangrik, want as iets nie volop funksioneer nie, gaan baie gelde verlore. AM gaan verseker die kwaliteit van voedsel beter maak. Maintenance moet vervang word met AM, die kultuur, of die denkwys van die ambagsmense moet verander word. 'n Gekombineerde training program moet dalk geïmplementeer word wat die ambagsmense leer hoe belangrik kwaliteit eintlik is. Maintenance en kwaliteit moet saamwerk. Maintenance is eintlik so belangrik en dit moet nie op neergekyk word nie. So AM gaan verseker 'n groot holistiese impak in die voedselbedryf kan maak.

R: Wie stel u voor kan ek kontak vir verdere data insameling in verband met die integrasie van AM en TQM? (To contribute to the validity of the interview)

N: Nee. Ek kan nie nou dink aan iemand nie.

The interview ends with formalities; thanking the interviewee for her time and insight.

B.5.4 Interview with Alec

Researcher (R) and Alec (A): Welcoming and introduction...

R: Is there any questions or uncertainties regarding this brief introduction of AM which I should know of or you would wish to elaborate upon?

A: No not really, I'm actually impressed with all these illustration because it falls into place with so many things to us. It is phenomenal, all this illustrations and information makes sense that you have introduced me with. Well-done.

Researcher continues with the interview...

R: Do you think AM could possibly help overcome the competitive pressure of producing high-quality food products?

A: Yes I think it would do that.

R: Please can you elaborate on your answer?

A: For us ((referring to the food industry)) to produce high quality products, you need to have proper assets. Especially for us, we need to have equipment no matter how automatic it is no matter how intriguing it is you need to maintain your assets, you need to be able to have proper assets, you need to look after you assets, and you need to have the correct assets. But before you acquire the correct assets, you need to design...((change of thought)) Okay, let's go back to your slides, I like the way your slides is done presentational as it is interrelated to my own research. Firstly, you need to know your customer, you need to know what your customer wants - your customer want high-quality food products. For you to produce a high-quality

product you need to have good processes to produce that good quality product. But before you go on to processing you need to design the processes. For you to design the processes you need to acquire the right equipment from which people are trained and learned to use, and invest in, that equipment. So, as part of AM, you need to acquire the correct assets for your business, for your processes, or for your product such that you can be able to provide your client with a good quality product. If the product do not conform with client specification, your business will sink. So, I do believe that AM (especially from the illustrations that you've given to simplify AM for me) will benefit all organisations.

R: Do you think AM would be beneficial to the food industry?

A: Yes it would. It will do away with a lot of hiccups, a lot of production breakdowns. And it would save companies a lot of money and the loss of business.

R: When concerned with the holistic system of food quality and food safety, where would you suggest AM to be integrated within the existing TQM system?

A: I think after going through with what you just shared with me in you presentation about AM. I think in my background on TQM (especially as TQM was something that I've studied as part of my qualification), I would say it would be wrong to separate TQM and AM. Yes I know, when systems are launched, you separate them first for implementation. And as you can see with AM, it is small baby that is slowly crawling in. But three quarters of the stuff that we have spoken about AM are really part of TQM. I'll give you an example: before you do anything you need to first know what your customer's needs is, then you need to go in and design your processes, while this designing of processes you are also sharing your vision with your team. Both involve people, both involve processes. During this designing phase, you need to acquire equipment (whether it is computers, machinery or whether it's a spoon...whatever) you need to acquire the right equipment. While you are purchasing the right equipment you need to make sure that your equipment will be able to produce the good quality product that you want. That is also supportive of TQM, because during continuous improvement, you speak of design, you speak of meeting and exceeding customer expectations, you speak of identify and resolve and all those type of stories. If you get your equipment, of course the guy who sells you the equipment will tell you a lot the good stuff about equipment but hardly tell you about the bad stuff of equipment what you only will find when you are running them in your production plant, then you start seeing the capabilities of the machine's capacities (maybe they will be limited to doing only longer hours, instead of shorter ones and all those things). Again, you will find those things during managing the equipment and you would need to manage it properly. But all that is part of your AM, but TQM also. Because in TQM you address preventative maintenance were you create preventative measures to prevent the re-occurrence of failures, the re-occurrence of breakdowns or negligence (which can be prevented with preventative maintenance). It starts with daily inspections before you run the plant, then you have weekly maintenance inspections that you do which include checking the oils and greases and all those things. And then you have quarter or monthly schedules of maintenance inspections to check the availability. Also during production you need to do maintenance. If you don't maintain that asset it wouldn't run effectively because it will bugger your production, and maybe would stop you from reaching your targets and that prevents you from running production effectively. So that is obviously part of your AMS, and TQMS for you to be able to produce a good quality product while maintaining equipment. We are also talking of appraisal costs, preventative costs or cost of quality. You need to create a balance. There are also people involved, you need to share your vision with the people, you need to train the people, and you need to employ the correct people (competent people) because you can't pick any person who have no clue to what he/she is doing. At the end you have to train the people to use different equipment. At first they are able to operate certain machinery, but as time goes on technology is changing, and they need to be trained to operate new equipment. These are 'nitty gritty' things, they might look small, but they all are important and should not be neglected. You have to spend time with your people, you need to train them, and you need to educate them on how to operate machinery properly. People has to test whether the equipment meets your needs in terms of the product you are producing.

A: They speak of food safety a lot nowadays in FSM, so they are slowly moving away from speaking of QM - food safety is seen as the more appropriate term to use. But, important, food safety was integrated into the QMS which uses a lot of fundamentals of TQM like your PDCA cycle. So actually you will see that all these systems are integrated and work together. One system is never efficient on its own, but that integration will be difficult to separate. They speak of food safety, but actually it forms part of your QMS. Again, it goes back to your design phase were you acquire the correct equipment, if your equipment is not service properly, your equipment will breakdown and it is going to be a hazard to whatever food product that you are producing especially in the food industry. It is going to become hazardous. The oils and greases that you use in your equipment needs to be food graded. You can't just use any type of oil in your machines since you are working with food. Again this forms part of your preventative maintenance schedules and food safety systems. So, AM does and will have a positive effect in the food industry and will be beneficial. I'm Sorry I speak a lot ((Laugh)).

R: No, please, you are allowed to speak freely and as much as you want to.

A: ((Laugh)) But, again, AM will have a huge benefit. Every asset has a life cycle but you only notice it at first when you use equipment, it would run effectively, but, as soon it is neglected it loses its effectiveness. Equipment that has a 10 year life cycle, which are running 24 hours a day - if it's maintained badly that equipment won't even last a year. That would be catastrophic to a company, because a lot of money will be lost. If assets are not managed properly, it would lead to financial catastrophes. Typically, if a machine would break, you will need people from the outside to fix the problem which becomes unnecessary, unnecessary costs. Thus this goes back to AM again, you need to manage your assets properly, you need to know exactly when to service your asset, you need to know the capability of and capacities of your assets. So all these things needs to be part of the management of an asset and planning of your production - demand and capacity needs to be balanced. If you buy an assets that is supposed to run for only eight hours but you run it for 16 hours then you are going to encounter problems - the life span of machinery is typically used that is not set out to do, so very soon you are going to have problems. So money can be lost, clients will be disappointed and business will be lost. You don't want to under deliver to your clients or you don't want to underperform, especially in this modern day world where there is a lot of competition out there, there is a lot of people who do things differently than you are doing so you have to keep up with times, the clients, the trends and demands - you need to exceed the expectations of your customer. If you don't exceed, you can't cope nowadays. With regard to equipment or 'assets', we need people, we need the intellectual property, we need information and communication - without all that, your business will not survive.

A: In TQM we speak of the 3 C's, which is: communication, commitment and culture. You've got a vision as leader, you need to make people excited employing your vision. People is part of the 4 P's of TQM which is: Planning, People, Processes and Performance. Performance is actually the main part of these 4 P's - you need the first three to lead to performance. You need to share the vision with all the people. People is another important asset (as you mentioned in your introduction) since people entails sharing the right information. So again, AM is beneficial to the food industry. I've seen a lot of companies that have unnecessary production hassles because of communication failures. An example is, the way you introduced AM to me, you simplified it to me so that I could understand it, it was straightforward - sometimes we over complicate things especially in the way we communicate. The way we communicate on floor level is completely different to the way we communicate on management level. So we need to keep things simple and communicate simple so that the next person whom you are speaking to can understand what you are saying to them. It is catastrophic if somebody assumes something that you didn't actually said, because this goes on to production and then you discover this problem only later. Thus, money is lost and you need to rework your product due to a lot of damages, which means that the amount of profit that you are supposed to be making is lost, including time (time is money). You need to start fresh. This leads to a lot of hiccups or negative results just because of one simple mistake. Talking about that, we speak of creating mistakes in processes in TQM...again in AM you need to acquire the right equipment for you processes, as I said, people operate physical assets, people must acquire the right information and they need to create a stack of processes. I can give you an example of how we are doing things here, if we are doing something new, we bring in all parties involved in achieving that project effectively. It is important that everybody partake because everyone has a certain area of expertise and that input is important in making the project successful. All together identify obstacles, and as a team (something that we speak about in TQM) we manage that obstacles and create something called quality actions or solutions to overcome those obstacles. Thus, it is critical to acknowledge and plan before you start with the project to identify what exactly we need to do (what resources to use and etc.). So, if we would acquire new equipment for example, we would first have to discuss it with all before we try to overcome the obstacle or start the project to first see if we have an alternative to prevent unnecessary costs. Because sometimes a client want this, you need to consider what resources you need. Clients sometimes do not take it seriously what you have got to offer to them because they know you did not use the right resources. So, clients buy something that you have to offer to or promised to them. Let's say, if you present a product to a client and they are happy about it, you will have to put resources into place (sometimes you don't always have the right resources) to make sure you present the product properly. So again, that balance. This all goes back to your AM ((Suggesting that it is required)). A damaged brand is not manageable, you can't restore that brand. A damaged brand occurs due to production hiccups or errors or equipment failures. This could damage the companies' reputation. This would cause consumers to create a stigma against your product. It is very difficult to repair that damaged brand and lost relationship (because you are not in direct contact with the client, but your product is). So before you start with your facilitations (the office level), that is where you should start to plan with AM. No food manufacturing company wants to be associated with equipment that operates ineffectively or those who are falling apart that could lead to serious food poisoning that could lead to illnesses or causes of death. No food company wants to be involved in killing people - that is my way of expressing the importance of it.

R: With what relevant food quality and safety standards do you suggest AM should be aligned with?

A: The GFSI standards which is your FSSC 22000, BRC, ISO 22000, HACCP. Within these food safety

management systems there are parts that includes maintenance and preventative maintenance plans and schedules. As we do our hazard analysis within all these food systems, we also look at our equipment (or assets) that we do have. Okay, we are going to talk mostly of physical assets, but I would also want to include another asset, which is people, this is sometimes overlooked. People are key to the success of a business which also is an asset. People is the biggest asset that one can possess in life, you need to involve people in our systems. Because people are those who run and design the systems and the assets. In order to run these processes, the people need to understand it and communicate it in a very simplified way. You need to now the knowledge level of every individual since every company runs differently. If you sell your ((referring to AM)) system to people whom are driving (or managing) your system, we need to be available at their level and make it acceptable to them so that they can see the benefit of the system. In TQM, you are supposed to involve the people, you have to inform the people exactly in what they are doing and how they must do it. They must know that they are allowed to ask questions because I want them to see that quality is not only in this office ((pointing to his office)) but quality is everybody's responsibility within the organisation. Quality nowadays are spoken or seen as FSM. So if you speak of AM it must be termed as one name 'Quality' so that if they want to know about AM, they could refer to the QM department. It is more holistic, it is a huge approach. You can never separate food quality from food safety and those management systems relevant to your food company - it is all integrated.

A: Just repeat the question for me again please.

R: With what relevant food quality and safety standards do you suggest AM should be aligned with?

A: Okay. I was thinking about TPM were you want to see your maintenance records, your maintenance schedules, and your maintenance plans (how you manage your breakdowns). When we do our hazard assessments for hazard analysis we look at all these assets which are potential hazards to the food product that we are producing. People can bring in certain hazards, like your micros, or you physical assets that they operate. Therefore, you need to employ people that are going to be an asset to your culture and employ people that can add value to your organisation which will be able to work well with you (somebody who abducts the culture) - thus, people adding value to your culture and adapts to your culture in the organisation. But it's also part of managing systems. So generally they keep on talking about FSMS, but actually it includes everything including quality (food safety is a part of achieving quality). So referring to the equipment again, sometimes you work with glass, it is hazardous, and then you have to properly design systems and processes to manage it. Also, you must speak to your suppliers - you exchange information, you exchange information with the guys on the floor who work with that equipment, you have to design something that is acceptable for the food industry. You look at the other things as well such as the bolts and nuts, and glass breakages which might appear in the equipment. Glass is a problem and is hazardous since it can break easily. How do you manage it?...So you have to think of other alternatives to move away from glass, such as maybe using plastic which are often used in the food industry. The food industry actually supplies now certain equipment that are hazardous free, so that the nuts and bolts are not easily accessible, to ensure that it would not be hazardous to the food product. You've got conveyor belts that are running using oils and many other things that could be hazardous. So the food industry has to design all processes with a food perspective. An engineer has to carefully understand the food industry before designing machinery and processes. For another example, we speak of food grade equipment, where you have to certify all assets to say that it is indeed capable of producing safe food products. Another example, you have to use the correct cleaning materials and chemicals on all equipment because the wrong chemicals could cause corrosion which may lead to food poisoning. Thus it is important for those people who design equipment to consider these elements of food safety.

R: Are you referring to PRP's when you are talking about all these important elements of food grade equipment?

A: Yes. All things that you use during processing has to be food grade. The most important thing to consider is that no toxins should be able to come out of your equipment that are capable of entering the food product. An example is PET (which is a plastic) - the certain toxins that can come out of this plastic can affect the food product which could become dangerous to the consumers. Nowadays food manufacturers typically uses a more safe PET plastic, which are BBF free. This type of plastic is commonly used for that bottling of baby purities (infant foods). This is just another example besides from only looking at you physical assets which has to be food grade. Thus, it is important to us to consider if all equipment and machinery is food grade before we purchase it.

R: Sorry, to summarise what you are suggesting, do you say that AM is relevant to everything including your PRP's, HACCP (food safety) and food quality standards?

A: Yes. I know BRC is quite strict with regard to those things. And ISO 22000 or FSSC 22000 actually also applies to this. These standards all suggests that you need to acquire the right equipment for safe food production and processing and to ensure that your equipment is not harmful to your product. So, again

you need to acquire the correct equipment. Another example is plastics - it can chip which are hazardous to food processing, so if you use plastics then you have to use those plastics that does not shatters all over the place.

A: ((Change of subject)) I think AM will also benefit health and safety within the food industry since I think it will also overlaps or integrate at some parts of health and safety, because health and safety is also concerned with equipment. Generally we are speaking about the physical assets. Concerning the building of our company, if the building's floors are slippery or the building is not maintained properly the people working or producing in there it affects your health and safety of the people. Thus, your people and buildings has to be managed in a health and safe way. So that is why I would say it is possible for health and safety to integrate with AM. But that is another topic that we are not going to go into now.

R: No problem, but I do agree with you it is relevant.

A: Some speak of SHEQ (Safety, Health, Environment, and Quality) you can look into that.

R: At the beginning of our discussion, you've mentioned about integrating systems, but would you suggest the food industry to use one integrated system that encompass everything holistically?

A: Depending on organisational culture and growth of an organisation. For example if systems or any management system are new to an organisation it can be dangerous to incorporate both systems in broad if they do not truly understand what the systems do. If it is overlapped within departments, it can be too much of an overload onto somebody to take care of the whole system on their own. I would suggest, depending on the organisation culture in terms of growth in their system management, I would suggest that they start the systems separately. Run and understand food safety on its own, because there are certain fundamentals which need to be addressed first. From my experience, if systems are not managed properly, either one of the systems can be overlooked - then we discover it only after certain things have happened. Certain organisations put an emphasis on certain things, I can give us ((referring to his organisation)) as an example, health and safety is something that we've started with but being a food industry, our emphasis are more on food safety and quality because we are producing products that are safe and high in quality. Also, our stakeholders or retailers wants us to be food safety certified. Health and safety in alignment to our industry are therefore not really emphasised but we still need to keep health and safety in place. But all argue that we must rather focus on quality, because of SHEQ we want all these things but we must therefore acquire other expertise in implementing it. Health and safety is quite big on its own, so you have to spend a lot of time studying it and implementing it properly, because you could get really into trouble if your safety measures are not properly integrated. So for me to lie and say, "guys, we've got a health and safety plan" then everybody would looks at me like it happened overnight, and then I go "well guys, actually we have nothing" and then they will be looking at me again. So I would say, for a start in an organisation, depending on the organisation's culture in terms of what systems they use, please do separate them, let them be introduced slowly into the industry, let them be accepted and comfortable with it and people running them, see that the system on its own (such as Health and Safety) is running well, see that AM is running well on its own. Then you will start to see which one is overlapping the other or what fundamentals are overlapping one another, then you start integrating it. For you to come and introduce an integrated system into an organisation that has never had such a system before could be catastrophic. Because, the person responsible for implementing that system might not be experienced in certain disciplines of the system. For example, it does not necessarily means that somebody that are used to quality (say a food technologists) can manage health and safety, can manage AM. Within the food industry, food professionals can come into the business as food technologists but they never had the background of machines or equipment, so you would need people to understand and are passionate about your physical assets. So we need to identify each other's expertise before thinking of implementing a holistic or integrated system. Because if you speak to a Quality manager in a certain company about a standard, he might not know it. For instance, an engineer speaks of bolts and nuts and certain things, some things that I ((referring to him as quality manager)) don't know of, know I would require an assistant that could explain those things to me. So it could become slightly catastrophic. But for... ((Changing subject)) AM, especially looking at your introduction, it is something that can be introduced on its own, as it is. Run it for a year and see its benefits, see the challenges it brings to the organisation before you integrate it with the other systems. Because if somebody just come in and introduce and implement a new integrated system, I'm afraid that people would not really know its (or yield its) effectiveness at the beginning. AM is a very important management system, which are definitely beneficial to the food industry, but it would be underestimated if people do not really understand what it is about since it is a complicated system. Thus, I suggest it has to be run on its own to yield positive results then integrate it to one system. And that integration has to be done by someone who is experienced with those systems. It cannot be done by someone who are inexperienced with those systems - it would be catastrophic. People have weaknesses and so it applies to systems and processes. For example, looking at companies that are two to three times bigger than us ((referring to his organisation)) it could be easier, where for somebody to come with another system and bring it into a certain department can be received

in a better way. Management has to say or instruct them to implement the new system or that we want to integrate systems. I mean, our quality department is small in comparison to other companies, other companies' department can be up to four times bigger which also includes your technical department, or operations, or possibly AM ((pause)). What I'm trying to say is that the whole body of the systems or the holistic point of the systems can be planned within a department in other organisations, but if they just see it as another paperwork story that needs to be done but actually it is not done like that. At the end of the day you will not yield the effectiveness of the system because of the way it was introduced. But if the company has properly defined and enforced everybody to implement an integrated system (because we feel that systems overlap and we are looking for a holistic system). So you have to explain to them exactly why you want to integrate systems since it would be beneficial to use one system. You need good information to build on, so you need to build the blocks for people to understand the benefits of implementing one system. In your case, you could go and say "okay guys, we've got this integrated system which has all these processes or systems regarding AM and TQM and I want to integrate the food safety and quality into this and this is what it does and this is how it would benefit you". But again, it goes back to the organisational culture and growth in terms of managing systems and how they will be able to integrate systems or not. But if it is a company that are struggling with HACCP (which are very basic) and try to implement an integrated system, it would be very catastrophic ((laughs)). Top management plays a critical role in any management system that an organisation have. Our company is very privileged to be able to have a boss like we do, who sees only positive things and always tries to include everybody's opinions and knowledge. He manages us as a great leader, he equips us with all the necessary tool, techniques and knowledge. He gives us responsibilities and respects our responsibilities and trust us to do it efficiently. He is committed to what we are doing, he understands what we are doing. He integrates us to be one, and that is the story of our success. And it's his way of managing us, the way he sells ideas and projects, the way he manages and values the input of each individual and the way he includes everybody to decision making. He includes everybody during the identification of obstacles while we discuss as a team ((emphasised tone)) the obstacles to propose solutions or alternatives for it. So we do it effectively, because all are involved in decision making and making the project work. So that approach of a good leader is important - the commitment from above is critical since it motivates the senior management team and changes their attitudes and way of thinking towards implementing new things or systems. Leadership can therefore have a great impact. Top management is important to share a vision. For instance, in your case ((referring to the integrated approach)), top management could say that there is a solution to our problems and hiccups during production by implementing an integrated approach of AM, sharing the vision of AM, sharing the possibility of its benefits within the food industry. Again, I think AM would be very beneficial to most food industries. For example, if your plant breaks down, this could affect your production very badly since a lot of product waste would occur or scrapping of food products. For example, if you are producing milk you will need to have a pasteuriser, but if that pasteuriser breaks the milk could become hazardous to the consumers so the milk must be disposed of, so AM is critical to these type of problems. The cleaning of the pasteuriser is another problem, it is very difficult to clean it.

A: ((Change of taught)) I think maintenance would be the most preferred guys to work with this ((referring to AM)) since they work with and look after the physical assets and has experience with it. They are responsible for fixing broken equipment or machines (physical assets). So you would want to have somebody who are experience with operating machines, checking maintenance schedules and planning for maintenance breakdowns. Since people work with machines and equipment, people are an important asset. So people need to be motivated and educated on operating machines and equipment. The people on the floor are our ((referring to senior management's)) eyes and ears, so we need to trust them to do things efficiently. You need to get your people to a certain way of thinking, to a certain culture of doing things to deliver high quality products to satisfy the customer. You need the people to commit to the same vision, the same culture. People are an asset that needs to be managed properly, you need to treat people right. If the people are not happy, it could cause unnecessary problems, which comes back to possibly affecting our brand. People are an asset that needs to be managed properly. AM is quite broad, you've got intellectual properties, brands, reputation, people, everybody is involved to manage our brand properly. Therefore I would say (because it is a new system to introduce) you have to break down the AMS - you have to define your assets and identify them and then find ways how to manage all assets efficiently. Your inputs and outputs needs to be balanced. It's like having a car, without servicing your car or putting fuel into your car, your car will not take you places, your car won't perform very well. Thus, you must not neglect the servicing of your car, same goes for your organisation. You have to identify your assets and start breaking everything down to manage each part (each asset, one by one) efficiently. Then later you can start integrating things then after that you can integrate the whole system, until you will find a holistic system running smoothly. Engineering gurus could really look into how to best integrate or implement such a system. As far as I know, this ((referring to assets)) is not something that is properly managed in South Africa, maybe it is, but I do not think so. Because I actually thought AM is just about finances, but in fact it isn't. I've actually spoken to our financial manager to ask him about assets, and he said that the value of assets depreciates over time, suggesting that the life span of assets should be considered. But people in the food industry do not understand that yet.

R: What would you classify as a suitable asset with regard to the food industry?

A: Definitely people. That would be my number one asset. Because people do the stuff physically, you can't achieve anything without people. People need to work towards one shared vision, work together as a team. Then I would say Information is the second important asset. The correct information is critical, you need information; Information is another key asset. Without knowledge you will not go far ((emphasizing tone)). Information and knowledge is critical for operating acquiring the correct physical assets (which are my third important asset). Because without the right knowledge, you will not be able to purchase or acquire the correct equipment, so you have to employ the correct people with the knowledge of equipment and suppliers. These three I would suggest is important, all the other things will fall into place within these three. Money is important yes, but it is not the solution to everything.

R: Post completion of the interview, the interviewee personally emailed the researcher on the same day of the interview (7 August 2015) and kindly asked the researcher to add the additional information to the discussion of information and knowledge which he felt needed to be elaborated upon. The following is quoted directly from the email:

"Hi Milandi,

Thank you for considering us in your research, we wish all the best in your studies!! There is part were you asked me my top assets and I named Knowledge and Information as my number two asset. Kindly add the following to my definition of Knowledge and Information, Knowledge and Information of:

- Your customer's needs and expectations...work towards satisfying and exceeding them
- Product (product characteristics, regulatory conformance, your competitor's products, market acceptance, product life cycle etc.)
- Processes (equipment, process capacities and capabilities, obstacles, bottlenecks, improvement and growth opportunities etc.)
- Your people...staff-internal customers
- Suppliers
- Competition or competitors
- Industry Norms and behaviours
- Regulations governing your industry, standards relevant etc.
- Markets
- Economy - financial trends

That's me in a nutshell; I felt I needed to elaborate more about that...
All the best!!

Kind Regards"

R: Do you think management find it difficult to connect maintenance management with quality performance?

A: Yes there is stigmatization. But it varies between organisations. It starts with top management, it starts with how you do you manage your people, how do you connect your people, how you make your people work together. Because you can't separate quality performance with maintenance, no. You can't separate them, because without maintenance management you won't have quality performance; zero maintenance (due diligence) means zero quality performance. But yes, very often these departments struggle to get along.

R: Would you therefore say that there is sometimes conflict between departments?

A: Yes, these guys will always have conflicts of interests. It all goes back for me to top management, how they sell their vision and mission statement which creates a certain culture which suggest how we do things as an entirety. If management allows this vision to be communicated to all departments; amongst maintenance management, and production management, and quality management, and financial management. These departments will have conflict if the vision is not shared. Therefore, in any organisation will have conflict, you will have conflict of interest. So, top management is the heart of any organisation. They have to distribute a common goal to all the departments which represent the organs of the organisation. If one fails, we all fails. If one doesn't read the other one well we all sink. Yes, I've seen this before, yes I've witnessed it before

were maintenance management, production, and quality do not see eye to eye. They can't sit in one room because they are down each other's throats, because this one blames that one, and that one blames this one for that. And I've seen top management not managing these conflicts very well were they do not assume the role of a peacemaker and were they do not fulfil the role of a good goal setter and instructing people to a certain way of doing things in the organisation (we all work together). This is why I would always speak highly of my boss ((referring to his current boss and his organisation)) because I love the way he manages all the portfolios of our organisations. If we speak of the organisation as a human body, everybody within the organisation is an organ, and each organ has a specific job to do to keep the body to function efficiently. Yes we've got conflict, but the conflict should be about the vision of the organisation, it should not become personal. If conflict is not about the vision, then we need to manage it. We have to look at the root cause of the problem and not the person. If you have a holistic approach to managing the problem (referring to what is the problem, what is the cause of the problem, how are we going to manage the problem and how are we going to solve the problem) and not focussing on an individual of who might have caused the problem. So, top management style of managing conflict is important since it will create either communication errors or effective communications. Communication is a stumble in everything that we do, yes, because we have to be very careful when sharing information - we have to be sensitive towards people and think about how you are saying things. So if you do not approach things as a team, you will always be down each other's throats. Thus, top management has the responsibility to make sure that all departments work together as a team, to work towards a common goal...Whatever the communication barrier or problem is, it has to be managed and fixed in a positive way. It's about managing the organisation efficiently. You must always make the people feel honoured and respected so that they would do things willingly, you have to make them feel important. You have to manage the people in a positive manner. So again, you have to generate a communal culture to encourage your people to implement an integrated system which should be positively sold by top management. Top management is responsible for preventing communication gaps between quality and maintenance.

R: If you put yourself within the shoes of the person responsible for maintenance, do you think they understand how important their role is to achieve high-quality products?

A: Yes. They do, but again, this varies between organisations and different cultures. There is stigmatization of maintenance guys within a company, where people think that they are not involved in product quality within an organisation. Because of the way cultures are practised within an organisation. For example, a project leader (usually top management leader) are responsible for bringing in new ideas and new approaches. You've got top management, then you have second management in line ((referring to senior management)), then you have line managers (your line leaders, supervisors and controllers). If your top management does not create a culture where you make your maintenance manager responsible for quality in their work environment, then these problems will happen. These guys are typically your engineers, and they are fixated on quality as they very well know of TQM. But they are focused on the quality of the process, not the quality of the food product. We need a project to involve all departments, let the maintenance people see for themselves were they fit into the big picture, let them realise what how big their responsibility is regarding food quality. Again, it is top management's responsibility to program this way of thinking into his head. Show them your vision, and explain to them the importance of maintaining that vision. Explain to them what their role is in the big picture, what their contribution is to the organisation. Sell the idea to him, change the way he thinks the way he sees things, change the way he precepts' things. Tell him what his actions is towards quality, explain to him the consequences. It all goes back to top management (what did they programmed him with) ((suggesting that top management could positively or negatively influence them, programme them)). If you treat somebody as important and treats him as an equal to everybody else, he/she will perform. Tell the person how he/she could add value to the organisation, how he/she is an asset to the organisation and how important that person is to the success of the business. If you point out a problem to a person, that person should be programmed in a way so that he/she feel honoured to try and fix the problem or to provide his/her services and top management should trust him with his responsibilities. People should look forward to delivering their service and to do their part for the organisation. But, I do agree, there is often communication problems and conflict between these two, however, this depends on the culture and the commitment of top management of the organisation. Maintenance is important, so they have to collaborate to the culture in order to provide good quality products - with this collaboration all the hassles will be overcome.

R: Do you believe that management principles (as outlined by ISO 9001 for example) should be evident in the implementation and maintenance of a management system? In what manner does management align their managing principles and responsibilities to the holistic management system of food quality and safety?

A: Yes. They are building blocks. For me they are the skeletons of the human body or the skeletons of a structure. We need to build on them, so we need to add flesh and organs on these skeletons. It is important that we make these principles relevant to the organisation and to ourselves and make use of them...It can be seen as the starting point. It serves as a good foundation to build on. It is an overlap of many things, it should not be seen as "it starts here and end there" but rather as a good starting point of everything

else. It is also important to consider that these principles should be aligned with an organisation who are passionate about growth and continues improvement or whatever they do (everybody should know what they strive for), they are going to soon realise that their business will die. There is a lot of competition out there, so you have to be bigger and better than the competitor to ensure that you can provide your client with the same stuff as the competitor but just better (offer them more). So, you need to keep up with times and trends and your industry knowns (the way you are doing things). You also need to keep up with your management skills, your client's needs and you need to meet and exceed your client's needs and expectations. You have to keep up to be competitive and outperform other companies - you have to be due diligent to exceeding customer expectations. So, that is just the building blocks, you can't stop there, there are many other things that need to be addressed such as your systems and standards, but without it you will yield results of a bad management system if not implemented. Remember, 'you reap what you sow'.

R: If the alignment between TQM and AM are successfully achieved on a strategic level, how would you suggest it to be practically achieved on an operational (day-to-day basis) level?

A: If we speak of maintenance, we've got our daily, weekly and monthly maintenance schedules. Implementing that can add a life span to your physical equipment or assets which can help preserve the life span of that equipment. Meetings with people would be important, driving feedback of people and the involvement of people because people are important. To me people is a huge asset. You have to speak with the people on the factory floor, your staff. I will say you have to generate a culture that allows a two way communication channel so that you could get feedback from people and to allow them to speak freely. I would say due diligence for your brands and your reputations because you need to maintain it or you have to preserve it. So, you do what we do every day; you speak to your clients on the farms, sending out invoices, meeting strangers, attaining to customer complaints, go speak to your suppliers (since they should be seen as your partners and not just someone who is providing a service to us). So you have to create a platform where every person partaking in the holistic system to speak freely. Also you have to create a common and acceptable way of doing things where we share each other's needs and certain that each other is satisfactory and exceed each other's needs. Thus, again, create a two way communication channel.

Researcher concludes the interview with concluding probes...

R: Is there any further comments that you would wish to add or is there anything that you think that I have missed but should be considered? (To contribute to the validity of the interview)

A: No. But I do believe AM is an important tool to management and it would be a great tool to improve many things that are relevant to the food industry. I think it can be collaborative to many difficulties that we encounter on a daily basis. For me yes AM would be beneficial. It is a well-done presentation, it relaxed me, and it also applies to many things that I already know about.

R: To whom should you suggest I talk to further explore the possibility of integrating AM with TQM? (To contribute to the validity of the interview)

A: My operations manager maybe. He will be able to give you a different perspective (especially from the production side of the industry) to your research. He could maybe contribute to a more holistic view of your research since all departments complement one another such that we achieve a shared vision and mission collectively. The food quality and safety department do not work directly with the equipment and machines, so your maintenance or operations people will maybe work more directly with AM since they physically work with the assets, where I would look at the intangible assets (brand reputation, people skills, people management). So those guys might also help you with more information. We need to do things is such a way to collaborate one another and understand each other's goals. Through this we will complement one another, to achieve our mission collectively. To come back to what we've discussed earlier, I've seen many times that sometimes during production a maintenance error occurs, but then the quality departments get blamed for it. ((laughs)) Serious, I've seen this happen in many cultures where the quality person just try to put out fires. If you attain a certain quality culture, you will not deal with these type of problems because then everybody will be focused on quality. It is amazing what top management can do (everything just falls into place with good leadership)...Anyway, I will try to arrange a meeting for you with him and then I will let you know in the coming week if he is available. Just remember me via email.

R: Thank you so much for this, I really enjoyed it and this is something that I would definitely would like to build upon. I actually learned from you today. We learn from each other ((laughs)).

The interview ends with formalities; thanking the interviewee for his time and insight.

B.5.5 Interview with Ian

Researcher (R) and Ian (I): Welcoming and introduction...

R: Is there any questions or uncertainties regarding this brief introduction of AM which I should know of or you would wish to elaborate upon?

I: As jy jou mense...ja dit is nogal sleg as mens so dink, ons het sopas in 'n vergadering daarvoor gepraat: vir ons om nog in die besigheid te probeer bly, kwaliteit hou ons nog eintlik aan die gang, maar om kwaliteit te behou kos vir ons baie geld, so die enigste manier (as ons die "prys game" wil speel) om dit te oorkom moet ons die 'human assets' waarvan jy gepraat het probeer minder maak op 'n manier. Dit is baie hartseer, maar dit is die realiteit. Daar is mense wat alreeds vir ons vra of 'retrenchment' in die pyplyn is, ons kan nie direk vir hulle se nie, maar dit hang als af van ons maatskappy se performance.

R: Ek besef dat dit moet 'n baie moeilike situasie wees. Dit maak dinge baie kompleks. Bygekrom tot dit, is daar enige ander vrae wat u wil graag bespreek voor ons begin?

I: Nee, ek het niks vrae nie. Ons kan maar begin.

Researcher continues with the interview...

R: Dink u AM sal die voedselindustrie help om hoë gehalte voedsel produkte te lewer, om by te bly by die mark neigings?

I: O ja definitief, want dit is wat die...((dink)) wat eerste gebeur as jy nou swaar kry of as jy sukkel om wins te maak, die eerste ding wat die ouens doen is hulle spaar op maintenance. Nou, het hulle nie geld om daardie masjien oor te doen nie, nou redeneer hulle dat die masjien nog 'n bietjie kan loop ("olie hom net so 'n bietjie, stof hom net so 'n bietjie af, okay right, hy kan nog so vir 'n jaar loop") ((hulle mentaliteit)). Ons dakke is stukkend, die mure lek, maar die mense redeneer so: "die struktuur staan nog, so nee ons hoef niks daaromtrent te doen nie, ons gaan maar nog so aan vir 'n jaar". Op die ou end van die dag, haal dit jou in op 'n stadium. 'n Voorbeeld, dit is presies wat nou gebeur het met die ander kant van ons fabriek ((verwys na die oos fabriek, oorkant die pad)) die kliënte het sulke behoeftes gehad oor onderhoud van algemene strukture ens. Toe op die ou end van die dag moes ons die hele fabriek plat slaan want dit het nie voldoen aan hulle behoeftes nie. Dit is nou 'n goeie voorbeeld van as jy nie by hou met jou asset management nie. Een van ons fabriek in Boksburg, het hulle dieselfde gedoen. Hulle moes bykom met hulle budget, en elke jaar het hy nou probeer wys dat hy soveel onder sy budget is of soveel minder gebruik as sy budget - toe op die ou end het hy soveel staan tye in die fabriek, toe moes die fabriek shutdown vir 'n hele jaar en die goed oordoen en reg doen om weer ordentlik produksie te loop. So ja, AM is belangrik, ons sien dit elke dag. Kyk, ek is mos in produksie, ons het niks te doen met die masjinerie nie of ons werk nie fisies op die masjiene nie, maar ons wil hê daai masjien moet loop. Vir ons is dit belangrik dat ons eerder geld spandeer, sit nuwe parte in te sit sodat daai masjien loop, want as jy jou klomp mense in jou fabriek het en jy verloor 'n uur...dan is dit die stoom het geloop, die boiler het geloop, water het geloop, krag het geloop, alles het geloop, die mense staan hierso ((insinier arbeid kostes)) en die masjien staan stukkend. Ja, en die mense ook, opleiding. Dit is mos ook deel van AM?

R: Ja.

I: Ons sien dit elke jaar meer en meer, ons mense is nie baie hoog geskool nie, maar hulle moet weet van Pest Control, foreign objects, hoekom is dit belangrik hoekom jy nie mag kou ((verwys na bubble gum)) in die fabriek nie, hoekom is dit belangrik dat jy jou hande moet was...veiligheid, ons kry hope audits elke jaar, so dit raak al hoe meer belangriker dat jy die regte ouens in kry ((verwys na werkers)) en dat hulle die regte en goeie opleiding kry, die basics van food safety moet hy ken, en dan moet jy vir hom die koper klagtes verduidelik. As jy nou een papiertjie in 'n produk gooi (dan dink jy miskien dit is nie so ernstig nie), maar daai een papiertjie gaan na 'n man toe wat miskien R 50 miljoen se produkte by jou koop en nou besluit hy sommer net daar hy gaan nie meer die produk koop nie ((verloor kliënte so)).

R: Dink u AM sal voordelig wees vir die voedselindustrie?

I: Ja. Dit was miskien nie altyd so 'n algemene ding nie, maar deesdae raak dit. Die ouens is deesdae bereid om 'n ekstra paar miljoen rand in te sit vir maintenance. Okay onthou ek praat van assets - want dit is hoe ek dit ken - as die toerusting, maar nou die ander assets, soos jy genoem het die 'brand', die brand vir ons is baie belangrik. Koo was nou weer die jaar gewees as die nommer een brand, maar as hy nie meer nommer een raak nie, dink net hoeveel verloor jy aan jou inkomste. As die ouens nou moet se 'Wellington' maak lekkerder appels as 'Koo' ((lag)) - imagine? So dit is baie belangrik.

R: Hoe sal u voorstel kan senior management AM gebruik sonder om dit te oorkomplekseer?

I: Ekskuus, bedoel jy hoe ons 'n AMS sal kan gebruik?

R: Ja.

I: Dit is nou soos daai goedjies waarvan ons gepraat het netnou, opleiding en daai goed. En dan praat ons van gereelde maintenance van assets. Ons gebruik op die oomblik 'n DMS sisteem, wat vir jou presies sê wat elke masjien se kapasiteit is. Dit se vir jou dat dit het nou bv. 100 ure geloop, wat beteken dit is nou tyd dat hy gediens moet word. So ek dink dit is belangrik, jy kan nie net die ding laat loop tot hy gaan staan nie en dan eers die ding wil reg maak nie. Jy moet proaktief wees. Jy moet presies weet wanneer die masjien gediens moet word voor jy by sy verval datum moet kom. En ek glo dit is wat AM op die ou end vir jou gaan sê.

R: Ja heeltemal reg.

I: Hoe ons ons mense bestuur is belangrik. 'n Voorbeeld, dit is belangrik vir ons om die mense in die fabriek te kry, maar nou sê die unie vir ons ons moet nie so kwaai wees met ons mense nie, ons moet nie so streng wees nie, hulle sê "hulle het ook hulle regte, hulle wil ook kafee toe gaan, hulle wil ook toilette besoeke doen". Maar ons sê net "as jy wil toilette toe gaan, dan moet jy in die tyd gaan wat jy voor beperk is, anders gaan ons van jou tyd vat". So dan doen ons dit nie, dan kla die unie daar oor. Dan tipies wat gebeur is, die spanleier op die vloer moet uitloop vanuit die vloer en gaan soek waar is die mense wat rondloop want daar is nou 'n ander een wat ook nou wil toilette toe gaan. So dit raak heeltemal uit verband uit. Ek weet nou nie hoe jy AM daarvoor gaan kan gebruik nie, maar die bestuur van die mense is belangrik wat ons het ongeveer 'n 1000 mense op 'n appelkoos skof. So ons mense speel nogal 'n groot rol in die hele storie ((verwys na die organisasie)).

R: Dink u dat om standarde te integreer 'n moontlike oplossing sou wees om AM te gebruik?

I: Watter standarde?

R: Enige standarde relevant tot voedselkwaliteit of voedselveiligheid, aangesien AM baie oorvleuel met baie departemente?

I: Ja, definitief. Dan praat ek nou somer van Pest Control wat deel is van ons kwaliteit standaard is. Omrede dat ons fabriek oud is (die dakke is stukkend, die geute is stukkend) kom daar peste in ons fabriek in (hier is duiwe in die fabriek, die rotte kom in die afvoer water sisteme op). So ja, as ons praat van die kwaliteit van die finale produk, hier was al kopers gewees wat glad nie wou gehad het ons moet meer vir hulle produkte produseer nie want ons dakke is nog van asbes byvoorbeeld. ((uhm)) Dan die aircon sisteem, as dit nie ordentlik werk nie sit ons met besoedelde lug binne in die fabriek dan kry jy swart stukkie wat direk in jou finale produk in kom. Dan kry ons ook koper klagtes, die produkte wat ons uitvoer word eers geïnspekteer deur PPECB (dit is ons land se kwaliteit buro). Produkte wan nie aan hulle standarde voldoen nie word nie toe gelaat om uitgevoer te word nie. So hulle stop jou eenvoudig as hulle iets nie reg vind nie of iets snaaks vind in die produk, dan mag jy net doodeenvoudig nie uitvoer nie. En as hulle nie vir jou 'n sertifikaat gee nie is daar geen manier dat die produk uitgevoer (of op die trokke gesit) word nie.

R: Ekskuus, waarvoor staan PPECB?

I: Dit is die Perishable Product Export Control Board.

R: Met verwysing tot die holistiese sisteem van julle voedselkwaliteit en voedselveiligheids sisteem, waar dink u sal AM goed in pas?

I: ((Dink lank)) Die goed gaan so hand aan hand. Jou hele struktuur van jou fabriek het op die ou end te doen met die kwaliteit. So val jou struktuur uit mekaar uit dan het jy nie 'n produk nie. As jy nie masjinerie het nie, dan het jy nie 'n produk nie. As jou masjinerie nie werk nie, dan raak jou arbeid te duur. Ek hammer nou aanmekaar op dieselfde goed, maar ek praat nou net oor die goed wat vir my belangrik is.

R: Ja nee dit is doodreg, ek wil graag u opinie beter verstaan. Dit help my baie.

R: Met watter spesifieke voedselkwaliteit en voedselveiligheid standarde stel u voor moet AM mee geïntegreer word?

I: Ons hoof sisteem wat ons het is HACCP (wat nou voedselveiligheid is). As ons nie HACCP het nie, dan mag ons nie uitvoer nie. Maar HACCP kyk mos nou net na jou voedselveiligheids gedeelte. Die ander standarde is jou IFS en BRC (British Retail Consortium). As jy IFS (International Food Standards) het, dan is jy veronderstel om, of is jou plek geskik om voedselprodukte voor te berei. Maar dan kom die Engelse ouens, hulle sê dan "nee, ons aanvaar nie IFS nie" en "ons mag nie daai sisteem hê nie" ons moet BRC eerder hê. Dit is baie na aan dieselfde. Soos bv. Is jou blikke toe?, geen vreemde voorwerpe mag in die produk wees

nie, is daar oorhoofse beskerming?, het die mense PPE ((verwys na oor pluïesies))?, was die mense hulle hande gedurig as hulle in kom?, het jy 'n pest control sisteem in plek? Nou praat ek myself deurmekaar, wat was jou vraag nou weer? ((Lag)).

R: Met watter spesifieke voedselkwaliteit en voedselveiligheid standarde stel u voor moet AM mee geïntegreer word?

I: Ons het geen ISO standaard nie, maar die enigste ISO ding wat ons doen is die Environmental standaard. Die spesifieke standaard moes ons binne ses maande voldoen aan, en gelukkig het ons hom geslaag met 95% ((praat van na dit geouditeer was)). Al daai voedsel standarde, buiten die HACCP sisteem want die HACCP sisteem is baie spesifiek gerig op die voedsel, maar die ander twee (die IFS en BRC) gaan nie meer net oor voedsel nie dit gaan ook oor mense regte en veiligheid, soos bv die health and safety standarde. Ons het nou bv. van daai oudits gedoen, toe staan daar een van ons IT manne en doen sy werk (ons worrie toe mos nie oor hom nie, hy doen net sy werk - hy was besig om 'n rekenaar kabel in te trek), maar toe was die ouditeer vreeslik bekommerd dat die IT ou op 'n leer staan sonder harnasse, toe het hy op die ou end vir ons 'n fining gegee. Toe besef ek dat health and safety raak al hoe meer belangrik. So AM kan daarin ook 'n baie groot rol speel, in jou environmental. ((Dink)). Ons sit met ou toerusting die goed lek water, ons hersirkuleer nie ons water nie...ons gebruik in seisoen tyd (tussen die twee fabriek saam) ongeveer 120 L/s water en daai water gaan net af by die drein. As ons die perskes klaar gewas het, dan gaan daardie skoon water af in die drein af. Dit is maar 'n klein persentasie wat ons in die stroop sit, al die res van die water word gebruik om die produk mee te was (was en voer water). So dit is die tipe van goed waarna ons moet begin kyk want hulle gaan begin druk op ons sit om energie te begin bespaar. So ek dink jou AM gaan jou baie help in jou environmental ook en om energie te bespaar. Byvoorbeeld met die krag onderbrekings, het hulle vir hierdie fabriek van ons uitgesluit uit die beurt krag uit. So as die dorp se krag af gaan, bly hierdie fabriek se krag aan. Dit is lekker vir ons, maar dit is net tot Mei maand volgende jaar toe. Nou het hulle weer briewe geskryf vir EKSOM en mooi gevra of ons weer uit beurt krag uitgesluit kan word, maar toe sê hulle vir ons nee en vra waar ons krag kan spaar. Daarna kan ons eers weer praat en weer vra vir uitsondering. Die krag onderbreking is eintlik nogal krities, want sê nou maar die krag onderbreking begin 8h, dan moet ons alreeds 6h stop sodat die mense al 7h uit die fabriek uit is. So wanneer die blikke in die koker kan ingaan is eers 8h, dus verloor jy 2 ure voor die tyd. Dan verloor jy 2 ure tydens die krag onderbreking. As jy dan weer begin nadat die krag weer aan is, dan is die boilers koud, dan moet daar van vooraf weer steenkool ingegooi word sodat dit weer warm kan word, so dit wat so 'n uur en 'n half. So vir elke beurtkrag verloor ons 5 en 'n half ure. Jy gebruik meer krag per produk, wanneer jy vanoggend opgestart het, moet jy later weer opstart nadat die krag afgegaan het. So dit is tye wat die boilers loop maar jy het nie produk in jou proses nie.

R: Hoe stel u voor moet AM geïntegreer word om voordelig te wees vir die reeds bestaande standarde?

I: Soos ek dit sien, as jy jou AM toepas, spreek jy elkgeval op die ou end al die ander goeters ook aan. So dit is nie los staande nie, die een is deel van die ander een. Dit is soos 'n PRP's, jy moet die een hê om die ander een te kan doen. So, hulle oorvleuel mekaar. So as jy kyk na die klousules van standarde, dan kyk jy waar pas die ander een by so jy kry dan outomaties die ander een ook.

R: Wat klassifiseer u as 'n bate 'asset' in konteks met die voedselindustrie?

I: Nou sien, jy het my baie geleer van assets. Maar as ek praat van 'n asset, dan praat ek van die strukture en toerusting. Ek het nooit gedink aan mense nie, ek het nooit gedink aan hulle as assets nie. Hoekom ek dit sê, as jy praat van AM, word daar eintlik by ons gepraat van as engineering. En engineering het niks met mense te doen nie. Engineering stel net die sisteem op en beplan die asset bestuur vir die volgende jaar. Dan sê hulle vir produksie "julle sê vir ons hoe gaan julle jul produkte goedkoper maak, hoe gaan julle jul proses verbeter?". En op die ou end kry jy proses verbetering as jy AM toegepas het, dan kry jy proses verbetering. Maar ons het meer gepraat oor waar kan ons die arbeid sny ((hy insinueer hulle het nie goeie beplanning gedoen nie, het gedink om die arbeid te sny is die enigste opsie)). Arbeidsbestuur en AM het ons apart gesien.

R: Bedoel u dat AM word reeds geïmplementeer in die voedselindustrie sonder dat dit geklassifiseer word as AM?

I: Ja definitief. Ja ons doen dit, ons noem dit net nie AM nie. Ons doen nie beplanning nie. Dit is iets wat gedoen word om net gedoen te word. Kyk, as jy buitentoe kyk ((wys na die masjiene wat buite lê) dan sal jy die masjiene sien lê. Dit sal nou tipies deel word van AM, die masjiene word uitgehaal, dit word oor gedoen, kyk watse parte moet vervang word. Asook, ons gaan nou die 1ste Oktober al ons mense kry sodat ons 'n sessie van 3 weke lank met hulle het waar ons met hulle praat van food safety, health and safety en koper klagtes ((kliënte ontevredenheid)), die kliniek suster kom in en praat van hulle kant af wat hulle verwag van die mense, die risk control mense kom praat met hulle, die lone kantoor kom praat met hulle, die klere afdelings, die engineering kom praat ook met hulle. Ons noem dit nou nie regtig AM, maar ek glo

dit is wat AM ook op die ou end van die dag is.

R: Dink u dat bestuur vind dit moeilik om 'n konneksie te maak tussen die onderhoud bestuur van masjinerie en verbeterde kwaliteit prestasies?

I: Nee ek dink nie hulle sien of verstaan dit nie. Ek dink hulle weet dit goed. By ons kom daar net die probleem in...“dit is die capex wat ons wil insit, dit is die verbeterings wat ons wil doen, maar dit gaan ons nou sê nou maar R 14 miljoen kos”. Okay daar is goeters waar as ons nie nou die masjien gaan reg maak nie of nou onmiddellik vervang nie, dan gaan dit verwaarloos en deur die vloer val. So daar is sulke goeters ook. Maar die gros van die goeters is, is om die goed beter en vinniger te doen. ((uhm)) maar as die ouens terug kom en sê ons het net R 10 miljoen (dit is al wat daar is) dan kan ons niks daaraan doen. So ons weet dit, maar ons aanvaar net die goeters wat ons nie soms kan kry nie. Dit gaan meeste van die kere oor finansies - finansiële druk, veral in die tyd waarin ons nou is en veral in die tipe bedryf waarin ons is. Mense koop nie sommer 'n blikkie perskes as hulle honger is nie, miskien 'n bietjie boelie beef ja ((lag, maak 'n grappie)). Ek werk al hier van 1992 af, en ek kan nog nie onthou waar daar 'n goeie jaar was nie, dit was nog altyd dat ons dit net-net maak, of daai gevoel van “ons gaan dit nie maak nie” of “ja geluk julle het dit gemaak maar nou sal julle moet uithaal en wys”. Ons wins grens is baie laag. As jy jou geld gaan belê in die bank gaan dit baie meer wees as wat jy dit sou belê het by ons. Ons aandeelhouers raak ook al bekommerd. So ons speel op so 'n klein grens waarop ons 'survive'. As daar netsoveel geldjies is om die assets mee aan te spreek, dan moet ons dit maar so aanvaar. Ons het verlede jaar gesê ons wil al die mense op busse laai en vat vir opleiding, toe dood eenvoudig sê hulle vir ons daar is nie geld vir opleiding nie. So, dit is nie dat ons nie gedink het dit is belangrik nie, die finansies is net nie daar ((hy verwys na die maintenance van masjiene asook die mense)).

R: Dink u daar is 'n kommunikasie gaping tussen die twee departemente (maintenance en kwaliteit)?

I: Nee. Ek sou nie sê daar is 'n kommunikasie gaping nie, elke ou het sy eie sterk punte. So ek gaan sterker op kwaliteit wees as die engineering (maintenance) ouens. Maar hy weet goed wat word verwag, m.a.w. hy doen dit om ons tevrede te stel. So dit gaan maar oor goeie kommunikasie - ons kan nie insinuer dat hy nie weet wat aangaan nie. Dit gaan daaroor hoe betrek jy daardie ou in die proses en hoe leer jy hom om dit te doen.

R: Verstaan maintenance dat vir elke aksie wat hulle doen is daar 'n reaksie op die produk kwaliteit is?

I: Kom ek verduidelik vir jou wat hulle nie altyd besef nie. As ek nou maintenance moes doen, dan sou ek seker ook so optree, maar...((gee voorbeeld)) Hier loop 'n band met vrugte en hier breek 'n apparaat, daai ou se werk is om onmiddellik die ding reg te kom maak. So nou sal hy met sy 'greese voete' op die band klim en bo-op die vrugte klim en die masjien reg maak. Natuurlik verstaan ons mos nie dit nie ((verwys na kwaliteit)), hoe verstaan hy nie dat die 'greese' moontlik nou in die produk kan kom nie? Maar ((uhm)) weereens dink ek nie dit is dat hy dit nie verstaan nie, ek dink net hy is gefokus om sy werk reg te doen. Okay, miskien is daar tog 'n gaping...((dink)) want as kwaliteit vir hom 'n prioriteit was dan sou hy mos dit nie so gedoen het nie? Dan sou hy ook mos miskien daarin gedink het om te se “oraait kom ons gooi die lyn toe, en verwyder die vrugte eers”? So ja, daar is dan verseker 'n leemte. Die maintenance ou is gefokus op sy werk, en sien nie die skade wat dit aan die produk doen nie.

R: Glo u dat die bestuursbeginsels (soos genoem in die ISO 9001) is belangrik vir die implementering en onderhoud van 'n bestuurstelsel?

I: Ja. Dit is ook belangrik. Soos bv., die “20 keys” wat ook 'n Japanese program is, maar om die lang storie kort te maak, dit is gebruik om die proses vinniger, beter en goedkoper te maak. Soos bv. Een van die keys sal wees quality control, die ander key sal wees om INVOCOMS te hou (vergaderings te hou met die mense), die ander key is sorting (gooi weg wat jy nie nodig het nie, sorg dat jou lessenaar netjies is, sorg dat elke ding op sy plek moet wees). Maar okay, dit is nou die 20 keys. Ons het ook sekere wette, bv. ons mag nie invoices teken van meer as R 5000 nie (dit is wet so jy mag jou nie skuldig maak daar aan nie), of daar saal ook staan dat alle brandings verkope gaan net deur die executive...maar okay, ek dink nou nie dit is deel van ons bestuursbeginsels nie.

I: Maar ja. Dit is belangrik om die besuursbeginsels in plek te hê.

R: Dink u dit moet in plek wees voor enige ander sisteme in geïmplementeer word?

I: Ja. As jy nie die beginsels het nie...ons top bestuurder se altyd vir ons ons moet fokus op ons MBO's (Management by Objectives). So as jy nie daardie goed het nie, as jy nie daardie basiese goed het nie, of daardie raamwerk het nie, dan gaan daar geen ander sisteem wat jy moet toepas reg geïmplementeer word

As ons nie aan die standaarde voldoen nie, dan vat hulle nie ons produk nie. As ek nou praat van BRC (al koop die Engelse net ‘n bietjie produk by ons) is die mense vreeslik vol nonsens. Hulle koop ‘n aantal containers by jou (so hulle bestellings is reeds gedoen), dan het ons reeds die goed gemaak en al die goed op die boot gelaai. Dan sal hulle bv. Vir ons sê: “alles wat ons het, maar die wat in die stoor staan of op die water is stel ons nie aan belang nie want dit voldoen nie aan die BRC standaard nie”. Nou gaan al daardie produkte verlore. Tot ons sisteme nie reg is nie of tot ons nie voldoen aan daardie standaard nie of doen wat hulle wil hê nie, gaan hulle nie die produk aanvaar nie. Hulle is baie baie streng.

I: Hier het so ‘n rukkies terug ‘n man gekom en was verskriklik krities oor baie goedjies soos stof ens. Hy het in ons stookkamer in gegaan (‘n plek waar niemand regtig meer gaan nie) en gekla oor goed wat op die grond staan, gekla oor die stof en als. Hy het ons erg “gefne”. Aan die begin het ons gedink die man is baie simpel, maar op die ou end was dit vir ons ‘n “eye opener”. As dit nou is wat hulle wil hê, dan doen ons dit nou maar so. Op die ou end was dit vir ons ‘n leerskool, so ons het verbeteringe daarop gedoen en dan beweeg ons net weer aan. Ons probeer “survive”.

The interview ends with formalities; thanking the interviewee for his time and insight.

B.5.6 Interview with Sam

Researcher (R) and Sam (S): Welcoming and introduction...

R: Is there any questions or uncertainties regarding this brief introduction of AM which I should know of or you would wish to elaborate upon?

S: No. When I’ve read through your letter of consent yesterday, it was a bit confusing, but know that you have introduced me with AM, everything makes complete sense.

Researcher continues with the interview...

R: Do you think AM could possibly help overcome the competitive pressure of producing high-quality food products?

T: Yes it would.

R: Could you please explain why you said that?

S: Because in terms of us ((referring his organisation)) if we do not exactly know which machines are we going to use and when we are going to use them, by that time, before we start using the machines that machine has to be prepared well in advance. We are supposed to maintain them and we are supposed to make sure that those machines are fixed and ready. We need well trained and skilled people to operate those machines.

R: So you would suggest that people need to be trained regarding AM?

S: Yes the people must be trained, because people need to be highly skilled to operate high technology machines otherwise they won’t be able to use the full capacity of the machine and equipment.

R: Do you think AM would be beneficial to the food industry?

S: Yes.

R: How would you suggest to the food industry how they could use AM without over-complicating the system?

S: Okay, we are currently using standards such as BRC and IFS (but we are not using ISO). So BRC is focused on food, but the AM is not focussing on the food itself. So doing that, you will be having a specific standard that are overall looking at your equipment and facilities.

R: Does that currently exist?

S: No, not at the moment. We are only implementing BRC who are only focussing on our food safety. So we do not have anything that looks after or focusses on our overall facilities and equipment.

R: Are you perhaps suggesting that such a system could be integrated with your existing standards?

S: Yes. It would be better be integrated with our existing standards. But, if we want to implement it, we would first have to implement it as a separate standard alone. First run it and understand how it works and then if we would have to incorporate it with our food standards we could understand it better and find ways were we could implement it with our food safety standards.

R: When concerned with the holistic system of food quality and food safety, where would you suggests AM to be integrated within the existing TQM system?

S: Your employees. Your employees needs to first understand what is needed from them. If the employees are only focussing on food safety, what would be the implication of implementing AM to them? What other equipment, what other machineries should they equip with to arrive at that vision? ((Suggesting that you should explain to them the objective and reason for why you are implementing AM)) Explain to them that because food safety is not just about having a good product but it is about investing in good machines too. The people need to understand what they are doing and how they should work, or how they should look like when they enter the factory in terms of what they should wear to protect themselves and to protect the product as well.

R: With what relevant food quality and safety standards do you suggest AM should be aligned with?

S: In our systems, we have food safety standards, the BRC standards. Which are competing with the international world. So if we could align our BRC with AM then that would be beneficial, because then it would be easier to compete with the international world.

R: If you are implementing certificates that are GFSI approved, would that be better for the food industry?

S: Yes it would.

R: So would you suggest that the ISO 5500 should rather be aligned with those certificates that are GFSI approved?

S: It can be incorporated with those, but for big organisations or factories (such as we are) that compete globally, sometimes customers demand for specific standards compared to all the other standards ((This is why they use only BRC)). So you need to understand what your customer needs before you decide what standards to use.

R: How would you propose this alignment to be done in order to add extended benefits to your existing standards?

S: As I mentioned earlier, first run a prototype or a trial to see what results are obtained. If you are running it alone, you could later refer back to your existing standard and see where you could add on to your clauses of the existing standards if you would want to incorporate the new standard. So you might find areas where your existing standard already tough on the areas of the other standard. So maybe through this you will find that it is applicable to just use your food standard where you can incorporate certain or appropriate clauses of the AM standard to the existing clauses. Because you might find that running two separate standards who are speaking the same language. Like we did with HACCP and BRC. So we found that we were spending a lot of money on HACCP and BRC as two separate certificates, but why can't we rather incorporate HACCP into BRC and use it as one certificate since it speaks the same language. So this would be the same as in your case.

R: Okay thank you very much. In conclusion what you have just spoken about, do you suggest that it could maybe not be necessary to be ISO 55000 certified but rather use it as a support system?

S: To support the existing standards that we are working with? Yes definitely. In my view, that would be appropriate yes. To just check to see what is applicable to us and then incorporate it into the existing standards that we are working with.

R: What would you classify as a suitable asset with regard to the food industry?

S: Your typical assets would be your equipment. You will need to have good equipment (or high technology) equipment to produce a good quality and food safe product. You also need to have invest in your people.

You will need to have people who have the 'know how's' and people who have the skills to operate those machines. People who are working on the lines, they need to know what is a good product and what is not a good product. So by doing that you need to invest in the people and you need to train those people.

R: Do you think management find it difficult to connect maintenance management with quality performance?

S: To us or the way we are working here, yes, it is sometimes difficult. Sometimes it is not easy working in a factory like this to know exactly what machines was fixed and what machines are ready to operate. You often find that *Manager X* from the engineering side saying that the machines are ready were they actually are not. So we will be running production, but then later you realise your machines are not operating to its full effectiveness. It is not operating at full capacity.

R: Do you think that there is a communication gap between the quality and maintenance departments?

S: From my experience within this organisation, I would say yes, there is that gap.

R: Please could you give me an example of such a situation?

S: We had a problem with our baked beans. Line 9 was supposed to run baked beans at a temperature of 123°C. So, they ((referring to engineering)) prepared the line and gave as the go ahead to run production a week after. But when we started with production, we could not even reach the specified temperature of 123°C. But the engineering said that the machines are ready and instructed production to start with production quality? So the cooker was running at 112°C, but the machine could not reach 123°C as they have claimed it would be running. They said the steamers are ready, but on the day of production it took us approximately 2 hours downtime to start the line, whereas they ((referring to engineering)) said that the line is ready to run production. That is one of the problems that we had with poor communication. I would say that they should ask us ((referring to quality)) to come and check the machines and to check if they did a proper handover or to do a proper inspection before we proceed (to see if we are happy with it). But that is not how it was done. They just prepared it on their own and decided by themselves that the machines are fine and production may start.

R: Do you think that maintenance now the consequences of their action towards the quality of the food product?

S: From my view, I would say engineering do not know, no. They are only focussed on their work. Like, as long as the machine can reach the desired temperature, say 360°C, then that is fine by them then they say they have fixed the machine. As long as the machine do that after fixing it then the machine is fine ((referring that that is their way of thinking)). That is, that's all they care about. So whether that machine is appropriate to the type of food producing or what standards are applicable to the production of the food product or what is done to obtain a good quality product is not really relevant to them. I don't think that they are at that level.

R: Do you think AM could help overcome this type of communication gap?

S: Yes it can. If you could get your engineering side to understand and explain to them to work with them together with quality and production. And say to them that 'this' is the equipment that we have, and with 'this' equipment we want to achieve 'this' capacity and 'this' throughputs at the end of the day. And explain to them that those throughputs we have to reach using 'this' quality standard. Explain to them what they should understand about 'this' machine, then when they are operating this machine or fixing this machine they will be thinking in their mind what outcomes should be expected. They should be thinking about the outcome and the final product after fixing the machine and not just about fixing the machine alone. From there you can hand it over to production so that production could run the process. Then engineering has to understand the implications of quality and understand where they exactly fit in the whole cycle. Once they have fixed the machine, they should know the outcome of it.

S: All of us should share one vision. We all should be working at the same level, because at the end of the day we are all working together. We all work for the same company, and we all are here to offer a certain service to the company, so, the service must be that of a good service to the customer which are the consumer of the product. We have to generate a culture to share one vision. The main problem is that if we don't have one vision or one culture, you would have people who are pulling in different directions.

R: Do you believe that management principles should be evident in the implementation and maintenance of a management system?

S: Continues improvement, encouragement, teamwork and those type of stuff?

R: Yes.

S: Then yes it has to.

R: Why do you say that?

S: Those principles, you have to incorporate all of them into your standards. So, people need to be built on a solid team. So you need to have an environment where all people are working as a team. We need to focus on continuous improvement, so people need to understand the direction we are heading to. So if we are focussing on continuous improvement, the people need to exactly understand what they should do to achieve it as one factory. So this goes back to the one vision and one culture. For example, the one principle saying that we should be customer focused (saying what do our customer want), so we as a team need to understand what the customer wants and strive towards it as a team.

R: In what manner does management align their managing principles and responsibilities to the holistic management system of food quality and safety?

S: In the manner that we are working currently, at the start of every season, you have to call upon all your seasonal employees as well as permanent employees as all need to go through training or introductions explaining to them what are expected from them. We do all these introduction as the starting point, then from there on you do continuous training with all those people throughout the entire season. Because if you have introduced it to them at the beginning of the season, many people sometimes forget it throughout the rest of the season. So you constantly need to train those people and explain to them what the company's vision are and what our direction are and what is expected of them.

R: Do you think that these principles should be in place before any other systems are implemented?

S: Yes. Before you start anything else, you have to share these principles with the people. Before you start with anything, be sure to have structures in place before you start with anything else. If you want to run production, make sure that all certain requirements and expectations are met before production starts or before you do anything.

R: If the alignment between TQM and AM are successfully achieved on a strategic level, how would you suggest it to be practically achieved on an operational (day-to-day basis) level?

S: The day-to-day operational level is just a matter of including it in your day-to-day talks, your INVOCOMS. INVOCOMS are meetings that we have every morning or before we start with each shift where we talk with our people with things like what happened the day before. And also talking about what are we going to do going forward. So by then you will bring all the issues of the previous shift forward by discussing it with the people in the morning meetings before start-up of the shift. So you will talk about all the issues that you had, you'll talk about all the breakdowns and all the downtimes and what was the causes (was it machinery or was it the people or was it due to the availability of our raw materials) and then try to address all those problems that you had or the issues that we had (whether it was machines, people or availability of raw materials). So I would suggest that AM would go about the same manner. On a daily basis you will be talking about all those issue that we had before we start with a day's production. We will talk about what problems we had yesterdays and how are we going about to prevent it. With AM I presume that it would allow all parties to discuss together then it will be a lot easier to fix those problems.

R: Are you suggesting that your different parties are currently not necessarily in the same meetings?

S: No, there is different INVOCOM meetings for different departments. There is a meeting for production, quality and engineering separately but all at the same time. So I would suggest that you need to have that, all meetings should be held in the same room where all parties are included and all talking about their issues, and how are they then going about working today and to resolve the problems as a team. Because, now, we are not holistically addressing those issues. We have those meetings alone. So how is everybody going to know about all the different problems? All these problems are linked with each other? Are they now going to send email to one another? That's not very accurate. So this comes back to the communication gap that we've spoken about. We know about a problem for an example, but do we really know it was fixed accurately? We won't know, because nothing was communicated about that. That is a big problem that I find with the meetings. So I would say that we should have meetings that include all the different parties. So we should have 15 minute meetings to discuss all the problems that we had and how are

we going to solve them and what are we expected to achieve for the day. But again, this is a very big problem.

Researcher concludes the interview with concluding probes...

R: Is there any further comments that you would wish to add or is there anything that you think that I have missed but should be considered? (To contribute to the validity of the interview)

S: No. But to comment on AM itself as a standard, it is a new thing that need to be looked at. If we can have something like that and implement it, it could solve a lot of our problems that we currently have. We can run our production to that full effect if we really know what machines, what people, what raw materials need to be used for what, for which machines at what speeds and what temperatures. ((pause)) because you will find that your machines run and run your equipment (e.g. your cooker) at a specific temperature whereas you got a fruit which are off, which are softer in texture than you run the day before.

R: Sorry, I do not quite understand, could you please elaborate?

S: The fruit is not the same texture as the day before. Let's say that you run today a firm fruit, then the following day you receive fruit from the farmers are that of soft texture. But you will still run them at the same temperature, because on line 9 you are running peaches for an example. So if we can understand that if the guys...or if we have that standard ((referring to ISO 55000)) we will know what fruit we will run and know the fruit texture and know at what temperature to run the fruit and how are we going to run it properly. You can think about it, today we have good fruits run as received from the farmers, but then the following week the quality of the fruit is already deteriorating on the farms, so now the fruit that we are receiving is getting ripe too soon. So, it is not going to be as firm as the fruits as at the start of the season. So now how are you going to work with that? Are you going to run them at the same temperature as the fruits run at the start of the season? Are you going to run them at the same speed or what?

R: That is very interesting, do you improvise the speed or temperature if this type of error should occur?

S: Yes, sometimes we do. But it goes back to the communication problem. Us, from the quality side, we are like the 'police' of production. ((Laughs)) We do not run production, we only go and check if they are doing what they are supposed to do or are they doing it according to customer specifications or expectations or are they doing it according to what the quality standard is saying. So know if production doesn't communicate with us to say that "the product that we are running currently, the quality is deteriorating, or the product is not as firm as the previous batch", and still run it at normal temperature or normal speed. That causes a big problem, because you are going to have two different classes of products, one that is firm and the other is mushy. So two cans with the same product does not look the same, the quality differs, it deviates. Whereas, if you know what your machine can do and at what point you will need to access your machine or at what point you will need to access your raw materials, and adjust your cooker parameters, or your speed based on what your raw materials looks like. I'm telling you, this is a big problem. When we are running INVOCOMS, production just want to read throughputs and their throughputs will be met, but all the other parties will have a problem because the product is over cooked. But for production, they make up all their targets ((he is insinuating that the other parties such as quality gets blamed for the problem)). So by the end of the day, all the product at the warehouse is overcooked product, we cannot sell it.

R: What do you do with the product, do you just throw it away?

S: Sometimes we need to find a market who are willing to buy it, but it is not easy. Because we base our work on customer orders. If you are our customer, and you said that you need this season 20 pallets of peaches, you are going to give us your specifications and your requirements and then we will work 20 pallets based on your specifications and your requirements. So if we run and 10 pallets are okay and 10 are not, meaning you short ten. Then we need to cut somebody else's quantities to fill up the 10 pallets. Then you will have a problem with your product orders and outputs. You can't then meet up with what the customer required since we did not met the customer requirements, or because we did not follow on what the customer requested from us or we didn't work according to what the customer required from us. Within these types of situations, there is a lot of money lost and what are we going to do with that? But at the end of the day, the customer is still expecting what he/she ordered. They don't care what your problem is or what you are saying. If they place the order now, and then next year January we can't say to them that we can only give them 10 pallets instead of 20 that you ordered. ((Laughs)).

R: Just to clear what we are talking about, are you suggesting that the quality departments get blamed for these type of situations?

S: Very often, the quality departments get blamed for these type of situations or get blamed for everything. Here's another example ((showing two plastic bottle of canned peaches)). See, there is a foreign object in

the product. It contains one piece of pear which should not be there, it should only contain peaches. This happened when we started with production for the day, they started with running pears in the morning, and then after the break there were a changeover. So this is an example of changeover not done correctly. So now the plastic line where the products are put into the hoppers were not cleaned properly (the hoppers were not cleaned properly). There were still pieces of pears stuck at the bottom of the filler. So they just hosed the hopper, but did not open the bottom valve correctly. After doing hosing incorrectly, they started with the peaches production. The pears that were stuck, fell into the bottles. Luckily, the pears only fallen into the first layer of the first pallet of products so we only had to discard the first layer. All the bottles only had like only one pear in it so we could spot it easily. Luckily the second and third layer had nothing in it. ((Laugh)) And now, this is the quality department's fault, but, who was supposed to do changeover? It was supposed to be production. But we ((the quality department)) get blamed for it. So it comes back to what we said earlier, they are supposed to know how important quality actually is and how to do a proper changeover. And we do have a SOP (standard operating procedure) for hand-over. So if they did it according to the SOP, we did not have that problem. They were supposed to inspect the entire line to see if the line is clear. So if there is foreign objects found in the product, it's an indication that changeover wasn't done correctly.

R: Are the people trained for proper SOP's?

S: Yes they are trained. But these type of things still happen although training is a on the way thing. So it is a matter of discipline. We provide training every-day, but it still happens. So it is a problem. It's a matter of disciplining the people, if you don't have disciplined people, then these type of things will happen. It not like everyone don't know how to do proper changeover, they are trained on performing changeovers, or the team leaders or the quality controllers - they know that. So basically I'm saying that there should be a person responsible (like AM), there must somebody who is dedicated and who are going to sign off after each changeover and instruct that the line is ready to run another product. So we need someone who does a proper changeover and are responsible for it, not people from different parties doing it. It is hectic sometimes, we have 10 lines to check changeovers, sometimes the people ask "but where are we going to find the time to check each line?". But, I mean, we have close to 3000 staff, surely there must be one person who can be responsible for it? ((Laughs)).

S: But this is now a good example for what the quality department get blamed for every time. They did not even go to production with this problem, it went straight to us. But obviously was this not our problem? But know it's our problem, we have to deal with it. But again, I don't run production, but now I have to right a report to exactly explain what happened there. To investigate this, I have to go to production and find out exactly what happened on that time, draw their records at that time and see if there were early changeovers at that time. There was a changeover for an half an hour, a changeover from 11:30 until 12:00 and then production started at 12:00.

R: How long does a proper changeover take?

S: Normally, proper changeovers take up to an hour (depending on the product type). So obviously this was not done properly in this situations. Production are too focussed on making their throughputs and on time, they do not do these type of things properly.

S: This is a big problem. And now, these type of things are time consuming, time is lost, and money is lost. If this was more serious, the quality is lost, the brand would be lost, reputation as well. At the end, it's our image that are lost. Look ((showing the label of the product)) this product gets exported to Spar in Austria, can you imagine the consequences? If we released this product with foreign objects in and shipped it to Austria, the customer that side finds this, they are not going to be happy - they will reject all the product. Now, we already booked the vessel that was transport from here to cape town where there is a container booked on the ship to Austria - and then as the product gets there, they just say "no, we did not order peaches with extra added pears". ((Laughs)) No.

R: That is interesting.

S: The customer paid for the booked container (the space in the container) on the ship. If he buys everything, and the product reached its destination and the customer found that it is not what he ordered, he/she is going to reject it. But who is going to pay for that container now? It's going to be us, because we did not give him what he ordered from us. Now we are sitting with a product that can't be sold. This product was produced, can you imagine the cost of producing this, how many people was involved in making this bottle - all these people had to be paid. Also, electricity, raw materials, packaging, all those stuff... Now we can't sell this to anyone, we can't even cover this bottle with a label and hoping that nobody is going to see it, because if the consumer would find eating a pear were its supposed to be peaches would be catastrophic. And this is a whole new problem again.

S: So if you have people who don't know what the business goes through or know the loss of quality of these type of problems, it becomes very difficult to manage. They should know exactly what the company goes through in these type of situations. There is a lot of money lost in the process, so if you don't have people who understand this, then we have a problem. You will always have a problem. ((Thinking)) Your machines have to be at that level of preventing these type of issues. I know that many other companies invest in machines that detect foreign objects during production, then if a foreign object is detected the production stops immediately from which the people can clear the problem. Those machines are programmed according to the product types, and then it detects the foreign objects. So if you could invest in these type of things, you will save a lot of money at the end.

R: Yes I understand.

S: So, I think AM could help change the mentality of people so that they could realise the implications of these type of problems. We need to get an understanding between all departments. To fix this problem we should let all parties in the come together (from production, engineering, quality, etc.). We should train them on how to properly operate a machine. Also trained on food safety, food quality and on what the final production should look like. So I think AM will help, it will bring all the parties together.

The interview ends with formalities; thanking the interviewee for his time and insight.

B.5.7 Interview with Ella

Researcher (R) and Ella (E): Welcoming and introduction...

R: Is daar enige vrae of enige onsekerheid rakend die kort inleiding van AM wat u het of graag daarop sal wil uitbrei?

E: Nee ek dink ek is okay, as ek vrae het tydens die onderhoud sal ek jou vra. Baie dankie.

Researcher continues with the interview...

R: Dink u AM sal die voedselindustrie help om hoë gehalte voedsel produkte te lewer, om by te bly by die mark neigings?

E: Ja definitief. Ek dink in 'n mate doen mens dit al klaar, maar nie noodwendig in die regte struktuur altyd nie. Kyk, jou assets word al klaar bestuur. Daar is klaar 'n proses en leeftyd aan dit. Dit is maar wat ons ingenieurs doen. Ek dink net nie daar is 'n ordentlike struktuur om dit te doen nie.

R: Watter voordele dink u sal AM tot die voedselindustrie kan inbring?

E: Ek wil eers begin met jou geboue en al daai dinge. Ek dink as daar 'n beter struktuur van bestuur sal wees (soos hoe om daai deel te bestuur) volgens watse termyn jy dit doen - in daai vlak sal ek sê AM sal baie help mee. Soos bv. Ons huur van ons geboue, ons maak verskriklik baie restourasies en knap die geboue op volgens seker standaarde wat ons volg en ons maak seker ons voldoen aan HACCP en al die ander ISO standaarde. So sou dit nie dalk beter gewees het om equipment bestuur ook daarop by gesit het nie? Of sou dit nie beter gewees het om die gebou te koop op daai opsig nie? Op watter punt maak jy die besluit of hoe verander jy dit of op watter punt maak jy die besluit om iets anders te doen? En dan as ons praat van equipment, ek dink tussen mense wat insluit jou werkers vs training vs equipment ((uhm)) is dit ook baie belangrik. Want, jy lei iemand op, hy werk daaraan en gaan werk. Nou sit jy met daai gap om te vul, jy druk iemand anders daarin en dan verduidelik jy vir hom die paar dinge om te doen wat gebruik hy vir produksie. Ons het apparate wat al baie lank by ons is (wat 'n baie lang life span het), ons is al amper gewoond daaraan of ons het 'groot' geword met dit vs ander wat weer tussenin staan wat almal taamlik nuut is. So om vir ons te werk op 'n equipment wat nuut is en te verseker dit funksioneer optimaal tydens 'n oudit. So enigiets wat kan help om daai optimum te kry sal voordelig wees.

R: Ekskuus, ek volg nie nou so mooi nie. Stel u voor dat die gap van mense en training en equipment moet gevul word?

E: Ja jy het jou strukture en equipment wat almal verskillende ouderdomme is, die een kan dalk nie vinniger loop as die ander een nie want die een is so tegnologie goed maar jy kan hom nie gebruik tot sy optimale nie. So tussen al die dinge wat jy het waar kry jy jou optimale, plus dan jou menslike kant, die training - is die mense goed genoeg opgelei om dit te kan werk. So dit bly eintlik 'n menslike faktor ook die heeltyd as jy verstaan wat ek bedoel.

R: Om af te sluit wat ons nou bespreek het, stem u saam dat AM wel voordelig sal wees vir die voedselindustrie?

E: Soos dit vir my klink, ja ek dink so.

R: Met verwysing tot die holistiese sisteem van julle voedselkwaliteit en voedselveiligheids sisteem, waar dink u sal AM goed in pas?

E: Ons voedselsisteme word opgebreek in 32 operasionele standaarde waar factory management in ag geneem word, daar is ook sekere ander standaarde wat equipment en maintenance dinge adresseer. Ek sou sê AM sal goed inval tussen kwaliteit en ingenieurs juis omdat dit vir my klink asof jy AM moet generies kan beheer maar met jou kwaliteit want jy sal dit nie alleen vir 'n ingenieur kan gee nie want hy sal gaan daarop om teoreties dit te bestuur maar nie noodwendig soos in kwaliteit waar teorie nie altyd die antwoord sou wees nie. Soos bv. Die kwaliteit gedeelte moet fisies kyk wat gebeur en watter specs inkom en hoe jy dit gaan verander so jy gaan altyd 'n descriptancy wees wat jy vandag gaan doen of more gaan doen. So daar moet altyd 'n kwaliteit oog teenwoordig wees.

R: Dink u dit sal relevant wees om ISO 55000 te integreer met die voedselstandaarde eerder as om dit apart te implementeer omdat dit 'n groot en holistiese sisteem op sy eie is?

E: Ek is nie seker hoe ander maatskappye werk nie, maar by ons probeer ons al die standaarde as een sisteem te integreer, maak nie saak of dit ISO of HACCP of die ekstra ((Company 7)) global strukture wat ons het probeer ons om dit as in een sisteem te integreer. So alles wat hier by kom wat of wat die ouditeure vra om by te voeg probeer ons in een sisteem te sit. So, enige iets wat ons ekstra sal wil implementeer sal ek sê ja ons moet dit in een sisteem te probeer integreer.

R: Kan u dit dalk vir my verduidelik met behulp van 'n voorbeeld asb.?

E: Ons het 'n 'Name Arbitrary Global Quality Management System' wat opgebreek word in die 32 standaarde waarvolgens sekere departemente afhanklik is vir sekere afdelings. Soos kwaliteit sal seker die AM verantwoordelikheid dra, R&D sal byvoorbeeld verantwoordelik wees vir die spesifikasies van die produk asook spesifikasies vir resepte en alles in verband met NPD (New Product Development). Ander tipe dinge sal wees jou glase en plastiek en dan die calibration of equipment en maintenance van equipment - dit sal tipies lê by jou kwaliteit of ingenieurs. Jy het klaar jou 'hokkies' van dinge. So enigiets wat nuuts in kom kategoriseer ons in die beste 'hokkie' waarin dit kan inpas. So ons sal dit nie by sit nie, maar ons sal dit inkorporeer waar dit die beste sal inpas.

R: So daardie 'hokkies' waarvan u gepraat het, is dit standaarde wat gesertifiseerd is?

E: As ons byvoorbeeld 'n oudit kry wat fokus op voedselveiligheid - en voedselveiligheid alleen sal nie al ons standaarde dek nie maar ons haal uit wat hulle spesifiek voor vra, dit is maar net ons groepering. So as HACCP kom haal ons sê nou maar sewe of agt verskillende goed of inligting uit wat hulle nodig het wat ons aan hulle dan kan verduidelik. Maar dit is hoe ons ons hele ISO sisteem bou. So alles word gefile volgens waar dit moet wees. Soos bv. as dit kalibrasie is dan het jy jou sertifikasie daar dan het jy alles onder kalibrasie - dit sluit in als van al jou lab equipment, jou fabriek apparate of enige iets wat binne in jou apparate gekalibreer moet word. So in daai geval werk kwaliteit en ingenieurs saam net om te sê hulle is accountable. Maar hulle weet nie altyd van mekaar nie. So as daar 'n ouditeer kom, kan jy net in daai 'hokkie' gaan kyk om te sien of als reg is, jy hoef nie noodwendig te gaan kyk of presies te verwys na die standaard nie. Solank daardie 'hokkie' net die inligting gee wat dit moet. Enige iets anders wat dan sal by kom sal iewers daar in pas. So op die ou en sal mens tipies gaan kyk waar die dele by mekaar in pas of overlap. Kyk ek is nou nie seker wat alles in ISO 55000 staan nie maar soos ek aanneem vervang dit nie 'n ander standaard nie neh? Of doen dit?

R: Nee dit vervang niks nie, maar dit is gebaseer op die ISO 9000 standaard of dit volg die tipiese bou blokke soos gevind in die ISO 9000 standaard.

E: Dan as hy 'n ISO 9000 agtergrond het, sal dit baie maklik inpas in wat ons reeds het. So ja, dan sal dit verseker maklik inpas in ons huidige sisteme en standaarde. Lang storie kort, ons sal dan tipies die ISO 55000 standaard inkorporeer in ons sisteem en nie hanteer as 'n standaard op sy eie nie.

R: As julle sertifisering doen, julle as industrie sê vir die ouditeurs julle voldoen aan 'n sekere standaard, maar hulle gaan nie fisies af met die standaard en kyk of hulle elke klousules na gekom het nie reg?

E: Kyk hulle oudit nie ons standaard (of ons 'management system') nie, hulle oudit die standaard waarop jy die sertifikaat gekry het. So hulle kom met HACCP of FSSC, dan wat hulle soek van ons, is iewers

geïntegreer in ons sisteem of proses. Al sit ons nie alles agter mekaar (van A tot Z) soos wat hulle dit soek nie, het ons wel alles, intedeel, ons het dalk meer ook.

R: Baie dankie. Dink u die ISO 55000 sal die voedsel standaarde kan ondersteun?

E: Enige iets wat 'n improvement is, sal natuurlik dit kan ondersteun. Ek dink net die nodige voedselinsigting moet net nie minder raak nie, mens moet steeds al jou gewone voedsel standaarde en dinge in plek hê...solank dit net nie beïnvloed word nie.

R: M.a.w. is dit reg as ek sou sê AM sal 'n 'add on' wees tot die reeds bestaande voedsel standaarde?

E: Ja.

R: Met watter spesifieke voedselkwaliteit en voedselveiligheid standaarde stel u voor moet AM mee geïntegreer word?

E: Dit is moeilik om te sê, omdat ek nie so goed AM ken nie.

R: Nee dit is dood reg, geen probleem nie.

R: Dink u dit is beter vir die voedselindustrie om standaarde te implementeer wat GFSI aanbeveel is?

E: Ja en nee. Ons het al agter gekom...in *Company Name Arbitrary*, as ons begin met 'n nuwe verskaffer, sal ons organisasie self die verskaffer gaan audit. Sommige verskaffers hoef nie in te kom nie, omdat ons al die standaarde het. Maar dit is vir ons organisasie verpligtend om die verskaffer te audit om te kyk waar is X, Y en Z. So daar is 'n gap vir 'n sertifikasie kry en wat is eintlik nodig. So ja dit sal goed wees om dit te kan hê. Maar hoe seker is jy as een audit gedoen is, al die goed is regtig en eerlik agter mekaar want 'n mens kan baie vinnig iets voorgee wat nie daar is nie. So partykeer is dit goed as 'n eksterne party vir jou kan audit om te kyk of al ons goed voldoen, dan is dit goed want dan kan jy sê julle gee niks voor wat nie daar is nie. Ek dink dit is een van die groot redes hoekom ons organisasie ook self ingaan en die verskaffers te gaan audit omdat daar nie 'n 100% sekerheid is wat 'n eksterne party sertifikasie is om te sê dat hulle voldoen aan alles wat ons van hulle vereis nie.

R: Okay goed baie dankie. Hoe stel u voor sal so 'n tipe integrasie lyk as AM inkorporeer word in so 'n tipe sisteem wat julle het? Sal mens kyk waar die klousules by mekaar oorvleuel en dan so dit by mekaar integreer?

E: Ja dit sal so werk. Dit sal nie in een standaard op eindig nie. Dit sal tien teen een oor 'n paar standaarde oorvleuel. Jy sal dit moet opbreek. Dit sal oor verskeie aspekte oorvleuel, ek glo wel baie van dit sal by die ingenieurs wees.

R: Dink u dat bestuur vind dit moeilik om 'n konneksie te maak tussen die onderhoud bestuur van masjinerie en verbeterde kwaliteit prestasies? m.a.w. dink u daar is 'n kommunikasie gaping tussen die twee departemente?

E: Ja, maar dit hang af van maatskappy tot maatskappy. Ek glo almal het maar hulle kommunikasie gapings want kwaliteit en ingenieurs het verskillende mindsets van hoe goed werk. Ek praat nou uit ondervinding uit, ons sal bv. vanuit 'n voedseltegnoloog kant - goed beplan, drafts doen...jy het 'n tipiese idee van hoe om goed moet vloei en hoe goed moet werk. Dan kom die ingenieurs, en stel weer voor 'n heeltemal anderste manier hoe om dit te doen. So daar is 'n heeltemal anderste manier van dink, so daar kan kommunikasie gapings wees. Ek dink dit hang af van jou span. Jy kry die ingenieurs wat meer teoreties en struktuur georiënteerd is waar hulle hul eie manier het van dinge doen; en dan kry jy die ander mense wat weer meer prakties en verbaal is. So ek dink dit is 'n persoonlike ding, of kultuur verskille.

R: Dink u dat maintenance besef dat elke aksie wat hulle doen het 'n reaksie of nagevolg op die kwaliteit van die produk?

E: Nee. Dit is weer 'n persoonlike ding. Dit hang af hoe lank hulle al werk vir die organisasie en hoe baie hulle ingetrek is in quality training sessions en dinge soos daai. Ons het nou onlangs 'n scenario gehad waar ons 'n spesifieke proses het wat hulle besluit het hulle kan taamlik kwaliteit spaar as hulle nie die produk afkoel tydens vulling bv. En by dit punt waar hulle uiteindelik vir R&D gesê het hulle moet aanboord kom, het dit op die ou end uitgekom dat die kwaliteit en die eienskappe van die produk gaan heeltemal verander as hulle nie die produk binne 5 min afkoel nie en vir 'n halfuur laat staan nie. So ja daar kan kommunikasie gapings wees en dit is baie belangrik dat departemente betrokke is by mekaar se vergaderings en met mekaar

kommunikeer (al voel dit soos tydmors). 'n Ingenieur kyk na die praktiese kant van die proses om dit makliker te maak, maar so kan dit die karakter eienskap van die produk verander as hulle nie heeltemal seker is wat die proses van die produk als behels nie (daar is 'n rede hoekom daardie produk eers moet afkoel en 'n rus periode ondergaan). Dit gaan nie net oor produksie nie, daar is baie ander faktore wat 'n groot rol speel op die finale produk. So as R&D vroeg genoeg aan board is en presies weet wat dit is wat die ingenieur wil doen vs dit is die tipe produk waarmee ons sit en die eienskappe van die produk aan hulle verduidelik sal sulke tipe goed nie gebeur nie. Kommunikasie is baie belangrik, en ja daar is 'n gaping. Baie keer word die inligting nie vroeg genoeg aan mekaar gekommunikeer nie en dan is dit te laat.

R: Dink u AM sal hierdie kommunikasie gaping kan verbeter of voorkom?

E: Ek weet nie. As AM deur al twee departemente gehandhaaf word, dan glo ek dit sal ja. Ek dink dit is belangrik dat daar 'n gemeenskaplike verstaan moet wees en dit nie gesien moet word as iets wat moet gedoen moet word net omdat dit moet gedoen word nie - dit moet nie net nog dokumentasie wees nie. Of AM moet lê by die kwaliteit departement en kwaliteit moet aandring aan ingenieurs wat verander moet word. Anders is dit weereens net nog 'n standaard wat afgedwing word en dan gaan dit sy waarde verloor en die belangrikheid daarvan ook. So ek sal voorstel om AM te integreer met kwaliteit waar dit oor gekommunikeer word aan die ingenieurs. Nie dat kwaliteit nog goed wil doen nie (omdat hulle reeds baie goed op hulle hande het) ((lag)). Daarom sou ek sê dit moet geïntegreer word sodat dit nie 'n werk oorlaai is vir een persoon nie.

R: Glo u dat die bestuursbeginsels (soos genoem in die ISO 9001) is belangrik vir die implimentering en onderhoud van 'n bestuurstelsel?

E: Ek dink dit is belangrik. Baie organisasies doen dit sonder dat hulle dit besef en dit hang maar af van hoe top bestuur die visie oor dra aan die organisasie. Kyk, normaalweg het mens jou strategie vergaderings waar jy jou hele jaar of 5 jaar se plan aan al die bestuur verduidelik want op die ou end van die dag wil jy hê almal moet 'align' tot dieselfde visie. So ja, definitief is hierdie beginsels belangrik.

R: Hoe stel u voor word hierdie beginsels geïntegreer met julle huidige voedselkwaliteit en voedselveiligheids bestuurstelsels of julle geïntegreerde 'management system'?

E: Okay, ons het mos netnou gepraat oor die 32 operasionele standaarde, maar ons het ook sisteem standdaarde. So dit waarvan jy nou gepraat het sal tipies inval by ons sisteem standdaarde. Dit word deur jou top bestuur 'gerun' aan die meer operasionele kant. So dit sluit in jou trainings en jou visies en jou dinge wat in plek moet wees en jou missies. Om sulke tipe beginsels te implementeer sal in plek wees by die strategiese of sisteem standdaarde en ook jou meer operasionele kant en dan waar top bestuur sekere besluite maak en afdra na die middel bestuur en dan uiteindelik bereik tot op die vloer grond.

R: Sal u voorstel dat top bestuur 'n baie belangrike rol speel in die besluite wat in die organisasie geneem moet word?

E: Ja. Verseker.

R: Indien die integrering van TQM en AM op 'n strategiese vlak suksesvol bereik word, hoe stel u voor kan hierdie integrasie bereik word op 'n operasionele vlak?

E: Ek probeer nog heeltyd hieraan dink ((lag)). Om eerlik te wees ek weet nie hoe AM op 'n dag tot dag basis gaan help op 'n beter kwaliteit produk te lewer nie ((Lag)). Maar, ons doen risk assessments op baie standdaarde, maar ek dink (persoonlik) dat ons is nog nie heeltemal daar is om ordentlike risk assessments te doen en fisies te gebruik en te implementeer op 'n daaglikse basis nie. Baie van die goed doen ons omdat ons dit moet doen en omdat ons dit op skrif moet hê vs. om elke lieve ding wat daar uitkom...daar gaan natuurlike dinge uitkom wat aandui ons het risiko's en ons moet dalk iets anders implementeer om dit te bekom of ons moet 'n 'check' doen op daardie risiko punt, maar ek dink dit is nog nie so goed bestuur om 'n daaglikse ding te raak nie. So, ek dink dit is waarnatoe ons moet mik. Indien jy 'n verandering maak of daar 'n probleem opduik om dadelik terug te keer na ons risiko assessments en dan dit te verander of die probleem op te los. Op hierdie stadium word die risk assessments eenkeer 'n jaar hersien omdat ons dit moet doen, maar dit moet eintlik 'n gereelde sisteem wees so eintlik elke keer wanneer jy 'n nuwe apparaat implementeer of iets verander moet dit al klaar op die sisteem wees sodat jy kan sien die resultate aan die einde van die jaar. So my vrees is dat AM dieselfde gaan word en dat dit iets is wat jy gaan gebruik net omdat iemand vir jou sê om dit te gebruik. En dit nie benut tot sy optimale wat dit kan bied nie. Mense sukkel om te verander, mense sukkel om net eenvoudig aan te pas en iets nuuts te doen. Dit is iets wat jaar in en jaar uit geïmplementeer moet word en jy gaan eksterne mense moet kry om die 'ways of working' te verander. So teoreties dink ek dit gaan goed wees maar in die praktyk gaan dit moeiliker wees en langer vat om dit geïntegreer te kry.

R: So u insinueer dat daar gaan implimentering probleme wees? Of die kultuur of change management gaan moeilik wees?

E: Ja. Die kultuur is een ding definitief. Maar ek dink in vandag se tyd die mense is oorwerk, so ek dink op die ou end van die dag jou main doel is om die produk by die fabriek te kan uit sit. So as jy sou moet kies tussen seker te maak die lyn loop of om heelyd in jou kantoor te sit om seker te maak jou excell sheet te werk?...Jy gaan op die lyn wees en jy gaan die lyn laat probeer loop. So, ek dink daar is 'n tekort aan resources by baie organisasies. As ek praat van resources verwys ek na die mense - die regte opgeleide mense.

Researcher concludes the interview with concluding probes...

R: Is daar enige verdere kommentaar wat u wil byvoeg of is daar enige iets anders wat u vermoed ons nie bespreek het nie? (To contribute to the validity of the interview)

E: Nee, ek dink daar is niks wat ons nie bespreek het nie.

R: Wie stel u voor kan ek kontak vir verdere data insameling in verband met die integrasie van AM en TQM? (To contribute to the validity of the interview)

E: Asb laatweet my as jy graag met ons Ingenieurs 'n vergadering wil reël vir verdere inligting? Kontak my gerus.

R: Baie dankie. Ek sal u verseker kontak.

The interview ends with formalities; thanking the interviewee for her time and insight.

B.6 In-depth Follow-up Interview Results

B.6.1 Follow-up Interview with Laura

B.6.1.1 First Follow-up Interview with Laura

Researcher (R) and Ella (E): Welcoming and introduction...

The researcher prompted the topic of standard integration to which a discussion regarding standard implementation followed...

L: Jy kan enige standaard implementeer, maar jy hoef nie noodwendig daarvolgens gesertifiseer word nie. Wat beteken, jy hoef nie ekstern geaudit te word daarteen nie. Maar om 'n standaard lewend te hou en voort durend te verbeter het jy 'n mate van ouditering nodig - so dan moet jy net 'n baie sterk interne audit stelsel hê om dit heelyd te audit. Die rede hiervoor is dat ouditering is die enigste manier van verifikasie of jy aan daardie standaard voldoen het.

R: Goed ek verstaan. So u stel voor mens hoef glad nie gesertifiseer te word daarvoor nie?

L: Nee jy hoef nie.

R: So dit is beter om te integreer eerder as om AM apart te implementeer aangesien AM so breed en kompleks is en omdat die implementerings proses jare se ondervinding verg?

L: Ja verseker. Ek stem saam dat dit gaan beter wees om die sisteme te integreer sodat dit die reeds bestaande standaarde te bevoordeel. Dit is dieselfde wat ons op die oomblik doen met Health and safety (die ISO 14000 en 14800) - ons implementeer daai standaarde, maar ons is nie gesertifiseer daarteen nie. Maar ons implementeer dit om tenminste aan 'legal compliance te voldoen' en ons audit ons self.

R: So mens kan dan nie vir die ouditeure sê jy comply daarteen nie?

L: Nee, jy kan comply daarteen, maar jy is net nie certified nie.

R: Ekskuus, ek verstaan nie so mooi nie. Waarvoor is certification dan?

L: Dit is slegs wanneer 'n eksterne certification body vir jou kom oudit. Dit gebeur gewoonlik wanneer jou customer vir jou vra om 'n eksterne oudit te doen.

R: Ek is bewus daarvan dat verskeie standaarde gebruik word in verskillende voedselmaatskappye gebruik afhangend waarvoor die customer aanvrae. Ek het ook agter gekom dat meeste participants glo dat die GFSI approved standaard is die beter opsie om te gebruik vir integrering vir hierdie studie se doeleindes. Stem u daarmee saam?

L: Jy gebruik een van daardie standaarde, en ek sou sê jy gebruik die FSSC standaard.

R: Hoekom stel u dit voor?

L: Dit is die standaard waartoe alle voedselmaatskappye in Suid-Afrika na neig. Hierdie standaard kan ook gebruik word vir uitvoer produkte en nie net nasionale produkte nie. Omdat GFSI dit goedgekeur het.

R: So meeste maatskappy gebruik die BRC/IFS standaard omdat die verbruiker dit aanvra?

L: Ja dit is die customers wat dit aanvrae. BRC is spesifiek vir Engeland uitvoere en IFS is vir Duitsland. So daar sal Duitse maatskappye wees wat nie jou produk sal aankoop nie, want hulle soek spesifiek die maatskappye wat voldoen aan die IFS standaard. En daar gaan Engelse maatskappye wees wat nie die produk aankoop nie want hulle versoek BRC.

R: Goed. Hoe stel u voor kan ons tot die gevolgtrekking kom dat FSSC die regte standaard sal wees om te gebruik vir integrering ten doel van die navorsing veld?

L: Daar is omtrent 5000 maatskappy wat aan die FSSC ouditering standaard volg, en daar is 5 maatskappye wat BRC het en 3 maatskappye wat IFS saam met BRC volg.

R: Dit is interessant, hoe seker is u van u feite?

L: Dit is algemeen bekend. Jy kan 'n survey om die internet gaan trek om dit te bevestig. Dan kan jy die ratio kry van hoeveel maatskappye gebruik FSSC teenoor BRC of IFS. Maar dit is huidig die algemene ratio in Suid-Afrika, die meeste maatskappy maak gebruik van FSSC.

R: Stem u saam dat die integrering van standaarde is 'n effektiewe strategie om verskeie probleme in julle huidige TQMS op te los en te verbeter?

L: Ja verseker. Teoreties gaan jy dit kan bewys dat die integrering gaan help om hoë gehalte produkte te lewer. ((Pause)) En dan natuurlik gaan dit jou verbruikers tevrede stel. Dit gaan jou hele sisteem verbeter. Jou TQMS. Ek wil net graag gou byvoeg wat ons net nou bespreek het oor FSSC.

R: Enigetyd.

L: Die rede hoekom FSSC ontstaan het, dit kom vanaf ISO 22000. En die rede hoekom ISO 22000 begin het is juis dat die wêreld wil een standaard hê waarteen hulle geoudit word, en nie 'n 110 ander standaarde nie. So al wat by ISO 22000 bygekom het is die ISO/TS 22002-1 specifications - wat jou PRP's is. Daardie twee saam gee vir jou FSSC.

R: Goed baie dankie. Sluit die FSSC ISO 9000 ook in?

L: Nee. Maar dit is gebaseer op die ISO 9000. So in jou geval gaan jy nie hoef die ISO 55000 standaard met die ISO 9000 standaard ook te integreer nie want FSSC bestaan reeds uit die ISO 9000. ISO 9000 is klaar geadresseer in die FSSC 22000. En HACCP is in die ISO 22000 geïntegreer. So outomaties, in die ISO 22000, het jy reeds die ISO 9000 en die HACCP sisteem. Al wat gekort het in die ISO 22000 was die PRP's. Nou is die ISO/TS 22002-1 inkooporeer in die ISO 22000 en so kry jy die FSSC 22000. Die GFSI het dit goedgekeur want hulle wil ook nie hê dat jy aan 'n 'duisend' standaarde moet voldoen nie. Dit is onmoontlik om so baie standaarde te beheer. So, dit is een rede hoekom ek die FSSC 22000 sal verkies.

R: Wie stel u voor moet die verantwoordelikheid neem van die geïntegreerde sisteem?

L: Verseker 'n administratiewe persoon soos die Quality Assurance Manager. Die QA Manager of die Technical (bekend as die systems administrator) Manager gaan die sisteem bestuur. En daardie persoon gaan vir die Maintenance Manager aanwys om die procedure van die integreerde sisteem skryf en in plek kry. So dit bly by die verantwoordelikheid van die Technical Manager waar die Maintenance Manager gaan moet aan rapporteer.

R: Eksuus, sal u asb. vir my die verskil verduidelik tussen die rolle van die QAM en die Technical Manager.

L: Onthou dit hang af van organisasie tot organisasie hoe die strukture gaan werk want party organisasies het 'n sterk QAM met 'n tegnologiese agtergrond en ander nie. Waar die QAM nie so sterk is nie is daar 'n tegniese bestuurder wat dan oor die QAM kyk.

R: Dink u dat dokumentasie gaan te veel raak vir een persoon om te hanteer?

L: Dit gaan moontlik wees ja, maar onthou, die Technical Manager gaan die sisteem bestuur. Daardie persoon gaan net sorg dat die sisteem en rekord in plek is. Die Operations Manager gaan die verantwoordelikheid hê om te kyk na slegs daardie 'gedeelte' van die stelsel.

R: Stel u dus voor dat dit sal nie nodig wees om 'n addisionele persoon aan te stel nie?

L: Nee. Want die operations manager gaan in elk geval daardie verantwoordelikheid kry. Kyk dit is wat hulle doen met 'n kwaliteit en voedselveiligheid sisteem. Jy kry ook die health and safety and environment sisteem, maar die Quality Manager sit hierdie goed ook in die sisteem wat hy/sy bestuur. Maar, iemand soos die "officer" kyk dan na dit in diepte - dit is gewoonlik iemand soos die HR Manager.

The interview ends with formalities; thanking the interviewee for her time and insight.

B.6.1.2 Second Follow-up Interview with Laura

Researcher (R) and Laura (L): Welcoming and introduction...

During a discussion about asset classes and people, the researcher prompted the following questions to which Laura responded:

R: On senior management level, the managers typically deal with the management of physical assets and ensuring efficient operation; however, on top management level, how do you think they go about managing assets in general (e.g. life cycle management of assets)? Please try to explain everything that comes to mind when answering the question.

L: Currently assets such as machinery and equipment are dealt with through a system called CAPEX. This system is used when new machinery and equipment are required. This system calls for 3 quotations and a full ROI. Depending on the outcome of this exercise the machinery or equipment are acquired/bought. After that the machinery/equipment becomes an item in/on the financial statements where depreciation thereof is accounted for. Also the machinery/equipment becomes an item on the Maintenance and/or Preventative Maintenance Schedule for regular/annual or perhaps breakdown maintenance.

R: People are seen as an asset that brings value to the organisation, how do you suggest people should properly manage the process of integrating standards in general?

L: The only way how people will properly manage processes is when they have goals and objectives to work against. These goals and objectives should be SMART (Specific, Measurable, Achievable, Relevant, Time-bound) and aligned with the business's vision and mission. Regular individual performance appraisals (IPA's) should be held with each and every individual in order to determine the progress on goals and objectives.

R: The importance and responsibility of people are sometimes overlooked, do you think that the food industry really do recognize that people are an important asset?

L: The food industry recognizes that people are important assets but there is a lack when it comes to the recognition of when people perform according to their KPI's and/or KPA's (Key Performance areas - each department has certain objectives to which they should perform).

R: Since people take responsibility for implementing standards, they will naturally be responsible for the implementation of the integrated approach too. Do you think that the people within the food industry, in general, are at that level of competency to be able to manage an integrated approach? Please explain why.

L: The people in the industry will be able to integrate systems as they are currently continuously integrating systems such as Health & Safety and Environment into QMS.

R: Thank you very much. Please could you elaborate how it is done in your company?

L: For example ISO 18000 Health & Safety and ISO 14000 are integrated into TQMS of companies to comply with the minimum legislative requirements from government. These standards are then internally audited for continual improvement opportunities. They do not have certification audits against these standards as more audits are time consuming and costly.

R: Would you suggest that training will help to effectively manage an integrated approach? If yes, how would you prefer the training to proceed?

L: Yes, an overview training course on a new standard that is to be integrated into TQMS will be necessary. The training should be formal and done by a trainer that is familiar with AM.

R: How would you suggest AM will assist with changing the way people think as seen in the previous question?

L: I think AM is much focused on human resources too (not only on the physical assets) as an asset of the business and will therefore ensure that people will change in their way of thinking.

R: The food industry normally do not want to invest into new physical assets (even if it is not yielding efficient results) or into properly fixing it because it is very expensive; instead they will increase the labour force on the asset that are functioning inefficiently to support the neglected asset. This often leads to slower production rates, loss of production time, reduced overall efficiency and ultimately decreased profitability. Do you think that AM could ever change the way the food industry think in terms of this example?

L: Yes I think AM can change the way of working.

R: Why do you agree or disagree?

L: Because AM focusses on managing all your assets to be effective and efficient all the time.

R: Is financial implications preventing the food industry from investing in assets or is it simply because of poor structure from management?

L: Maybe not poor structures but perhaps poor informed/trained/educated managers. Also wrong persons in certain and key managerial positions.

A general discussion regarding asset problems and communication proceeded accordingly:

R: Engineers (or maintenance) has a certain way of thinking and doing things in their frame of reference. Generally, they do not know how critical their actions is towards yielding a high-quality and safe food product because they lack the knowledge of food characteristics and other hazardous factors. If AM would be integrated with your existing quality food safety systems, would it change the way engineers think about food products and why?

L: I think it will change the way engineers are thinking because AM would be part of the Q and FSMS. They will then recognize their input and impact per clause. For example, within the management commitment statement we will know address AM and will serve as an objective within that statement, through this the engineers will recognize parts that are familiar to them. In turn, they will recognize where their parts serves as important to the Q and FSMS.

R: Engineering typically want to decrease production costs, but very often the food industry would rather decrease labour costs than to invest in assets which could in the long-term yield decreased production costs. Do you agree and why?

L: Yes, in the SA Food Industry labour cost is very high compared to the rest of the world therefore it is easier to decrease the labour force than to invest in assets.

R: Do you think that asset problems (e.g. quality deviations caused by inefficient operating or maintenance of physical assets by human assets) is caused by improper communication channels within the quality, operations and production departments as well as culture differences?

L: Yes it is true that improper communication channels and culture differences cause inefficient operations.

R: Please would you be so kind to elaborate?

L: Yes. For example in the Pouch factory if we make a tomato sauce based product and have a breakdown during the filling process the product will recycle at a high temperature for as long as it takes to fix the equipment or machinery. This will cause the product to burn, discolour and disfavour/taste which often then has to be tapped off and reworked at a later stage. This causes losses in yield and time which increase the cost of the product and decreases net income.

R: Do you think that a holistic understanding of integrating AM with TQM will prevent asset problems from occurring and change the way people think about maintenance and quality performance? In turn, close communication gaps between departments?

L: Yes integrating AM with TQMS will close communication gaps between departments.

R: Sorry, could you please elaborate on this?

L: Should AM be integrated into TQMS the maintenance and production departments will become more part of the system and will have goals and objectives to achieve and through this communication gaps will be closed.

R: Poor management of assets (i.e. not scheduling work time of assets efficiently during season and off season) causes increased costs since the asset is not adding value. How would you propose AM will improve asset performance annually? In other words, how do you think AM will create value for the food organisation?

L: Poor work scheduling of people and machinery is the food industry's biggest problem and AM will certainly improve this aspect of any food business.

R: In contribution to the previous question, do you think AM will increase the organisation's overall equipment efficiency and capability as well as overall performance? Please elaborate.

L: AM will definitely improve overall performance because as soon as OEE's are measured poor performance can be managed. Very few food businesses in SA measures OEE's.

R: Do you think the food industry lack proper guidance in how to effectively manage their assets to yield high-quality and food safe products?

L: Yes the food industry lacks proper guidance to effectively manage their assets.

R: Asset problems (e.g. production hiccups or equipment failures) often leads to deviations of the final product and lost brand reputation which ultimately influences customer's satisfaction. In order to prevent this from happening, AM is found to support the process of producing high-quality products and because of fulfilling the stringent regulatory and customer requirements, would you agree it is better to integrate the ISO 55000 standard with relevant food standards instead of implementing it separately? Please try to explain anything that comes to your mind.

L: Yes integration of ISO 55000 with food safety standards is better. Implementing standards separately will cause departments to work and communicate in silos. In today's economic climate around the world it is important that people from different departments in a business must work together as a team. "Individuals win a game but teams win a world cup".

In a more refined discussion of the concern of communication, the following remarks regarding communication was made:

R: It has been confirmed that communication gaps between quality and engineering exists because they are managed separately in different silos. It is also a fact that AM and TQM focusses on breaking down silos to generate a collaborative working environment, thus it is evident that AM will contribute to closing communication gaps. However, would you propose that AM will help overcome this problem of poor communication if it is integrated into the food quality and food safety systems?

L: With strong leadership AM can assist in managing the change to overcome poor communication.

R: Do you agree that integrating AM with TQM will help to breakdown silos and that it will be better to integrate so that one department can manage the system?

L: Yes.

R: Would you advise systems integration or implementing systems separately?

L: Yes I advise integration because implementing separately will leave you with silos again.

R: Would you suggest that the AMS (and its ISO 55000 standard) would be used as a support system to overcome communication problems between departments (e.g. misinterpretations, poor information sharing, etc.), in turn, asset related problems as well?

L: YES. ((Exclaimed this))

R: How do you think it will support your systems?

L: As mentioned before, if AM should be integrated into TQMS the maintenance and production departments will become more part of the system and will have goals and objectives to achieve. In turn, I think communication gaps will be closed.

With regard to the need for AM, a discussion proceeded accordingly:

R: Results indicate that AM yield various benefits that are appropriate to the food industry and that they should strive towards attaining some elements of it. However, the food industry is not yet competent enough to implement the holistic AMS efficiently since they lack proper knowledge about it, will misinterpret its importance and benefits in due course of implementation process, their culture is not yet aligned to the AMS, and they are not yet fully equipped with efficient physical assets. Also, it will take years to master the implementation process of it. Would you therefore suggest that integrating parts of the system would be the better option and to rather use it as a supporting system that provides additional benefits to the existing food systems to ultimately improve product quality? Please elaborate.

L: Yes I would suggest integrating parts of the system and use it as a supporting system.

R: How will it serve as a supporting system? Please explain via an example (for instance your Health and safety system).

L: This may be referred back to what I've mentioned earlier: "For example ISO 18000 Health & Safety and ISO 14000 are integrated into TQMS of companies to comply with the minimum legislative requirements from government. These standards are then internally audited for continual improvement opportunities. They do not have certification audits against these standards as more audits are time consuming and costly".

R: Establishing a culture that allows departments to communicate effectively and promotes quality throughout the production process is critical for an integrated approach, do you think that the food industry will be able to attain that specific culture?

L: Yes if everyone in the supply chain can understand that through managing your assets you will yield in high-quality and safe products, world class OEE as well as have happy workers.

R: Since problems currently occur within the existing food systems, integrating AM with relevant food systems would be beneficial and since areas of overlap are significant, integration is viable to help improve food quality. Do you agree with this statement? Why?

L: Yes as mentioned above through managing your assets you will yield in high-quality and safe products, world class OEE as well as have happy workers.

In light of the emergent category of integrating AM with TQM, Laura commented on the following:

R: I understand that integrating systems (specifically standards) will ensue slotting in clauses that correlates with each other. However, what specific food standard would you suggest will applicable for integration with the AM standard (ISO 55000)?

L: FSSC 22000 is an integrated system which consists of ISO 22000 and ISO/TS 22002. Thus FSSC 22000 is a good standard for integration.

R: I do recall that BRC/IFS and FSSC is the most often used food standards. If you would integrate ISO 55000 with one of these GFSI standards, would you regard it as applicable to any type of food organisation? What is your opinion?

L: Yes BRC, IFS and FFSC are standards specifically for the manufacturing of food.

R: So to be GFSI certified and integrating it with a GFSI certified standard will be seen as the better option for the food industry?

L: Once again, I refer back to the example I gave you earlier. About ISO 18000 and ISO 14000. She said: "For example ISO 18000 Health & Safety and ISO 14000 are integrated into TQMS of companies to comply with the minimum legislative requirements from government. These standards are then internally audited for continual improvement opportunities. They do not have certification audits against these standards as more audits are time consuming and costly".

With regard to the category of customer satisfaction, Laura mentioned the following:

R: Is it important for the food industry to be GFSI approved or not? Do they value GFSI approved standards highly?

L: Yes customers value GFSI approved standards highly as it gives them confidence that the food they consume is of high-quality and safe.

Upon this, the relevance of standard selections and integration was deliberated in another discussion. See below:

R: Does the food industry prefer to implement standards that are certified?

L: Yes.

R: Would it be necessary to be ISO 55000 certified? What is your opinion?

L: No certification would be required, because it will enhance the TQMS. From my point of view, I think it is better to incorporate ISO 55000 in TQMS, rather than implementing it. Otherwise it will create another certification audit which becomes overwhelming. Like for instances, health and safety, ISO 18000, is incorporated into the TQMS but not audited for certification on ISO 18000. But we follow the principles in order to comply with legislation (OSH Act). We could have implemented ISO 1800, but then the certification audit becomes tedious and is unnecessary, thus, as long as you comply with the legislation's minimal requirements it is in order. Also, it becomes very expensive to have a second certification audit. Thus, I would prefer to comply with ISO 55000 rather than implementing it and be certified for it. Another example is ISO 14000, which is Environment, which are also part of the TQMS but is not certified audited. It is however audited internally. This principle is very common in the food industry.

R: Would the ISO 5500 standard be used as a non-certified standard and audited internally? Why?

L: Yes, and if it is integrated in the QMS it can be used as a supporting system.

R: If the ISO 55000 standard would be used as supporting system by integrating it with relevant food standards, is it necessary to audit against the standard and should it be internally or externally?

L: For continual improvement any system must be audited internally against a frequent schedule. External auditing is used for certification.

R: Acknowledging the fact that AM will contribute to producing high-quality and food safe products by ensuring efficient asset operations (i.e. to prevent temperature fluctuations, speed differences and specification deviations), it has been proven that the food industry requires AM to support their existing food standards to yield high-quality products. For this reason, would you suggest that in order to establish the link between AM and the food industry the systems should be integrated (e.g. perhaps through standard integration to attain one system

for quality)?

L: Yes as mentioned before integration of AM will enhance the QMS.

R: Contributing to the previous question, do you think that integrating standards will create an appropriate way to introduce AM within the food industry and to establish a culture that creates a quality environment in all departments?

L: Yes because implementing another standard could be very time consuming and cause the silo effect.

R: Do you think that the food industry requires structure in order to guide them to achieve high-quality products using an integrated approach?

L: YES ((emphasised tone)) leaders must be familiarized with AM.

R: How would you propose AM should be introduced to the food industry?

L: Your thesis should be published! ((Laugh))

R: Thank you very much ((Laugh)). But how would you go about introducing AM to the food industry (or your organisation in general)?

L: Annually, a strategy meeting is held with executives. I believe that it will be the senior manager's responsibility to introduce such an integrated approach on a strategic level (in a strategic level), but the top manager will have to make the decision to establish an objective for the integrated system. As soon as it becomes an objective, it will become a goal which then is communicated through KPA's. On the yearly strategic session which executives and senior managers take part to discuss the future and determine gaps from which tools are identified to reach the future goals. This is where the senior managers introduce AM to the executives and explain to them how AM can be integrated into TQMS to yield high-quality and safe foods. At that point in time, we I will propose the need for AM and provide them with a guideline (especially the ISO 55002 and mapping of it with FSSC 22000).

The topic of general management systems pursued with a discussion accordingly:

R: In general, systems are well developed and defined within the food industry; however, the implementation of an integrated system will depend on the organisational growth and culture in terms of flexibility, control, sustainability and continues improvement. In other words, the success of integrated systems will depend on the maturity level of the organisation itself. Do you think that the general food industry is at that level of competency to be able to implement an integrated approach? What is your opinion?

L: Yes I think the food industry in SA is ready for change to a next level otherwise they are going to fall behind and soon not be competitive in the market.

R: How would you propose a competent level of maturity look like? Or how would you define a suitable culture for integration?

L: I think a company is mature for integration after their 3rd to 5th certification in FSSC or any other accredited food safety standard. I think by then (as soon as the FSSC is established properly), integration would be possible to be successfully achieved.

Finally, it deemed necessary to discuss the importance of leadership. Laura made the following remarks:

R: In order to establish the link between AM and the food industry efficiently, it has been found that top management will play a critical role to successfully overcome communication problems, in turn, asset related problems as well. Do you believe that leadership commitment will make or break the integrated approach? Please elaborate your answer.

L: Yes if the leader of an organisation is not fully committed then integration of AM and QMS will not be possible.

R: Top management will be responsible for correctly defining the TQMS and its policy and scope with the new elements of AM added to the system. How do you suggest that leadership should go about producing an environment fit for integration?

L: Top management must communicate their decision on integrating AM into TQMS and appoint a team leader that will drive the integration process.

R: The food industry rely on the people to manually operate physical assets and non-physical assets which often causes deviation from quality specification. Contradicting this, the engineering industry rely on automated physical assets which leads to more precise production. Thus, managing people effectively are of great importance to the food industry. Do you agree or disagree?

L: Yes I agree with the statement. And also one often see in the food industry that advanced assets are acquired but within a year it has been modified in such a way that it becomes hand operated again. For example, our pouch filling machine is fully automated and should only be operated by one person, but, currently there are two additional operators who put the caps onto the pouches manually. So it seems it is easier to put two people on the broken line that to maintain the capping system. If that operator would have been managed and trained appropriately to look after his machine, this might not have happened. Managing people as an asset could have prevented this example to happen. The food industry in general in SA is not prepared to pay for qualified operators, so they rather take an unschooled labourer to work. But, also then, employing this unschooled labourer, the food industry neglect this employee and do not provide sufficient training and education. AM will then help to ensure the realization of people as assets to prevent these type of problems from reoccurring.

R: Do you think that effective leadership will help manage people successfully which will ultimately prevent asset problems, communication gaps and deviations from product quality and food safety?

L: YES I agree with the statement. They should assure proper management.

Another important topic under discussion was the person responsible. Laura commented on a prompted question accordingly:

R: The integrated system should be managed by an individual dedicated to achieving AM efficiently. It has been confirmed that the quality department will take responsibility for such an integrated approach. What do you think is the reason for the quality department taking responsibility for it? How do you suggest that they should go about managing the system?

L: Normally the Food Safety Team Leader is the Quality Assurance Manager or the Technical Manager, depending on the organisation and how their structure works, of the organisation that leads the food safety team. So the FSTL can also lead the integration of AM into QMS. He/she will appoint an expert on AM to be part of the team to provide his/hers expertise to the team (or meeting). So the QAM will take the responsibility of the system from which he/she delegates responsibilities, from which they have to report to. The QAM/Technical do not necessarily have to attain all the knowledge of AM, because his/her team is multidisciplinary which provides valuable insight in the daily tasks and operations.

R: As we've discussed in a previous interview, could you once again just confirm the differences of responsibilities between the Technical and QAM for clarity? Will the Food Safety Team Leader be responsible for the integrated system or is it the other way around?

L: Yes the QA manager or the food safety team leader will be responsible for the administration of the system, and the technical manager (i.e. accountable for the quality and food safety system) will be the person to which the QA manager/food safety team leader will report to. So, the technical manager is normally qualified in food science, technology, factory machinery and has a good background of manufacturing practices, therefore, he/she will be accountable for asset care and the QA manager will be responsible for the integrated system. The technical manager may also designate the engineering or maintenance manager as the expert of AM which will then be the leader of asset care. However, the QA manager/food safety team leader will still administer the system.

R: You have previously spoken about top down training, what did you mean with top down training?

L: Top down training means training means that the top management should be trained first, then the senior managers, then the middle managers, then the junior managers and supervisors, then operators and controllers and last the shop floor workers.

The interview ends with formalities; thanking the interviewee for her time and insight.

B.6.2 Follow-up Interview with Garry

Researcher (R) and Garry (G): Welcoming and introduction...

During a discussion about asset classes and people, the researcher prompted the following questions to which Garry responded:

R: On senior management level, the managers typically deal with the management of physical assets and ensuring efficient operation; however, on top management level, how do you think they go about managing assets in general (e.g. life cycle management of assets)? Please try to explain everything that comes to mind when answering the question.

G: Financially motivated, whether an asset adds value or not, policies to do with the financial structuring, tax shield effects.

R: The importance and responsibility of people are sometimes overlooked, do you think that the food industry really do recognize that people are an important asset?

G: This is too broad a question, recognising people as an asset is about leadership, the Gallup report on actively engaged employees in the workplace states that only 18% of SA workforce are engaged, the rest are disengaged. This is therefore a leadership issue and not food industry specific but all industries.

R: Since people take responsibility for implementing standards, they will naturally be responsible for the implementation of the integrated approach too. Do you think that the people within the food industry, in general, are at that level of competency to be able to manage an integrated approach?

G: Given the specialist skill sets and training yes.

R: How would you suggest AM will assist with changing the way people think as discussed in the previous question?

G: Not sure.

R: That is okay, thank you.

R: The food industry normally do not want to invest into new physical assets (even if it is not yielding efficient results) or into properly fixing it because it is very expensive; instead they will increase the labour force on the asset that are functioning inefficiently to support the neglected asset. This often leads to slower production rates, loss of production time, reduced overall efficiency and ultimately decreased profitability. Do you think that AM could ever change the way the food industry think in terms of this example? Why do you agree or disagree?

G: Unfortunately in practice much revolves around cash flow, asset support through maintenance is sometimes not carried out in the hope that it could be postponed until later. It is difficult to generalise about the food industry but I a, not sure it is applicable to say a capital intensive business can be propped up with additional labour.

R: Is financial implications preventing the food industry from investing in assets or is it simply because of poor structure from management? No. it is a matter of strategy, risk management and expectations of growth.

G: Company policy has a big role since single hurdle rates when calculating IRR on new potential asset investments may wrongly reject projects with a negative NPV due to the wrong hurdle rate used.

A general discussion regarding asset problems and communication proceeded accordingly:

R: Engineers (or maintenance) has a certain way of thinking and doing things in their frame of reference. Generally, they do not know how critical their actions is towards yielding a high-quality and safe food product because they lack the knowledge of food characteristics and other hazardous factors. If AM would be integrated with your existing quality food safety systems, would it change the way engineers think about food products and why?

G: No, however it will help all concerned with food safety to integrate all systems since they are interdependent.

R: Engineering typically want to decrease production costs, but very often the food industry would rather decrease labour costs than to invest in assets which could in the long-term yield decreased production costs. Do you agree and why?

G: I think most industries try to follow that course, cost reduction rather than investment. Again capital intense businesses require reinvestment in new assets, it can be difficult to reduce labour costs.

R: Do you think that asset problems (e.g. quality deviations caused by inefficient operating or maintenance of physical assets by human assets) is caused by improper communication channels within the quality, operations and production departments as well as culture differences?

G: It is possible to blame many things on communication. Probably coupled to that working in silos. Teamwork is the key and that is driven by from the top.

R: Do you think that a holistic understanding of integrating AM with TQM will prevent asset problems from occurring and change the way people think about maintenance and quality performance? In turn, close communication gaps between departments?

G: It can be part of the process since it will incorporate interdependence preferences too.

R: Poor management of assets (i.e. not scheduling work time of assets efficiently during season and off season) causes increased costs since the asset is not adding value. How would you propose AM will improve asset performance annually? In other words, how do you think AM will create value for the food organisation?

G: It is fundamental in operations management to do this and that is why OEE may be superseded by TOEE. Therefore a target of 85% OEE should not be seen as so good when compared to TOEE.

R: In contribution to the previous question, do you think AM will increase the organisation's overall equipment efficiency and capability as well as overall performance?

G: It is part of it.

R: Do you think the food industry lack proper guidance in how to effectively manage their assets to yield high-quality and food safe products?

G: As a whole probably but individual companies will be better at it than others. Seasonal companies have to factor in utilisations of greater than 100% (compared to rating capacities) in season compared to <50% out of season.

R: Asset problems (e.g. production hiccups or equipment failures) often leads to deviations of the final product and lost brand reputation which ultimately influences customer's satisfaction. In order to prevent this from happening, AM is found to support the process of producing high-quality products and because of fulfilling the stringent regulatory and customer requirements, would you agree it is better to integrate the ISO 55000 standard with relevant food standards instead of implementing it separately?

R: Yes it is always easier to manage systems that are aligned and part of each other.

With regard to the need for AM, a discussion proceeded accordingly:

R: Results indicate that AM yield various benefits that are appropriate to the food industry and that they should strive towards attaining some elements of it. However, the food industry is not yet competent enough to implement the holistic AMS efficiently since they lack proper knowledge about it, will misinterpret its importance and benefits in due course of implementation process, their culture is not yet aligned to the AMS, and they are not yet fully equipped with efficient physical assets. Also, it will take years to master the implementation process of it. Would you therefore suggest that integrating parts of the system would be the better option and to rather use it as a supporting system that provides additional benefits to the existing food systems to ultimately improve product quality?

G: Yes, integration of systems is difficult and sometimes demotivating when there are repetitions. Also new standards can take time to mature and be more applicable when adopted later. A good example is how ISO 22000 evolved.

R: Establishing a culture that allows departments to communicate effectively and promotes quality throughout the production process is critical for an integrated approach, do you think that the food industry will be able to attain that specific culture?

G: Yes why not? Culture is driven from leadership, which must be in place to achieve corporate goals. Holistic approach will always be more sustainable than silos.

R: Since problems currently occur within the existing food systems, integrating AM with relevant food systems would be beneficial and since areas of overlap are significant, integration is viable to help improve food quality. Do you agree with this statement? Why?

G: It would seem to be a natural progression to include AM since food safety evolved to much more than safety but also quality management, service supplies ISO 22002 etc.

Upon this, the relevance of standard selections and integration was deliberated in another discussion. See below:

R: Does the food industry prefer to implement standards that are certified?

G: Depends - often it is customer driven. In some countries like EU it is a requirement to have HACCP if you are producing food.

R: Would it be necessary to be ISO 55000 certified? What is your opinion?

G: No, cost/benefit to be analysed.

R: Acknowledging the fact that AM will contribute to producing high-quality and food safe products by ensuring efficient asset operations (i.e. to prevent temperature fluctuations, speed differences and specification deviations), it has been proven that the food industry requires AM to support their existing food standards to yield high-quality products. For this reason, would you suggest that in order to establish the link between AM and the food industry the systems should be integrated (e.g. perhaps through standard integration to attain one system for quality)?

G: Yes but this is a repeat what I have mentioned before.

R: Contributing to the previous question, do you think that integrating standards will create an appropriate way to introduce AM within the food industry and to establish a culture that creates a quality environment in all departments?

G: It would help but leadership creates the culture standards are just a rigid structured platform. Leaders use their skills to ignite the passion to follow and thereby contribute through doing what is desired by the leadership.

G: It is difficult to answer this. Sorry. I cannot elaborate any further.

R: No problem at all. Thank-you very much.

R: Do you think that the food industry requires structure in order to guide them to achieve high-quality products using an integrated approach? Please explain.

G: ISO standards are by their very nature structured. I think I have spoken to you about this before?

R: How would you propose AM should be introduced to the food industry?

G: I think through a structured manner as I proposed earlier.

The topic of general management systems pursued with a discussion accordingly:

R: In general, systems are well developed and defined within the food industry; however, the implementation of an integrated system will depend on the organisational growth and culture in terms of flexibility, control, sustainability and continues improvement. In other words, the success of integrated systems will depend on the maturity level of the organisation itself. Do you think that the general food industry is at that level of competency to be able to implement an integrated approach? Please elaborate your opinion.

G: Yes they are used to standards, look at HACCP and evolution to ISO 22000.

R: How would you propose a competent level of maturity look like? Or how would you define a suitable culture for integration?

G: This is very qualitative and no straight forward answer. But, Systems Integration implementation must be driven from the top and collaboration sought from below to buy in.

Finally, it deemed necessary to discuss the importance of leadership. Garry made the following remarks:

R: In order to establish the link between AM and the food industry efficiently, it has been found that top management will play a critical role to successfully overcome communication problems, in turn, asset related problems as well. Do you believe that leadership commitment will make or break the integrated approach?

G: Yes definitely. It contributes to what I've mentioned before.

R: Top management will be responsible for correctly defining the TQMS and its policy and scope with the new elements of AM added to the system. How do you suggest that leadership should go about producing an environment fit for integration?

G: This is basic leadership stuff, if you force you will find resistance. Change management is important.

R: The food industry rely on the people to manually operate physical assets and non-physical assets which often causes deviation from quality specification. Contradicting this, the engineering industry rely on automated physical assets which leads to more precise production. Thus, managing people effectively are of great importance to the food industry. Do you agree or disagree?

G: I definitely agree.

R: Do you think that effective leadership will help manage people successfully which will ultimately prevent asset problems, communication gaps and deviations from product quality and food safety?

G: Of course!

The interview ends with formalities; thanking the interviewees for their time and insight.

B.7 In-depth Confirmation Interview Results

B.7.1 General Confirmation Interview with Fred and Jim

Researcher (R), Fred (F) and Jim (J): Researcher welcomes and introduce the purpose of the study as well as the differences between the two systems. The grounded theory analysis and results was discussed....

Comments made on Certification during the introduction:

F: Dit is nie nodig om ISO 55000 gesertifiseerd te wees nie nee. So lank as wat jy comply aan sy minimum vereistes en dit intern geouditeer. Dit is dus redelik om te kan se dat integrasie is moontlik om gemengde resultate te kry as jy dit saam gebruik.

The researchers starts the discussion of causal conditions Asset Problems:

J: Wat bedoel jy met 'asset problems'

R: 'asset problems' sluit in enige probleme wat jou assets negatief beïnvloed. Die mens en fisiese assets veroorsaak gewoonlik hierdie implikasies. 'asset problems' is 'n term wat die participants gebruik het om die norm van probleme verwant aand assets te beskryf.

F: Die definisie van AM is vir my is nogal belangrik. Die definisie lees: is enige iets wat potensiaal het of wat waarde toevoeg. So, asset problems verwys na enige iets wat binne daardie definisie'n probleem gee.

R: Dit is reg ja.

No further questions was asked regarding the causal conditions. The researcher continues to explain how the phenomenon developed. Phenomenon:

J: Wat is 'n fenomenon?

R: Die fenomenon is iets wat ontwikkel vanuit opinies en vanuit resultate. Die causal conditions lei daartoe dat iets ontwikkel of waar is volgens hulle, die fenomenon, maar dit is nie iets wat fisies getoets word nie want dit is gebaseer op mense se opinies. Dit is hoekom dit genoem word 'n fenomenon.

J: So die volgende navorser gaan dit toets. Met ander woorde jou grafiek is net die tegniese name wat gebruik word deur die participants.

R: Dit is reg ja.

No further questions was asked regarding the phenomenon. The researcher continues to explain how the strategy proposed by participants in response to the phenomenon. The Intervening conditions was discussed:

Regarding customer satisfaction...

J: Jy moet in jou studie mooi definieer wat is 'n customer. Verduidelik wat is die verskil tussen 'n customer en 'n consumer. Dit is nogal belangrik, wat hier by ons maak ons baie keer daardie fout. Ons verskaf aan 'n bottelerder wat dan aan die customer verskaf. So ons customer is nie eintlik die customer nie, ons verskaf aan 'n verspreider. So ons kliënt is'n verspreider en die kliënt is dan nou iets soos Pick 'n Pay, en die shopper is dan die persoon wat die produk gaan koop. Die consumer is dan die persoon wat dit fisies drink by die huis. So daar is drie, vier vlakke. Dit is heelwaarskynlik so vir die alle voedselbedrywe. Ek dink nie almal wat vervaardig werk nie direk met die kliënt of verspreider nie.

F: Wie bepaal dat ons die TQMS en al die HACCP sisteme in plek het? ((Fred asks Jim))? Doen die customers?

J: Nee. Nie noodwendig nie. Die voedselveiligheid, jy moet jou produk veilig kan gee aan die consumer. M.a.w. dit is'n interne gedrewe ding.

F: Kyk, toe ons HACCP training gehad het, het dit gegaan daarvoor om veilige produkte verskaf aan die consumers. Consumers moet vertrou die produk wat hulle eet, hulle consider nie eers of die produk dalk moontlik gevaarlik vir hom/haar gaan wees nie. En as dit gebeur, dan is dit 'n groot risiko vir besigheid.

F: Ons besef dat as ons wil verseker dat ons besigheid sustainable moet wees, dan moet ons seker maak dat die risiko vir die consumer so laag as moontlik moet wees. Dit moet parallel gedryf word.

J: Omdat die consumer nie presies weet hoe die produk gemaak word nie, vertrou hulle outomaties dat die produk wat hulle gaan eet is veilig. So alles wat op die label staan moet waar wees, die persentasies van bestanddele moet akkuraat wees, daar moet ook allergeen informasie wees. Dit is als deel van HACCP. Maar ek het nog nooit gehoor iemand se spesifiek vir ons dat ons moet HACCP hê nie, ons wil HACCP hê want ons wil verseker dat ons produk veilig is vir die consumer om te gebruik. Wat wel nou verander het met nuwe wetgewings in Suid-Afrika is dat indien die consumer siek raak van die produk wat hy gebruik kan daai persoon enige iemand in die voedselketting aanvat. Hy kan vir Pick 'n Pay aanvat, die verspreiders.

R: Goed baie dankie. Ek sal dit in ag neem.

The researcher continues to discuss standard selection...

R: Die meeste voedselbedrywe (vanuit'n kwaliteit oogpunt) verkies om standarde te gebruik wat GFSI aanbeveel is. Dus het hulle gevind dat AM sal die beste in pas by die GFSI standarde.

J: Dit maak 100% sin ja.

F: Dit is so ja, ons kwaliteit bestuurder is hoekal nou besig om ons standaard te probeer verander sodat ons produk die internasionale mark kan intree. So daar is definitief 'n neiging tot GFSI standaarde.

R: Data het daartoe gely dat die FSSC 22000 gebruik sal word vir die inkorporering proses. Wat dink u daarvan?

J: Goed dit klink reg.

R: Dink u dat die inkorporering van AM met TQM is 'n moontlikheid?

F: Ek dink nou aan die driehoek met verskillende vlakke van AM. Hierso het jy integrity (ons praat nou van equipment), Hier is reliability, availability, en hier is quality, en daar is performance en daarso is world-class manufacturing ((hy verwys na die verskillende vlakke van die driehoek)). Hoekom ek nou hieraan dink is – ek het nog nie die link gemaak tussen die onderste drie bou blokke, wat volgens my asset care of AM is, met kwaliteit nie. Volgens my is asset care daar om jou asset te bestuur (vanuit 'n besigheids oogpunt uit) of om soveel as moontlik 'n rendement, throughput, en koste effektief uit jou assets uit te kry. So die link na die quality gedeelte toe, ek weet net nog nie hoe groot daardie link is nie?

J: ((Jim beantwoord Fred se vraag)) Wat ons mee die laaste ruk sukkel is quality issues, maar eintlik is dit 'n asset issue. Baie van ons kwaliteit issues is die konveyer het op die laaste vibrasie nie reg geprint nie, die ink raak verstop in die pyp so nou print ons die datum nie reg nie. Dit is alles kwaliteit issues. Bv, die kapper waarmee ons gesukkel het gisteraand, die spring het gebreek. So a.g.v. dit het ek 2% van my produkte gereject gisteraand. Ek wil nie 2% reject hê nie. So dit is nie die kwaliteit wat by die consumer uit kom nie, maar dit dryf miskien meer die kostes van die kwaliteit van die produk.

F: Goed ek verstaan nou.

J: So die AM in ons lewe, ons het baie vangplekke ja. Die gehalte van die produk wat uitgaan bly dieselfde, maar die koste van daai gehalte word beïnvloed. So AM het 'n groot invloed op die 'cost of quality' van die produk.

F: So die kwaliteit wat gereguleer word is eintlik 'n interne ding, dit is nie 'n customer of 'n consumer ding nie. Dit is hoe ons intern die kwaliteit reguleer.

J: Ja. Met ons FSSC sisteem wat by ons in plek is, se dit dat ons mag nie 'n produk uitstuur wat nie reg is aan die mark nie. So die AM proses gaan net maak dat ek minder uitsit, dit gaan nie maak dat ek slegter goed uitsit nie, want ek gaan nie laat slegter goed uitgaan nie. Die besigheid gaan net dunder raak.

R: Omdat AM gefokus word op die mense en die physical assets, stem u saam dat dit sal help om op die ou end beter gehalte produkte te kan lewe?

J: Ja. Dit sal meer consistent beter gehalte produkte lewer. Dit is nie netso straightforward so in alle gevalle nie, dit is seker hoekom dit noodwendig nog nie so gedoen is nie. Omdat daar 'n groot link is met jou vang nette, jou 'cost of quality'. Soos die sap wat ons produseer. Maar senou maar jy bak koek en jou proses is te stadig en jou koek se consistency is nie so lekker nie, so daar is plekke waar die kwaliteit van die produk kan afwyk a.g.v. physical assets wat nie optimaal funksioneer nie. Dit is nie 'n voedselveiligheids issue nie, dit is 'n kwaliteit issue. Daar is nie 'n direkte lyn nie, maar daar is 'n lyn.

F: As ons praat van OEE, dan kyk ons na die kwaliteit aspek of die rendement aspek dan kyk ja bv.: as die masjien gedesign is vir 20 000 L, dan kyk ons hoe ver is hy van daai merk af.

J: Nog 'n voorbeeld, as ons kyk na ons Brix meters wat gemaintain moet word. As ons ons Brix meter uit is en agter uitgaan, en ons kom nie eers agter dit gaan agteruit nie, dan sal ons heelwaarskynlik low brix, high brix produkte uitstuur na die mark toe wat dan lei tot consumer complaints.

F: Baie van hierdie goed spreek tot die design, equipment selection, wat adequate vir die proses is.

J: Dit is 'n groot issue wat ons alhoemeer begin besef. Die CPK van die proses (is dit capable of te doen wat jy wil hê hy moet doen). Jy kry 'n spesifikasie van die vervaardiger af soos bv. die onderkant van 'n glas bottel, en ons wil vul volgens daardie spesifikasie. Die binnekant van die bottel moet senoumaar 25 ml produk kan vat, maar soos daai moulds oud raak, raak die glas al hoe kleiner. Dan begin ons vulling issues kry. So daar is 'n definite link ja.

Researcher continues to discuss the general conflicts of interest found between the quality and engineering departments...

R: Participants verwys na die idee waar die verskillende ‘mindset’ moet met mekaar geïntegreer word. M.a.w. as jy jou kwaliteit doen, moet jy in gedagte hou die AM elemente en konteks daarvan, en vice versa. Kwaliteit en maintenance moet saamwerk om op die ou end’n beter gehalte produk te kan lewer.

J: Ek weet nie wat anderste gaan wees nie. Jy het jou tipiese goed soos jou HACCP sisteem, om die basiese hazards te voorkom en die kritiese punte te kontroleer. Ons het seker plekke waar daar kontak is met die produk, soos bv. by die vuller. As ons werk aan die vuller, dan moet daai ding uitgehaal word wat nie reg funksioneer nie, maar ons sit dit dan dadelik in steriel middel voordat dit weer terug gesit word in die vuller. Ten alle tye moet die hande gealkohol word ens. So ons reeds baie streng protokolle rondom sekere goed om te verseker dat die produk nie gekontamineer kan word nie. In ons werksprosedures sal ons voedselveiligheid aanspreek en ons moet dit na kom. So jy sal ons nog moet oortuig (lag). Sodat ons die uitkomst kan verstaan.

R: Daar is’n duidelike verskil tussen HACCP en AM. HACCP is’n baie algemene ding in die voedselbedryf wat al lank gebruik word. Waar die verskil inkom met AM is die bestuur wyse, m.a.w. hoe jy die physical en non-physical assets sal bestuur oor’n lang tydperk. Baie keer in die voedselbedryf, operate mense hul masjiene verby sy leeftyd (hulle oorwerk die masjiene). ((onderbreuk)). ((Het probeer verduidelik dat die vergeetagtige manier van bestuur van assets lei tot swak gehalte produkte, dus in so’n manier maak AM’n verskil))

J: Ja as die ding nog werk dan gebruik jy hom, maak nie saak wat nie. Ons het stelsels om die leeftyd van assets te bestuur, maar ons druk dit baie keer vir ‘n paar jaar meer. Dan al wat hulle doen is hulle pas die depresiasie aan op die produkte of items wat nog waarde het.

F: Dit maak nie sin om ‘n ding te vernietig net omdat dit 20 jaar oud is nie.

R: Presies. Wat ook gevind was is dat meeste van die maatskappye met wie ek gepraat het, het slegs ‘n 60% OEE, wat nogal sleg is in vergelyking met die wêreldklas OEE van 85%.

J: Wat bedoel jy met wêreldklas?

R: Dit word verwys na die ‘Industry Leaders’.

J: Ek stem nie hiermee saam nie. Enige iets bo 50% is ‘n goeie OEE waarde. OEE oor naweke sal meer raak. Ons het twee lyne, en ons loop nie die lyn oor naweke nie. Ons loop ook net een lyn op ‘n slag. So ek is klaar op 50%, voordat ek begin met produksie omdat ek arbeid rondskuif tussen die twee lyne. Ek hardloop voltyds, maar my OEE is klaar 50% want ek hardloop twee verskillende lyne en hulle word appart gehardloop. Ek werk ook nie oor naweke nie. OEE is gelyk aan die totale tyd maal effektiwiteit maal kwaliteit. Ons loop 5/7 dae, dan maal jy dit met jou effektiwiteit (70%) en dan maal jy dit met kwaliteit (99%). Dan sit jy sommer gou-gou met ‘n 50 of 60% OEE.

F: Ek was al by ‘n OEE gesprek betrokke. En wat daar gesê was is: ‘Show me how you measure me, and I will show you how I behave’. Dit is tipies hoekom party ouens 80% OEE kry, want hy doen sy berekeninge so: as hulle toemaak op ‘n Sondag of ‘n Vrydag, dan meet hulle dit nie. So dit kom by tot wat Jim genoem het.

J: Dit is baie waar, jy kan nie 80% claim nie, want die masjien het dan heelnaweek gestaan? So die asset word nie gebruik nie. Party van die ouens sal sê hulle loop net op dag skof, meeste voedselmaatskappye werk in nagskof ook, maar die ouens wat net op dagskof werk - hulle sal nie sommer ‘n OEE bo 50% kry nie. So om te staaf dat die industrie norm is 80% is bietjie wild, want nie almal werk drie skofte nie en nie almal werk naweke nie. Maar, as jy wil geld maak en jy is ‘n wêreldklas vervaardiger, dan sou ek se 80% OEE is nodig ja (dit is tipies in die geval by Tiger Brands of die groot maatskappye). Maar by ons maak die som nie sin nie, want ons het net twee lyne. Dit maak die som anders.

R: So dink u dit is relevant as Tiger Brands dit dalk gesê het? Dat hulle 85% OEE het?

F: So by Tiger Brands kan dit verwag word. Weetbix moet gemaak word die heeldag, die heelnag en heelnaweek ook. Dit gaan oor demand ook. Hoe sterk of stabiel jou demand is beïnvloed ook hoe baie produksie jy gaan moet hardloop. Seisoen tye speel ‘n groot rol. Somer maande is ons bedrywige maande asook Kersfees en April vakansies (Paasweek). So daar is sekere dinge wat buite ons beheer is, omdat dit deur die demand beïnvloed word. Ons moet gereed wees om daardie demand te kan na kom.

J: Wat tipies gebeur is as jy ‘n groot maatskappy is en jy het ‘n groot demand, dan sit jy tipies ‘n klomp fabriek op om daai demand te kan balanseer. Nou daai fabriek moet omtrent heeltyd funksioneer om 80% te kry, en dan die laaste fabriek gebruik jy om te flex. Ons is een maatskappy wat vir die hele land produseer, so ons flex, so ons gaan nooit by daardie klas van syfers uit kom nie, want ons is die enigste een.

Enige vervaardiger wat alleen produseer, sal nie 80% OEE kan kry nie. As hy 80% kry, dan het hy te min fabriek en dan is hy 'at risk' want as daar iets breek in die fabriek sal hy dit nie kan supply nie. So dit sal baie onverantwoordelik wees om so 'n syfer te probeer kry as jy 'n alleen fabriek is. Hoe meer jou kapasiteit word, as jou fabriek meer as 80% begin utiliseer, dan begin jy in die moeilikheid kom omdat dit alhoemoeliker begin raak om jou kliëntediens te vervul. As ek 7 dae 'n week hardloop, en daar breek iets, is daar niks wat jy daaraan kan doen nie want jy het nie flexibility nie (jy kan nie die tyd op maak nie). Jy is "dead in the water". Jy moet die vermoë hê om te kan flex. En wat 80% vir my sê as dat jy het geen vermoë om te kan flex nie. So, 60% is vir my 'n meer aanvaarbare nommer om die industrie norm te gefineer en groepeer. Dit is net om daardie nommer in konteks te sit. Maar die vervaardigers wat bestaan uit verskeie takke mag dalk ja. As hy 80%.

The researcher continued to describe how the method for the strategy proceeded, as according to the participants:

Regarding top management commitment...

F: Kan ek jou vra, die vlak wat jy hier noem waar jy die besluit op 'n strategiese vlak maak om die twee sisteme te integreer, is dit geverifieer dat die norm sê dat so 'n besluit op 'n hoër level geneem moet word? En al die standaarde wat jy moet gebruik?

R: Ja. Dit alles is gebaseer op senior en executive level.

J: Ja jy sal dit so wil hê, jy kan dit doen sonder hulle, maar dit is die beste om dit so te doen. Dit sal ideaal wees om 'n geïntegreerde sisteem te bekend te maak deur top management commitment. Jy sal dit wel kan doen sonder hulle, maar dit is ideaal.

F: As jy kyk na 'n groep van executives, daar is gewoonlik een verteenwoordiger vir vervaardiging in die value chain. En ek dink op sy vlak is waar hy sal besluit hoe hy dit sal bestuur in sy manufacturing site. So ISO 55000 en FSSC 22000 het 'n direkte invloed op sy deliverables as 'n vervaardigings deel.

J: Kyk na SAB, dit is 'n baie groot maatskappye. Iemand sal daar op 'n "spark idee" kom en voorstel hoe dit gedoen moet word, dan sal hulle dit van hulle kant kan afdwing op ander maatskappye.

F: Dit is ideaal. Dit is eintlik hoe dit moet gebeur.

J: Ons het 'n vervaardigings filosofie wat geouditeer word deur SAB. En as jy aan SAB behoort, jy SAL moet perform volgens hulle. Jy het nie 'n keuse nie. Jy SAL moet rapporteer aan hulle. M.a.w. dit is 'n top-down approach. Dit word gedwing op al die ander. Daar word baie keer vir ons gesê hoe dinge gedoen moet word. Ek sou se dat dit is die beste manier om AM so bekend te maak. Jy wil nie dit moet in 'n debat ontlaar nie, jy wil hê iemand moet daai besluit vir jou neem en ons volg dit net.

R: Word ISO 55000 in die voedselbedryf geïmplementeer volgens sertifisering?

J: Nee.

F: Nee. Orals waar ek gewerk het dit nog nooit opgeduik nie nee.

R: So stel julle dalk ook voor dat daar is 'n neiging vir integrering eerder as om dit apart te implementeer? Of om sekere elemente daarvan te inkorporeer om op die ou end prosesse of produksie te verbeter?

J: Is ISO 55000 dieselfde struktuur as ISO 9000?

F: Ja.

R: Ja.

J: Tot watter level gaan dit? Hoeveel detail bevat daardie sisteem?

R: Dit is baie gedetailleerd.

F: Dit is baie groot. As jy kyk na ons gedeelte, maintenance word gesien as asset care en dit is slegs een been van AM. Terloops, ons doen ander goed van AM ook, maar dit is nie gestruktureer nie. Die mense van Gaussian het die volgende gese: In 'n top struktuur, in die executive span, behoort daar eintlik 'n asset care executive te wees. Of 'n verteenwoordiger tenminste van AM. En op hierdie stadium is daar nog 'n gap. Dit spreek jou punt ook aan, AM gaan op daardie vlak aangespreek moet word anders gaan dit nie gebeur

nie. En daai ouens neem besluite op grond van rand en sent. So die waarde realisering van asset care of AM as sulks het nog nie ge-feature nie, want dan sou die ouens allankal dit op daai lyn geklim het en sê as ons ons revenue wil laat groei, dan moet ons asset care doen. Dit gebeur net nog nie.

R: Wat dink u is die rede daarvoor, dat AM nog so onbekend is?

J: Fabrieke is die stiefkinders van enige maatskappy.

F: Dit is reg ja. Van 'n value chain is die fabriek eintlik die een wat die geld uitgee. En soveel te meer, binne die fabriek struktuur, die ouens wat na die assets moet omsien is die wat meeste geld uitgee as in vergelyking met die fabriek self. As ek daai expense nie het nie, dink net hoeveel meer geld sal jy op die ou end op die bottom line hê. So die ouens sal altyd sê kom ons kyk of ons die maintenance buget nog 'n bietjie kan afdryf nie (of die asset care budget for that matter).

R: Dit is baie interessant dat u dit noem, want ek het 'n maatskappy besoek wat glad nie meer hulle bottom line verkry nie omdat masjiene nie reg gemaintain of geoperate word nie. Nou stop hulle produksie wat dit is te duur vir hulle.

F: Dit is daai balans van die bestuur proses wat hulle natuurlik gedryf het tot dit. Hulle verstaan nie die konsep van AM belang nie.

Researchers proceeds with the discussion of consequences to taking the strategy:

Whilst the researcher has described the need for establishing the 39 Subjects, Fred made the following remark...

F: Sommige van die 39 Subjects word reeds geïmplementeer, maar nie almal nie.

Comments made about financial implications...

F: Dit is nogals belangrik dat jy 'n business case doen, want soos jou studie kwalitatief is, gaan die business case ook kwalitatief wees. Kwantitatiewe business case vlieg baie maklik, ek meet dit ja en ek kan staaf hoe effektief dit is en op grond van dit sal jy jou ROI kan bepaal. Maar as jy vir die ouens gaan sê: teken die tjek vir my, dit is soveel rand wat dit vir my sal kos om ISO 55000 te gaan implementeer. Dit is moeilik om dit te motiveer.

J: Het ons al 'n rand en sent syfer wat dit vir ons sal kos? ((Vra vir Fred))

F: Nee. Maar as jy gaan kyk na die dokument, dit is so betrokke tot baie goed. Jy kan dit op 'n klein vlak doen, maar as jy dit 'full-blown' wil doen dan gaan jou hele struktuur in lyn met dit moet wees. So ons praat van maintenance planning en daai goeters. Daar gaan iemand wees om daai job te doen en al daai administrasie werk te doen. So, daar is definitief 'n koste gekoppel aan die implimentering daarvan.

R: Dit is reg ja, en dit mag jare vat voor resultate van die integrering sal wys.

J: As jy 'n voorlegging vir my gaan gee, gaan jy moet dit verduidelik in rand en sent en dit 'verkoop' in so 'n manier, anders gaan dit nie gebeur nie. Die business case sal goed beplan moet wees. Dit is dalk moontlik om dit verder na te vors om vas te stel wat al die finansiële implikasies van die integrering proses sal wees. In jou navorsing kan jy dalk sê dat dit "axiomatically" lyk dit waar soos gebaseer op die participants, maar die finansiële benefits is unknown en dit sal nagevors moet word. Axiomatically is dit waar omdat dit gebaseer is op die 'cause and effect'. Jy kan mos nou vir jousef dink dat dit gaan benefits hê. Jy kan natuurlik die ding oordoen en nie geld maak nie, so hoe lyk hierdie business case. Maar dit geld vir al die ander goed ook, soos jou FSSC 22000.

F: Dit is reg ja, self vanuit 'n ingenieurs oogpunt uit - enige iets kan geïmplementeer word, maar daar net eenvoudig nie altyd geld nie. Daar gaan altyd 'n koste daaraan verbonde wees.

J: Die koste implikasies is belangrik, want miskien het ek daai geld nodig om eerder 'n nuwe masjien te koop. Bogger die ISO 55000, ek koop eerder 'n nuwe masjien. Op die 'board room table' word als in rand en sent om geskakel, want dit is wat die stakeholders seek. Dit gaan oor die opportunity cost van dit ((die integrering sisteem)) wat jy gaan moet opweeg, en dit is tipies hoekom hierdie tipe van goed nie gebeur nie. Mens kan sien dit maak sin, maar wat jy nie sien nie is die holistiese view van ander alternatiewe (soos bv. om eerder 'n nuwe masjien te koop in pleks daarvan om 'n hele nuwe sisteem te implementeer)). Hierdie alles maak sin, ek weet net ongelukkig nie hoe lyk die ISO 55000 nie.

F: Iets wat jy ook in ag moet neem is dat asset care in Suid-Afrika, Europa of Afrika is drie verskillende dinge. Asset care se vlak van bestuur gaan dus verskil, dit gaan drasties verskil tot die van 'n eerste wêreld. Dit maak nie finansiële sin nie.

R: Ek verstaan 100%. Wat ons wel gevind het is dat Suid-Afrikaanse voedselbedrywe moet neig tot die manier van produksie internasionaal, ons moet op dieselfde vlak begin funksioneer.

J: Ja jy is reg, maar onthou, 'n operator in Europa word dieselfde betaal as wat ek hier in Suid-Afrika betaal word. As hy rond staan is dit 'n groot krisis in vergelyking met ons operators. So jy moet daai in konteks sit.

The researcher continued with the discussion of integration, or mapping...

F: So jy het basies die strukture van die standaarde met mekaar vergelyk om die similarities te vergelyk? So dit vergelyk basies die struktuur en nie die inhoud nie?

R: Tot 'n sekere mate word die inhoud vergelyk, want party dele van die ISO 55000 word nie aangespreek in die FSSC 22000 nie. Of te meer, daar is seker dele van die FSSC 22000 wat elemente van seker klousules van die ISO 55000 bevat. So dus het ons dan cross referencing gedoen.

J: Het jy al met iemand gepraat wat ISO 55000 in plek het? Het jy met iemand gepraat wat dalk ISO 55000 het wat nie buite die voedselbedryf is? Ek stel voor jy praat met iemand wat ISO 55000 kennis het.

F: Ron Con, hy is die bestuurder van die Elektrisiteit in die Stad Kaapstad. Vra vir Wyhan.

F: Wat gebeur as jy hierdie vergelyking getref het?

J: Word integrasie nie eintlik gedoen as albei sisteme reeds in plek is nie? Die business case sal eers moet wees rondom ISO 55000 en om dit in plek te sit, en dan sal mens sien dat dit is dalk bietjie rof om ISO 55000 ook apart alleen in plek te sit. So miskien moet ons dit integreer? Die 'sou what' vraag is: Ons het dan nog nie eers ISO 55000 in plek nie, hoekom moet ons bother om dit nog te probeer integreer ook?

F: Die logika is dat ISO 55000 kan 'n leading input wees om kwaliteit te verseker, maar ons het die vangnet wat uit 'n besigheid oogpunt uit 'n risiko is. So ISO 22000 is 'n moet, want ons moet verseker dat die produk wat na ons customers of consumer toe gaan veilig is. Maar wat is hierdie goed wat hierdie vang net te kan verbeter? Of watter goed gaan minder druk op hierdie vang net plaas? Dit gaan eintlik net oor om meer koste effektief te wees, want jy gaan nie rework hê nie, jy gaan nie al daai goeters hê nie. Dit is die input wat AM gaan gee.

J: Die maintenance gedeelte word geneglect omdat jy gee maklik die verantwoordelikheid vir 'n ou met 'n overall en vra hom om die masjien uit te sort. Dit is net nie eenvoudig soos dit nie, dit is 'n veld wat aandag nodig kry.

F: Dit is omdat AM gesien word as 'maintenance' en nie AM nie, dit moet ge-elevate word op 'n strategiese vlak.

J: Jy moet my eers convince dat ek ISO 55000 nodig het om in plek te sit, dan kan ek eers aandag gee oor hoe nodig dit is om dit te integreer. Dit is dalk 'n chicken and egg storie, want ek is dalk nie lus vir ISO 55000 op sy eie nie, maar as ek ISO 55000 piggy back op hierdie ander sisteem, mag ek dalk 'n AM sisteem kry wat makliker is om te implementeer as wat ek nou 'n hele nuwe sisteem op sy eie probeer implementeer.

F: So jy gaan baie voedselindustrie kry wat vanuit 'n besigheids oogpunt eerder aandag wil gee aan areas wat hoër risiko's het. Doen net wat jy gedoen het tot vandag toe, moet nie probeer om 'n oplossing te gee nie.

R: Dink julle dat hierdie integrerende sisteem sal vir julle kan help as mens dit sou verduidelik aan die persoon wat dit sou implementeer? Veral as jy kan sê: ek het reeds iets wat dele geïntegreer is, so ons gaan nie van vooraf moet begin nie?

J: die eerste vraag wat ek myself sal vra is: wat gaan dit vat om ISO 5500 op die been te kry, wat is die inpak wat dit sal hê op my FSMS, want ek wil nie hê dat 'n nuwe sisteem hê wat 'n bestaande sisteem gaan swakker maak nie. Gaan dit my quality managers se aandag weg trek van die goed wat huidige belangrik is? En wie gaan die ISO 55000 dryf? As jy vir my gaan sê dit is die kwaliteitsbestuurder gaan ek vir jou sê los, want daardie persoon is reeds klaar besig genoeg en het baie ander belangrike dinge om te doen op die huidige stadium. So wie gaan ISO 55000 dryf?

F: So dit kom terug na jou eerste vraag toe Johan, hoekom moet ek ISO 55000 hê. Convince my eers hoekom ek dit nodig gaan kry. Dan gaan ek dalk begin sien dat daar is waarde tot die sisteem vir my. Die sisteem gaan waardevol wees vir my.

J: Die belangrikste vraag wat ek sal graag wil weet is, gaan ISO 55000 my engineering/ operational up-time verbeter oor 'n lang termyn?

F: Definitief dit sal. ((Fred beantwoord Jim se vraag))

J: Maar as jy daai kan kry om my te oortuig, dan sal ek sê: maar okay kom ons kyk na die sisteem en kyk waar is die raakpunte en dan kan ons oor tyd dit integreer. Ek staaf weer, ek sal graag eers 'n raamwerk van ISO 55000 wil hê voor ek dit sal wil integreer. Want hierdie kar (verwys na FSSC 22000) loop klaar lekker, ek wil nie hê hierdie kar moet begin swaar kry as ek hierdie waentjie (verwys na ISO 55000) aan hom wil hak nie. So die risiko is dat die FSMS kan suffer want die aandag daarvan word dilute. Jy gaan nie sommer ekstra mense kry nie, 'n ekstra kop kos mos nou 'n paar R 100 000 om 'n manager in plek te kry. Dit is die groot risiko. Deur om jou FSMS te probeer verbeter gaan jy dit eers verswak en FS is so krities dat jy nie nou kan bekostig om dit te verswak nie. Dit help nie jy sê vir die consumer dat jy gaan eers oor twee jaar beter resultate kry nie, so kou nou maar eers aan daai nuts and bolts vir eers. Dit is die vrae wat hulle vir jou gaan vra, dit is wat die senior managers vir jou gaan vra.

R: Maar as areas van overlap bestaan, is dit nie 'n teken van integrering nie?

J: Hierdie is potensiële areas van overlap, so wat jy sal kan sê, of die verkoops angle gaan wees: 'Ek wil nie die ding stand alone hê nie. Jou ander sisteme het jy stand alone gedoen, maar omdat die ISO 55000 so resource effektief is'. Ek het al vir maatskappye gewerk waar jy net besig is om papiere in te vul vir die ouditeure wat more kom, en as hulle weg is dan vergeet jy weer van als. Ons werk nie so nie, en ek dink dit gebeur nie sommer in die voedselbedryf nie. Waarvan ek nou gepraat het was nie die voedselbedryf nie. Die voedselbedryf maak gebruik van traceability.

F: As ek dink aan Kaapstad, en omdat hulle hul presentation verander het na ISO 55000 toe is dat dit 'n direkte impak het op 'n key output gehad. 'n Key output van hulle was service delivery gewees en integriteit van regulasies stelsels. So om daai key output te manage, het hulle ISO 55000 gehad. So ISO 55000 het 'n direkte impak op hulle key output gehad. Waar in die voedselbedryf, het ISO 22000 daai tipe van impak op die bedryf as jy verstaan wat ek bedoel. Ek wil amper sê dat ISO 55000 sal op hierdie stadium gesien word as 'n 'nice to have'. En as jy dit wil link, sal jy dit moet kan verander na 'n 'must have' toe.

J: Jou studie moet dit wys. Jy moet dit kan elevate.

R: Dit kan verseker een van my uitkomstes wees wat 'n volgende navorser gaan moet doen. En die business case analiseer. Ek maak die teorie dat dit bestaan en waar kan word.

F: Okay goed, so jy hoef dit nie te bewys nie?

R: Nee.

F: So jy sê basies 'die is amper gelyk aan daai' ? ((Lag))

R: Ja ((Lag)). Ek stel 'n moontlike hipotese wat 'n volgende persoon kan navors.

J: Ek stem 100% saam met dit. Jy kan dit later gaan analiseer en bewys.

Comments regarding the general concept of overlap...

J: Ek verwag redelik baie overlap van die twee sisteme omdat dit twee bestuur sisteme is. ISO 14000 praat oor die omgewing, maar as jy hom langs ISO 9000 sit is daar geweldig baie overlap omdat dit 'n bestuursstelsel is. So as jy ISO 9000 en kwaliteit en environment kan saam gooi, sal daar verseker geweldige overlap wees tussen FSSC 22000 en ISO 55000.

R: Wat baie ander voedselbedrywe doen is, hulle is gesertifiseer met FSSC 22000, maar hulle comply steeds met ISO 14000 of ISO 18000 wat slegs intern geouditeer word. Soos geïdentifiseer deur participants, glo hulle dat dit is die idee van ISO 55000 dan nou ook. Dat dit nie noodwendig iets gaan wees waar 'n eksterne ouditeurs firma gaan moet inkom om te kyk of hulle aan dit voldoen of nie. Dit gaan bloot net wees om hulle te help om beter kwaliteit produkte te lewer en om sodoende die FSSC 22000 sisteem te bevoordeel.

J: Ja. Daar word nou alhoemeer gedruk om ISO 14000 te implementeer, dit raak deesdae alhoemeer belangrik om dit in plek te kry. ISO 18000 is net dan 'n goeie praktyk om jou veiligheid te verseker. Ons sisteme is nou nie geïntegreer nie, ons sit met die 3 standaarde alleenlik. Ons het nie ISO 9000 ook nie. Elke departement het dan die verantwoordelikheid om na die 3 standaarde na om te sien.

Recommendations for future research proposed by both Jim and Fred:

Comment about the study that Jim currently are enrolled for...

J: Ek praat van interpersoonlike leierskap eienskappe. Lean manufacturing het te doen met diskresionêre efforts. Om diskresionêre efforts uit iemand te kry, moet hulle dit vir jou gee omdat hulle dit wil vir jou gee, want dit is diskresionêr. En as ek jou nie behandel in manier wat jy vir my wil werk nie en jy werk vir my net omdat ek vir jou geld gee en as jy nie doen wat ek vir jou sê nie dan nail ek jou. Hierdie manier van bestuurstyl werk nie in manufacturing nie. Incentive schemes werk nie, maar almal doen dit. Maar dit is omdat niemand besef dat die roots sit by die mense. Maar dit gaan nie spesifiek oor die mense nie. Dit gaan oor my en jou verhouding. Jy werk vir my. Maar dit gaan oor legitimate relationship power. Jy werk vir my omdat jy wil, jy gee my die reg om jou te command. Ek kan dit nie demand as jou leier nie. Bv. Zuma is ons leier, maar is hy 'n legitimate leier? Nee. Ek gee hom nie die reg om vir my te besluit nie, want hy kyk net uit vir homself. Dit is presies hoe dit is as jou manager net uitkyk vir homself, dan gee jy nie vir daai ou die reg om jou te command nie. En dit is presies wat gebeur in die alledaagse gebeure. Almal weet dit, maar niemand maak die connection nie.

Comment made by Jim that is relevant to my study...

J: Wat hierdie sisteme jou mee help is dat daar minder diskresionêre effort hier binne. Jy sal die management sisteem so doen en jy sal dit so doen (verwys weer na 'n top-down approach). Jou regte competitive advantage lê by jou diskresionêre efforts. 70% van jou competitive advantage van maatskappye is jou diskresionêre efforts. Die sisteme praat met die onder 30%. Die eerste ding wat gaan moet gebeur is, jy moet dissipline in die werksplek hê. Dit help nie jy het mense wat ekstra slim is of baie bydrae lewer maar hy/sy daag laat op nie. Die onderste 3 aspekte is: dissipline; hygiene factor. Hygiene factor in 'n maatskappy is items wat verwys na gebeure soos: as jy dit nie doen nie, dan faal dit, as jy dit doen dan is jy net waar jy moet wees. Jy is tevrede. So dit is nie 'n competitive advantage nie. So as jy van bestuursisteme van 'n hygiene factor praat, dan is dit soos FSSC 22000, of ISO 9000. Dit word verwag van almal om ISO 9000 te hê. Dit maak jou nie beter as die ander maatskappye nie. As jy dit nie het nie, dan gaan jy siek wees as ek dit so kan stel. Dit is hoekom hulle die term gebruik 'hygiene factor' - dit is iets wat almal moet hê, maar dit gaan jou nie beter maak nie. Nou AM is iets wat jou kan beter maak, so dit is nie 'n 'hygiene factor' nie. So dit is 'n competitive advantage. Ek is seker daar is al ouens wat studies rondom dit gedoen het om te se wat is die competitive advantage van maatskappye wat ISO 55000 implenteer. Ek dink nie dit is so relevant vir die konteks van jou studie nie, maar dit is iets wat verseker aanbeveel moet word vir verdere navorsing. Gaan kyk watse ouens het ISO 55000, hoe goed is hulle binne hulle veld? Dit maak nie saak of hulle in die voedselindustrie is of nie. Stad Kaapstad het ISO 55000, Gauteng en Tswane het nie. Is service delivery beter in Kaapstad as Gauteng of Tswane? Ja dit is, ek wil so glo. Dit is miskien makliker om maatskappye met sy peers te vergelyk, en nie noodwendig stad Kaapstad nie. Doen peer vergelykings. Gaan kyk na maatskappye in die motorbedryf, wie het ISO 55000 en wie het nie, wie doen beter en wie doen swakker. Gaan kyk na die chemiese industrie wie het dit en wie het dit nie, wie doen goed en wie doen nie goed nie. Ek is seker as jy op internasionale vlak bietjie google, sal jy iewers sulke tipe inligting kry op emerald oor maatskappye wat ISO 55000 het.

The interview ends with formalities; thanking the interviewees for their time and insight.

B.7.2 Follow-up Confirmation Interview with Fred

Continues to the simultaneous dialogue between the researcher (R), Fred (F) and Jim (J), a separate discussion with Fred followed accordingly...

R: Do you agree or disagree with the causal conditions (i.e. asset problems, communication problems, people, and leadership) contributed to the need for AM? In other words, do you believe that AM will contribute in resolving those problems?

F: There are 3 basic causes to failure:

1. Not adhering to a standard is the most common deviation or mistake. There is either a non-compliance to an existing standard/requirement or the requirement does not exist. In both cases this relates to the accountability of leadership. Leadership are accountable for identifying the need and setting the requirements. Once this has been implemented and communicated the leadership must then hold the people compliant and responsible. If there is then a deviation from a particular standard it needs to be investigated if it is found that the deviation is malicious the transgressor must be disciplined. If after investigation it is found that the intent of the deviation was benevolent ("and honest mistake") the transgressor must be censured.
2. Uncontrolled or unexpected stress usually happens when a process veers out of control. The design of the asset or system in which such and asset functions has not been designed to accommodate this deviation. This causes a failure to occur. Failures of this nature are not common and usually causes serious to devastating effects. Fortunately due to the inherent risk of such failures it is mitigated in the design of systems or machines. This phenomenon needs to be considered at design of an AM strategy by the people and leadership responsible for it.
3. Weakness in the system/process/equipment design is quite similar to the aforementioned scenario. The weakness lies either in the inherent design of such an asset or group of assets (system) which can also be defined as an Incapable process. Or it is the cause of natural deterioration (end of life) for a particular asset or system. These factors must be controlled with tools such as RCM and the four maintenance tactics. This action lies squarely with leadership.

F: In conclusion to this brief overview it is clear that systems such as AM are crucial towards achieving business objectives. But it is critical to emphasise that these system needs constant energy and activation. Systems like AM do not resolve or remove problems or failures. It is leadership and behaviours such as ownership and being present and engaged towards achieving common goals reached through collaboration and buy in that is key to manage required business outcomes.

R: Do you agree or disagree that AM overlaps many elements of the TQMS? Please elaborate your answer.

F: I find it difficult to respond to this question. We don't have an AM system that is formalised to the same extent as our FSSC. Therefore I can only see the similarities made evident to me through your findings.

R: Do you agree that the causal conditions caused or influenced the phenomenon (i.e. the integration of systems) to occur?

F: Chicken or the egg question for me. Excuse my ignorance...

R: Do you agree or disagree that the context to developing the strategy (i.e. Integrating Standards) is relevant? Note: the term 'context' refers to the possibility of incorporating certain elements of AM to the TQMS by using it as a supporting systems, hence Standard Integration is deemed appropriate.

F: In my view in our industry we use the FSSC standard to control food safety and quality. To screen all production and mitigate the food safety risk to acceptable levels. This aspect is critical to the success of our business and is therefore managed as such. AM is still considered as a "nice to have" as opposed to a "must have" such as FSSC. Senior management needs to be convinced of the benefit of a well maintained AM system such as ISO 55000.

R: Do you agree or disagree that a relationship between AM and TQM exists?

F: Referring back to your second question that you've prompted...In addition the integration/alignment of the systems will improve collaboration between manufacturing departments breaking down silos and aligning key performance areas and indicators.

R: In addition to the previous question, do you believe that AM will be supportive and supplementary to all food systems, as represented in the figure ((figure 5.7 has been represented to Fred))?

F: This surely does make sense. The fact that FSSC requires AM representation acknowledges the impact of aspects from the various disciplines in the business. It helps to ensure alignment of outputs towards achieving TQM and ultimately agreed business goals.

R: It appeared that the implementation of the AMS will take years to master, what is your opinion regarding this?

F: It depends on the complexity of the system. I also think that the level of the outcome that you require from an AMS will vary drastically depending on the complexity and size of the asset base. Here I take special cognisance of the definition of assets (anything that adds value or has the potential to add value) assets such as data and human capital can add immensely to the complexity of your business AMS. This level of complexity has at least a directly proportional impact on the implementation time line in my opinion.

R: In response to the previous question, do you also think that integrating the AMS with the TQMS is an appropriate solution to implementation implications?

F: I am not convinced that it should be implemented as a combined solution. I can see the advantages of linking the two systems since there are some interfaces. But if I am a business owner in the food industry and had a choice on the sequence of implementing FSM and AM I would still spend my effort on FSM first to manage the immediate high and evident risk. AM and the integration of systems would come later.

The interview ends with formalities; thanking the interviewee for his time and insight.

B.7.3 Follow-up Confirmation Interview with Jim

Continues to the simultaneous dialogue between the researcher (R), Fred (F) and Jim (J), a separate discussion with Jim followed accordingly...

R: Do you agree or disagree with the causal conditions (i.e. asset problems, communication problems, people, and leadership) contributed to the need for AM? In other words, do you believe that AM will contribute in resolving those problems?

J: Reactive maintenance is vastly different from preventive or planned maintenance. The real need is a need for thinking and the AM program forces the incumbents to do just that. The program provides structure and process to ensure all the required work and thinking is done.

R: Do you agree or disagree that AM overlaps many elements of the TQMS?

J: The asset management system due to its very nature will definitely overlaps TQMS. Both are management systems and will follow similar processes. TQM is also similar to ISO 14000 and OHSAS 18001.

R: Do you agree that the causal conditions caused or influenced the phenomenon (i.e. the integration of systems) to occur?

J: No I do not agree. Due to the fact that AM systems are not highly procedurised the need for integration in my view is premature.

R: Do you agree or disagree that the context to developing the strategy (i.e. Integrating Standards) is relevant? Note: the term 'context' refers to the possibility of incorporating certain elements of AM to the TQMS by using it as a supporting systems, hence Standard Integration is deemed appropriate.

J: The concern with the strategy of integration is that as a support service it could influence the quality and resource allocation that was originally destined for the core system work of ensuring total quality and food safety. As a strategy it could thus introduce risk to the existing system. This does not mean it should not happen. Management needs to recognise the risk and take mitigating actions to prevent a dilution of system resources.

R: Do you agree or disagree that the intervening conditions (i.e. customer demands, management systems and standards, and standard selection) influence the strategy (i.e. Standards Integration) in response to the phenomenon (i.e. Systems Integration)?

J: Yes, system selection will definitely influence the strategy. Ease of compliance and implementation are factors that will influence the phenomenon.

R: Do you agree or disagree that a relationship between AM and TQM exists?

J: In a mechanised environment a close relationship will always exist between TQM and AM. The machines do the most of the work in modern FMCG factory environments.

J: The alignment of the machines, the set-up of the machines, all affect the final product quality which included cosmetic and ascetic appeal in a highly competitive brand conscious market. Oil leaks, vibrations, incorrect weighing can affect the food safety and legal issues which is part of consumer protection.

J: Calibration and preventive maintenance tighter with the capital expenditure program which should be selecting and maintaining the correct machines is very important.

R: In addition to the previous question, do you believe that AM will be supportive and supplementary to all food systems, as represented in the figure ((figure 5.7 has been represented to Jim))?

J: Yes it will definitely.

In a follow-up email regarding the person responsible for Systems Integration, the following discussion between the researcher and Jim emerged...

R: In verband met die persoon verantwoordelik vir die geïntegreerde sisteem het diegene wat in beheer is van kwaliteit en voedselveiligheid tot die gevolgtrekking gekom dat die QA bestuurder of die tegniese bestuurder die hoof verantwoordelikheid sal dra vir die sisteem waarna hulle aktiwiteite uitdeel tot lede geskik vir die bestuur van bates asook ander aspekte in konteks met kwaliteit. Wat is u opinie rakend hierdie konklusie?

J: Die maklike antwoord is dat dit die QA Bestuurder moet wees. dit is dan slegs van 'n sisteem perspektief. In die prakteit moet hierdie sisteem uitgevoer en geïmplimenter word. Dan raak 'n QA bestuurder se kennis en agtergrond gebrekkig om te verstaan wat die werk behels om die items prakties werkbaar te maak. Die rol van die persoon is meer as net 'n klerk wat moet sorg werkkaarte is uitgedeel.

J: Omdat die integreerde sisteem te laat werk glo ek moet dit van 'n strategiese oop punt gedoen word en dit sal heelwaarskynlik ook 'n nuwe struktuur behels en 'n nuwe Vervaardiging strategie/filosofie. Die sisteem kan nie as 'n entiteit op sy eie bekyk word nie. Daar is meer verreikende gevolge wat finansiële asook beplannings gevolge sal he op taktiese en operasionele vlakke.

J: Daar moet krities na rolle en verantwoordelikhede gekyk word en ek hou van die konsep van 'n "Tegniese Bestuurder" wat dat vir beide verantwoordelik word. Hierdie persoon moet ook "intergreer" word. Jy gaan sukkel om sommer so 'n persoon te kry, maar hulle is daar buite, maar meestal gaan hulle ontwikkel moet word.

J: Die stelsel is net 'n stel woorde op papier en ons moet nie die rol van gefokusde leierskap onderskat wanneer dit kom by die volhoubaarheid van so 'n stelsel nie. Die ondersteunde fondasie wat 'n integreerde sisteem ondersteem gaan die regte uitdaging wees. Hoe dit moet lyk is ongelukkig nie nou duidelik nie omdat die konsep so vars en nuut is.

J: Antwoord dit jou vraag?

R: Ja 100%, baie dankie.

The interview ends with formalities; thanking the interviewee for his time and insight.

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