

A practical decision-making framework for
improved demand planning in small to medium-
sized wineries

by

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Declaration

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the authorship owner thereof (unless to the extent explicitly otherwise stated), and that I have not previously, in its entirety or in part, submitted it for obtaining any qualification.

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Abstract

In recent years, supply chain performance has become a major part of the way in which companies gain competitive advantage and create value for customers. A company's supply chain encompasses the flow of information and products between the supplier's supplier and the customer's customer. The processes that direct these flows need to be managed to ensure timely and perfect execution of orders or services, thereby improving business performance. These processes have been studied and implemented widely in top performing companies worldwide.

In the wine industry, the body of knowledge and literature on wine supply chains, strategy and business aspects are lacking, despite the abundance of literature regarding the production of wine. Therefore, little is known about the implementation and execution of supply chain practices within the wine industry. Since the South African wine industry is struggling financially, with many producers making less than a 1% return on investment annually, considering the improvement of supply chain practices can be beneficial to these producers.

Since wine can only be 'manufactured' once a year, the amount of wine necessary to fulfil demand in that year needs to be planned accurately. The production and packaging of wine is expensive, especially in small- and medium-sized wineries where smaller volumes lead to higher unit costs. Undesired surpluses and lost sales opportunities are therefore costly.

Record-keeping and planning can improve decision-making and business performance in wineries. A demand-planning framework is developed to provide wineries with a more structured approach to forecasting, planning and managing demand. This incorporates the value-adding opportunities present in the wine industry to be exploited by wineries based on their product offering and capabilities. These value-adding opportunities are incorporated into demand forecasting to develop the demand plan. Given the numerous quantities of stock-keeping units (SKUs) present in wineries owing to, among other things, different bottle shapes, sizes and labels, SKU grouping and classification is used to simplify the forecasting process.

The framework proposed is developed from literature and the experience of the researcher. It is then implemented at a medium-sized case study winery in Stellenbosch to evaluate the outcomes of the framework. This is done by using historical sales data of the winery, as well as conducting structured interviews with the winery management team. The framework objectives are further validated by other wine industry role-players by means of semi-structured interviews. It was found that a need exists for structures and processes aimed at improving record-keeping, decision-making and demand planning, which would benefit the wine industry as a whole.

The framework implementation at the case study winery proved that the framework is easily implementable and beneficial for record-keeping, decision-making and planning. From the external validation, the industry role-players commended the framework to be feasible, practical, structured, easy to use and holistic. The framework also proved to be adaptable since more than one winery sees the capability and benefit of using the framework. The proposed framework was found to be especially beneficial in generating and tracking data within wineries to repeat past successes and eliminate repeated failures.

Opsomming

Die prestasie van voorsieningskettings het in die afgelope paar jaar 'n belangrike onderdeel geword van hoe maatskappye mededingende voordeel bou en waarde toevoeg vir kliënte. 'n Maatskappy se voorsieningsketting omvat die vloei van inligting en produkte tussen die verskaffer se verskaffer en die kliënt se kliënt. Die prosesse wat hierdie bewegings reguleer, moet bestuur word om die uitvoering van bestellings of dienste in geheel en betyds te laat plaasvind, en sodoende besigheidsprestasie te verbeter. Hierdie prosesse is wêreldwyd in toppresterende maatskappye bestudeer en geïmplementeer.

Die kennis en literatuur rakende wynvoorsieningskettings, strategie en besigheidsaspekte ontbreek in die wynbedryf, ondanks die oorfloed literatuur wat in verband met wynproduksie bestaan. Gevolglik is daar min bekend oor die implementering en uitvoering van voorsieningskettingpraktyke in die wynbedryf. Aangesien die Suid-Afrikaanse wynbedryf finansiële suksesse, met baie produsente wat jaarliks minder as 'n 1%-opbrengs op belegging maak, kan hierdie produsente voordeel trek uit die verbetering van voorsieningskettingpraktyke.

Aangesien wyn slegs een maal per jaar 'vervaardig' kan word, moet die hoeveelheid wyn wat in daardie jaar in die aanvraag moet voorsien, noukeurig beplan word. Die vervaardiging en verpakking van wyn is duur, veral in klein en mediumgrootte wynkelders waar kleiner volumes tot hoër eenheidskoste lei. Daarom kom ongewenste surplusse en verlore verkoopsgeleenthede teen 'n hoër prys.

Rekordhouding en beplanning kan besluitneming en besigheidsprestasie in wynkelders verbeter. 'n Aanvraagbeplanningsraamwerk is ontwikkel om wynkelders van 'n meer gestruktureerde benadering tot vooruitskatting, beplanning en die bestuur van aanvraag te voorsien. Dit omvat die waardetoevoegingsgeleenthede wat in die wynbedryf voorkom en deur wynkelders ontgin kan word, afhangend van hul produkaanbod en vermoëns. Hierdie waardetoevoegingsgeleenthede word by die aanvraagvoorspelling geïnkorporeer om die aanvraagplan te ontwikkel. Gegewe die groot hoeveelheid voorraadhoudingseenhede (VHE's) in wynkelders vanweë, onder andere, verskillende bottelvorms, -groottes en -etikette, word voorraadhoudingseenheid-groepering en -klassifikasie gebruik om die vooruitskattingsproses te vereenvoudig.

Die voorgestelde raamwerk is uit die literatuur en die navorser se ondervinding ontwikkel. Dit word vervolgens by 'n mediumgrootte wynkelder in Stellenbosch geïmplementeer om die uitkomstes van die raamwerk te evalueer. Dit word gedoen deur die wynkelder se historiese verkoopsdata te gebruik, asook deur gestruktureerde onderhoude met die wynkelder se

bestuurspan te voer. Die raamwerkdoelwitte word verder gevalideer aan die hand van semi-gestruktureerde onderhoude met ander rolspelers in die wynbedryf. Daar is bevind dat 'n behoefte bestaan aan strukture en prosesse wat op die verbetering van rekordhouding, besluitneming en aanvraagbeplanning gemik is en waaruit die wynbedryf in sy geheel voordeel kan trek.

Die implementering van die raamwerk by die gevallestudie-wynkelder het bewys dat die raamwerk maklik is om te implementeer en voordelig vir rekordhouding, besluitneming en beplanning is. Wat die eksterne validasie betref, het die rolspelers in die wynbedryf die raamwerk as haalbaar, prakties, gestruktureerd, gebruiksvriendelik en holisties beskou. Die raamwerk blyk ook aanpasbaar te wees, aangesien meer as een wynkelder meen dat hulle die raamwerk kan gebruik en voordeel daaruit kan trek. Die voorgestelde raamwerk is veral voordelig vir die generering en nasporing van data in wynkelders ten einde vorige suksesse voort te sit en herhalende mislukkinge te vermy.

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Acronyms

AHP	Analytical Hierarchy Process
ANN	Artificial Neural Networks
BOM	Bill of Materials
CV	Coefficient of Variation
FMCG	Fast Moving Consumer Goods
GDP	Gross Domestic Product
KWV	Ko-operatiewe Wijnbouwers Vereniging van Zuid Afrika
MAD	Mean Absolute Deviation
MAPE	Mean Absolute Percentage Error
MSE	Mean Square Error
MTO	Make to Order
MTS	Make to Stock
NDA	Non-Disclosure Agreement
OIV	International Organisation of Wine and Vine
PPI	Producer Price Index
PwC	Price Waterhouse Coopers
ROI	Return on Investment
SAWIS	South African Wine Information and Statistics
SBA	Syntetos-Boylan Approximation
SCC	Supply Chain Council
SCM	Supply Chain Management
SCOR	Supply Chain Operations Reference
SCS	Supply Chain Strategy
SES	Simple Exponential Smoothing
SKU	Stock Keeping Unit
SMA	Simple Moving Average
S&OP	Sales and Operations Planning
TS	Tracking Signal
WISE	Wine Industry Strategic Exercise
WOSA	Wines of South Africa

Chapter 1

Introduction and background

1.1 Chapter introduction

This study aims to develop a demand planning framework for small and medium-sized wineries to increase business performance and steer wineries toward a market-driven approach. This chapter introduces the research problem, the objectives the researcher aims to achieve and the strategy for the research project.

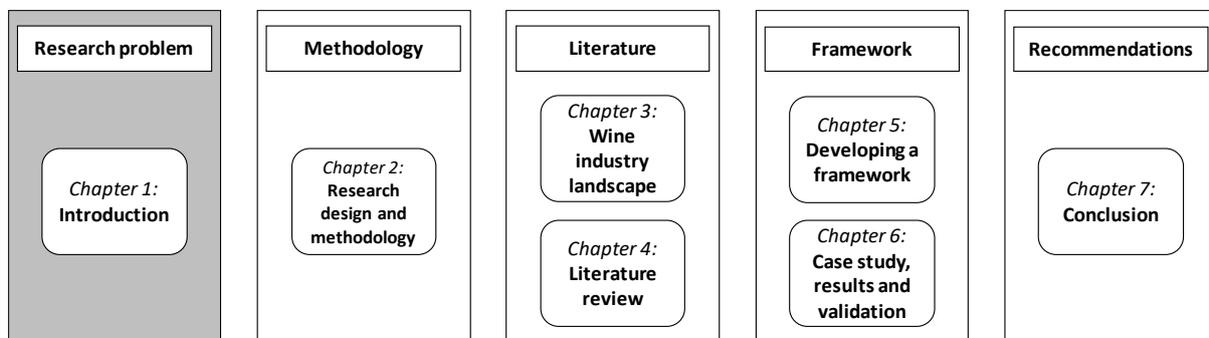


Figure 1.1: Thesis outline

1.2 Background

The South African wine industry is one of the oldest industries in South Africa, dating back to 1655 when the first vines were planted. More than 350 years later, South Africa is now the eighth-largest producer of wine worldwide (OIV, 2017) and is gaining more acclaim for the quality wines produced here. The wine industry is also a large contributor to the country's GDP (through wine sales and tourism) and employs close to 300 000 workers – ranging from unskilled to highly qualified (SAWIS, 2015).

Although the South African wine industry is the oldest of all the 'new world' wine countries, in a sense it is also the youngest. At the end of the nineteenth century, the Cape lost a quarter of its vines due to the Phylloxera epidemic. After that apartheid reigned and isolated South Africa from the rest of the world. The 'Ko-operatiewe Wijnbouwers Vereniging van Zuid Afrika' (KWV) was founded and became the regulatory body for the wine industry in 1918 (Goode, 2013). This led to numerous wine producers planting high yielding grapes, as they were paid for quantity instead of quality. By 1924, almost 95% of vineyards belonged to the KWV and they had the power to regulate the policies and set their prices and terms (Robinson, 2006). Because of the high yielding, low-quality grapes produced, 70% of South Africa's wine grape harvest was used for distilling and grape juice production. Since the abolishment of apartheid in the early 1990s, the South African market opened for exports and the deregulating of the industry in 1997 led the South African wine industry to change completely. Now, the industry uses 70% of its wine grape harvest for producing wine (Johnson & Robinson, 2009). The number of private wine cellars has doubled since the turn of the century and South Africa is now considered to be one of the most dynamic and innovative wine industries in the world (Atkin, 2016).

1.3 Problem statement

The South African wine industry is not profitable, wine prices are too low and the industry is following a production-driven approach.

The South African wine industry is not profitable. On average wineries make less than 1% Return on Investment (ROI) yearly (WISE, 2018). That is far less than an average investment would grow when invested conservatively. On average 15% of wine farms are operating at a profit, 55% are at a break-even point and another 30% are operating at a loss (Loots, 2016). The industry leaders and experts are searching for solutions to the problem. Surely South Africa can gain higher profits for their highly acclaimed wines.

The wine industry, with VinPro¹ at the helm, has conceived a strategic plan – Wine Industry Strategic Exercise (WISE), to steer the South African industry in the right direction. Several task groups have been formed to drive the key challenges within the industry. Amongst other targets, the WISE model aims to be more market and value chain-driven in 2025, than the current production-driven outlook. Furthermore, supply chains will amongst other things be at the top of the global agenda in taking South African wine forward (Augustyn & Heyns, 2016). Several benchmarking supply chain studies have been finished and are currently underway at the University of Stellenbosch, to develop the wine supply chain into maturity and thus move the industry forward.

One of the major industry concerns is that more wine is made yearly than what is being consumed. This used to be an enormous problem globally, but due to some smaller harvests (mainly due to drought and frost) in recent times and the uprooting of a couple of thousand hectares of vines in France (mostly), the demand and supply seem to have balanced out. And even though it seems like the wine supply and demand are now in equilibrium in South Africa (WISE, 2018), individual producers still produce excess wine each year. This is especially evident in the discounted wine (especially white wine) or unlabelled wine sales we see every year. The WISE movement aims to have this production-driven business model transformed into a market and value chain-driven business model. Thus, for the wineries to know what the consumers want and how much they demand, demand planning is essential.

Apart from the WISE initiative, Price Waterhouse Coopers (PwC) has been collecting financial data on the wine industry since 2003. Their aim is to investigate the outlook industry players have for the industry and identify opportunities and threats in the industry. In 2010, PwC reported that demand forecasting and planning needed improvement in wineries. It also stated that the competitiveness of the industry relies on timely information being shared throughout the supply chain by the market the wineries serve (PwC, 2010). More recently PwC has collaborated with the University of Stellenbosch and the CSIR to focus on the supply chain within the wine industry (PwC, 2013). The research has identified that the lack of understanding and expertise in these fields can be a major drawback for the wine industry. This needs to be addressed as wine producers are already under a lot of financial pressure (van Eeden, et al., 2012).

¹ VinPro is the wine industry's service organisation. Representing about 3600 producer and cellar members, it strives toward the industry's commercial sustainability as well as being their representative in dealings with Government, amongst others.

1.4 Demand planning in the wine industry

A winery can be described as a ‘manufacturer’ of wine. Therefore, implementing decision improvement processes that drive manufacturing, ought to increase business performance (Miller, 2012). The researcher considered classic industrial engineering principles and methods to create a sustainable method by which wineries can move toward a market-driven approach and winery profitability can improve.

The ‘Lean’ methodology can classify these issues into two categories: Waste of over-production (wine surplus) and Waste of inventory (cash-flow issue) (Government, 2014). Both wastes contribute to the financial pressure and can be decreased or eliminated by means of demand planning. When demand planning is implemented correctly, it can effectively plan the amount of stock which there is a demand for per specified time. This could lead to matched supply for the demand, as well as matching demand within a given period (which would minimise inventory at any given time).

Since wine is only ‘manufactured’ once a year, accurate demand planning can assist wineries to produce the right amount of wine each year. This means that they do not have unnecessary expenditures on overproducing, nor do they lose out on revenues from lost sales. Another benefit from successfully implementing demand planning would be that suppliers can be notified well in advance about the dry goods or packaging material that are needed at a specific time. The researcher assumes that suppliers could possibly offer discounts because of this and they will probably be more reliable.

According to the structure of the wine industry, as shown in Figure 1.2, the South African wine industry consists mostly of private cellars and a few producer cellars and producing wholesalers. Almost half of the industry’s private wine cellars produce less than a hundred tons of grapes each year, with only just over a hundred cellars producing more than a thousand tons of grapes each year. Thus, most wineries in South Africa can benefit from this study as their planning should be done much more accurately to minimise cost. Wineries producing small volumes of wine can benefit immensely by improving record-keeping, decision-making (based on evidence of record-keeping) and planning.

Figure 1.2 illustrates the structure of the wine industry graphically. From this it is clear that there is a larger quantity of small wineries, but that the total volume of what they produce is less than the large and cooperative wineries.

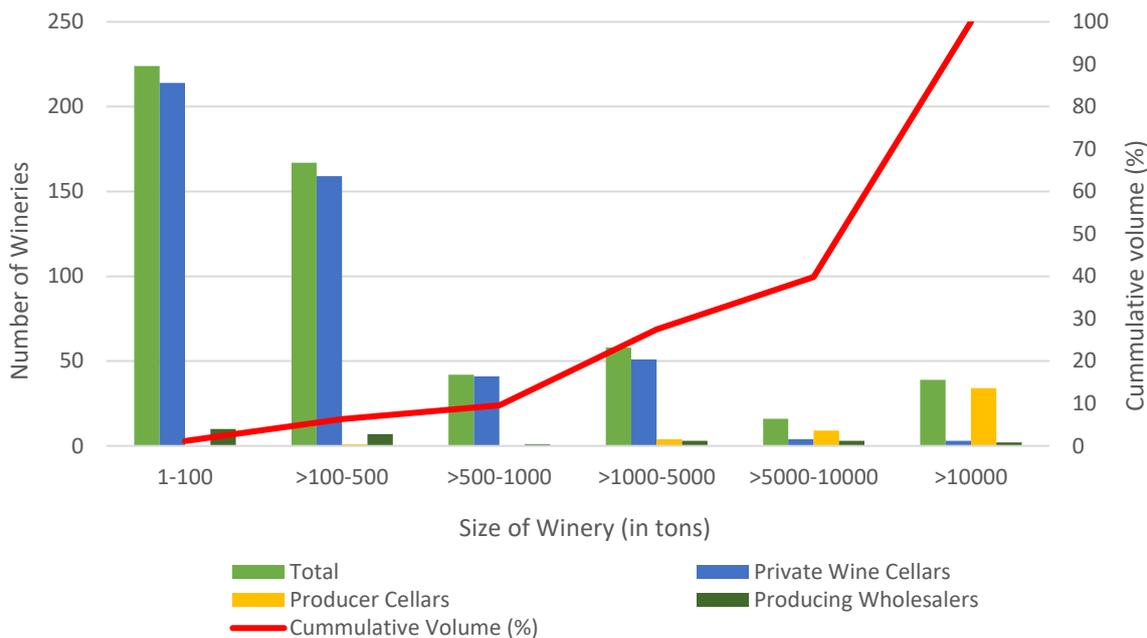


Figure 1.2: Wine industry structure (Adapted from SAWIS, 2018)

Since the literature on supply chain management is very limited within the wine industry, the researcher aims to conduct structured interviews with winery management to determine their planning maturity and decision-making. From previous experience in the wine industry and informal conversations with wine industry players, the researcher determined that demand planning in wineries is rarely up to standard. A practical, easy-to-use framework could serve as a tool for wineries to improve their demand planning and move the industry forward.

1.5 Research questions

Based on the background and the establishment of the research problem, the primary research question to be considered in the study is:

What should a generic demand planning framework for small to medium-sized wineries look like?

In support of the primary research question, a number of sub-questions need to be answered to support this:

- How feasible is demand planning in the wine industry?
- What are the wine and winery specific attributes and opportunities in the wine industry?
- Can demand planning be easily implemented in the wine industry?
- At what level of maturity within planning and decision-making do small to medium-sized wineries operate?

- e. What would be the major execution barriers of implementation?
- f. Who should be the drivers of the plan and what are their roles within this?

1.6 Research objectives

To respond to the research questions stated in the previous section, the researcher set objectives to guide the study in answering the research questions. The main objective of the study is:

The research aims to develop a practical decision-making framework to implement at small to medium-sized wineries, especially aimed at improving demand planning.

This research objective addresses one of the WISE aims – for wineries to move away from the production-driven approach (Basson, 2015), to a more value chain-driven approach. Theoretically, wineries could benefit greatly from accurate demand planning and execution to reach this state. In an attempt to reach this main objective, more manageable sub-objectives are set to ultimately reach the main objective. These include:

1. Choose an appropriate research design and shape a constructive methodology to develop a framework.
2. Explore the following fields of study:
 - a.) Determine value opportunities in the wine industry
 - b.) Wine and wine industry specific attributes
 - c.) SKU grouping and family classification
 - d.) Demand forecasting and planning
 - e.) Strategic and tactical planning and decision-making
3. Establish the fundamental principles of the demand planning process and factors/decisions influencing it.
4. Consider appropriate forecasting models to implement in the wine industry.
5. Define the strategic decision-making process and planning maturity of wineries.
6. Evaluate the impact of the implemented demand planning model on wineries.

1.7 Research scope

To stay focused on the research topic and its objectives, and to finish the project within the given time, the boundaries of the study are explicitly stated here. The following restrictions were adhered to throughout the project:

- The framework and research are concerned with strategic and tactical planning and decision-making practices.

- The framework is specifically designed for small to medium-sized wineries (smaller than 1 000 tons).
- The framework is specifically designed for people without prior experience in demand forecasting and planning or any knowledge thereof. Thus extremely sophisticated models are outside the scope of the study.
- It is possible that the framework would be able to be used in other similar industries by altering it accordingly. The focus of the research, however, remains in the wine industry.

Although there will be some mention of other practices or industries, these practices are included to evaluate whether the practices are transferrable to the wine industry.

1.8 Overview of research methodology and design

This mixed methods study will develop a demand planning framework for small to medium-sized South African wineries. A convergent parallel mixed methods design will be used, and it is a type of design in which quantitative and qualitative data are collected in parallel, analysed separately, and then merged. In this study, sales data and financial statements will be used to test the theory of forecasting. Demand planning and forecasting will, when implemented effectively, positively influence the planning ability of wineries which could lead to big wins. The qualitative data in the form of structured and semi-structured interviews will explore the maturity of the winery's planning and decision-making strategy as well as the process flows within the winery. The reason for collecting both quantitative and qualitative data is to merge the two forms of data to bring greater insights into the problem than would be obtained by either type of data separately.

1.9 Research outline

As this is a deductive study within which literature is also used as a part of the research methodology, the thesis is structured in such a way that it can be easily and logically followed. It is also structured in the order in which the research process was followed to deduce the necessary knowledge.

The research objectives and questions stated in previous sections are met in the following chapters as mentioned in Table 1.1. The thesis is presented in seven chapters.

Table 1.1: Research outline

Chapter	Question	Objective
Chapter 2: Research design and methodology		1
Chapter 3: Wine industry landscape	b, c	2a, 2b
Chapter 4: Literature review	e, f	2c, 2d, 2e, 3
Chapter 5: Developing a framework		4
Chapter 6: Case study, results and validation	a, c, d	5, 6
	Main question	Main objective

Chapter 1: Introduction

Chapter 1 introduces the research. It gives the background to the South African wine industry and states the problems the research needs to address. The importance of the study is described. Furthermore, the researcher shares the hypothesis as to which industrial engineering principles can be implemented to resolve these critical issues. After that the research questions are stated along with the objectives the study aims to reach. An overview of the research methodology is given, concluding with the research strategy and outline.

Chapter 2: Research design and methodology

Chapter 2 outlines which design and method were followed to conduct a successful research study. After selecting an appropriate design and approach for the research, the methodology is discussed in depth. Methods are explained and justified according to appropriateness and ease of use. The validity, reliability, and replicability of the study are also discussed. Finally, the ethical considerations of the study are defined.

Chapter 3: Wine industry landscape

Chapter 3 consists of the literature regarding the wine industry. The state of the South African wine industry is discussed as well as the wine supply chain. In an attempt to understand where demand planning plays a crucial role in the winemaking process, the main phases of the process are explored. Furthermore, the unique attributes of winemaking are discussed, along with the exploration of other industries which share overlapping attributes.

Chapter 4: Literature review

Chapter 4 consists of the literature available on demand planning as a process to improve business functioning. The literature was used as a part of the methodology to understand the application of different forecasting and demand planning methodologies. The extent of demand planning and the field of stock keeping unit (SKU) classification and demand forecasting was

studied to gain an in-depth understanding thereof. Furthermore, best practices within the field were noted and the researcher was on the outlook for implementation opportunities within the wine industry. Topics in the literature study include the SKU classification, forecasting methods, and application and demand planning amongst others.

Chapter 5: Developing a framework

Chapter 5 proposes the framework as the solution to improved demand planning. The framework is discussed step by step as derived from the researcher's experience and the literature studied. The framework is developed according to the set objectives and scope of the study.

Chapter 6: Case study, results and validation

Chapter 6 introduces the case company on which the framework is tested. The framework is then implemented as per the steps developed in Chapter 5. The results and validations of the framework are stated at the end of Chapter 6.

Chapter 7: Conclusion

Chapter 7 concludes by summarising the main findings of the study. It is retrospective on the outcomes of the study and the main challenges the researcher faced during the study. Future research is suggested as well as improvements to the study.

1.10 Chapter conclusion

The chapter introduced the research problem and how the researcher aims to address this. In Chapter 1 the research question was clearly stated as well as the more manageable sub-questions. The researcher then set clear objectives to answer the research questions and ultimately fulfil the research question. The research scope and methodology were also discussed. The chapter concluded with the outline and strategy of the study.

Chapter 2

Research design and methodology

2.1 Chapter introduction

The introductory chapter defined the profitability issues that the South African wine industry is currently facing. This chapter outlines the methodology chosen for this research project and the appropriateness of the techniques implemented in going about the research. The chapter commences with the research approach being implemented, which also led to the suitable research design and methodology for the study. The appropriate mixing of methods is explained and how each method contributes to the overall outcome of the study. Furthermore, the researcher explains the criteria for the evaluation of the research, including the reliability, validity, replicability and the role of the researcher in the study. This chapter concludes with the ethical considerations related to the study.

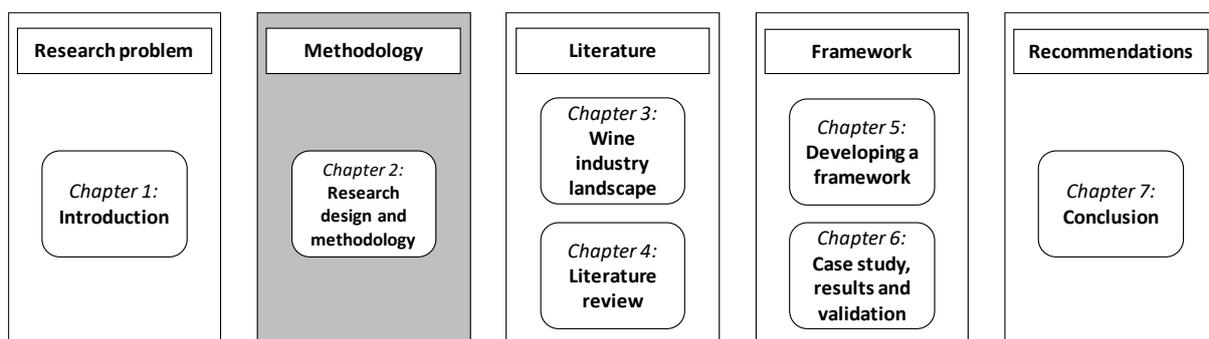


Figure 2.1: Thesis outline

2.2 The nature and foundation of mixed methods research

This section includes the reasons for combining methods and establishes the alternative knowledge claims associated with this study, which led to the chosen philosophical worldview.

2.2.1 The need for a mixed methods approach

There are two main reasons for mixing quantitative and qualitative methods in this study. The researcher identified that the need exists for another data source since one source may be insufficient. Initially, the researcher thought it fit to develop a demand planning and forecasting model based solely on data gathered from wineries. This is quantitative data. However, the researcher realised that qualitative research in the form of a literature study, structured interviews and field research is needed to develop, explain and evaluate this framework. Thus, qualitative research methods are also implemented to gain the amount of knowledge needed.

Furthermore, qualitative methods are employed to enhance the study. It is used to explain the results gained in the quantitative data analysis. It gives rise to a better understanding and more accurate implementation of the results; thus, bringing about more effective change through the implementation of the framework.

2.2.2 Advantages of mixed methods

A major advantage of using a mixed methods approach is that the disadvantages of quantitative methods can be countered by qualitative methods and vice versa (Creswell & Plano Clark, 2011). Through combining the two methods in this study, the context of current procedures in the specific winery is given through the qualitative results. The qualitative data enables the researcher to understand the quantitative results better.

2.2.3 Alternative knowledge claims

To determine which methods should be used to achieve the desired outcomes of the study, the following characteristics of the field of study were considered:

- The main outcome of this research is to implement an already existing field of knowledge, practices and techniques in an environment which does not use it. Therefore, the paradigm should be evaluative.
- The research is also practical and should be implemented. A real-world or practice-orientated paradigm should be used.
- Furthermore, as the decision-making, planning processes and maturity of a winery are not known, the methods should also be exploratory to understand this.

A mixed methods approach should be appropriate for this study as it uses qualitative and quantitative approaches.

Several philosophical assumptions based on a set of beliefs guide inquiries in mixed methods research (Guba & Lincoln, 2005 cited in Creswell & Plano Clark, 2011). The five main elements influencing the paradigm or worldview chosen, is ontology (the nature of reality), epistemology (how we gain knowledge), axiology (the role that values play in research), methodology (process of research) and rhetoric (language of research) (Creswell, 2009; Lincoln & Guba, 2000 from Creswell & Plano Clark, 2011).

Ontology deals with the reality and philosophy about reality and its characteristics. In this mixed methods approach, singular and multiple reality ontologies are present. This is since the researcher tests certain assumptions and provides multiple perspectives on the outcomes and the qualitative data gathered (Creswell & Plano Clark, 2011). The epistemological element of the data is practical. It refers to the relationship of the researcher and what is being researched. The researcher, in this case, addresses the research problem with a practical solution, demand planning, and evaluates the outcomes based on the results. In terms of axiology, the researcher has multiple stances, that is the biased and unbiased views (Creswell & Plano Clark, 2011). Unbiased views are generally a result of quantitative research, where the answers are given numerically and no interpretation is required. But during the study, biased views are also expressed by the researcher due to the outcomes and conclusions arrived at based on the findings. Researcher bias should be avoided so far as possible.

As this is a mixed methods approach, the researcher uses an abductive logic to direct the flow of the study. This is a combination of inductive and deductive logic. Inductive logic is mainly associated with qualitative research, where the researcher derives theory from the data gathered. Deductive logic makes use of quantitative data and tests the accuracy or validity of theories (Bryman & Bell, 2016). According to Wheeldon & Ahlberg (2014), the abductive approach combines the deductive and inductive processes, but “relies principally on the experience, expertise and intuition of the researcher”. Although a literature study, interviews and the analysis of data are fundamentally used as the research approach, the experience and logic of the researcher, a winemaker with experience locally and abroad, is also leaned on for insight and reasoning. Figure 2.2 visually illustrates this logic.

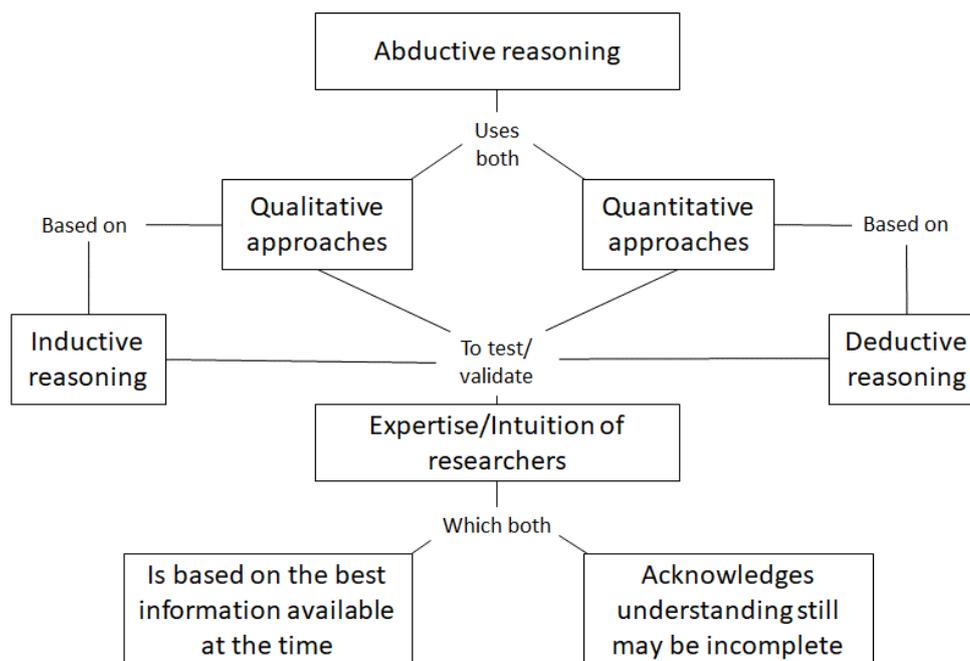


Figure 2.2: Abductive reasoning (Wheeldon & Åhlberg, 2014)

Due to the nature of the research, an abductive logic is deemed an appropriate fit. During the course of the study, the researcher identifies the problem and the possible reasons for the problem. The researcher then attempts to solve the problem by implementing techniques derived from theory, making this part of the study deductive. This theory is mainly derived from the literature study at the beginning of the research. Inductive reasoning is implemented after the techniques and theories are tested, to build theory in a new industry, namely, the wine industry. The output of this thesis will be a framework for demand planning, specifically in the wine industry. Thus, one can say that theory is tested and reshaped to fit a specific industry. Therefore, the theory is also built.

2.2.4 Philosophical worldview

The philosophical worldview can be defined as the “general philosophical orientation to research” (Creswell & Plano Clark, 2011). The four main worldviews within which research is usually conducted are known as postpositivism, constructivism, participatory worldviews, and pragmatism. Pragmatism is the worldview that is mostly associated with the mixed methods research approach (Biesta, 2010; Creswell, 2010; Creswell & Plano Clark, 2011). Therefore, this study makes use of a pragmatist worldview wherein the aforementioned worldview elements also exist.

Pragmatism offers a particular view of knowledge, one that principally corresponds with this study. This view is one that claims that knowledge can only be gained through action and

reflection. Knowledge, according to the pragmatist view, is always about the “relationship between actions and consequences” (Biesta, 2010). In the same way, this study aims to gain knowledge through implementing a practical solution to the problem and evaluating the consequences. In this case the evaluation of the actual outcomes would be too time consuming, thus, historical data is used and tested. Pragmatism is problem centred. It focuses more on the problem posed than the methods that are used (Creswell & Plano Clark, 2011). Generally, a variety of methods are tried to gain valuable knowledge, practically. This worldview lends itself not solely to either a qualitative approach or a quantitative approach but uses both extensively to build knowledge (Creswell, 2003). Qualitative data in the form of literature and interviews were used in combination with quantitative data in the form of sales data, to build knowledge through an implementable framework.

2.2.5 Choosing a mixed methods design

Figure 2.3 illustrates the considerations taken into account to formulate an appropriate research design. Alternative knowledge claims, strategies of inquiry and the methods are conceptualised by the researcher. In the previous section the choice of a pragmatist worldview was explained. The researcher then considered a basic method in which to practically solve the research problem. It was considered a good idea to build a step by step framework to improve demand planning in small to medium sized wineries. The framework needed to be understandable and easy to use. Thereafter, a detailed procedure and the need for specific sets of data were decided. The researcher concluded that such a framework needed to be built on literature and the experience of the researcher. And to implement this at a case study winery interviews need to be conducted as well as the winery’s demand or sales data and financial data is needed. Based on that the research approach is decided – quantitative, qualitative or mixed methods (dependant on the data required and the process of research). For this study both qualitative and quantitative data were thus needed. After all these factors are considered, the detailed research process can be designed accordingly. The researcher then decided on the questions that need to be asked, the methods for data collection and analysis, the specifications of the case study winery and validation wineries and what would be in and outside the scope of study.

Elements of inquiry

Alternative knowledge claims
(Philosophical assumptions)

Strategies of inquiry
(General procedures)

Methods
(Detailed procedures of data collection, analysis, etc.)

Approaches in research

Qualitative
Quantitative
Mixed Methods

Conceptualised by
the researcher

Design process of research

Questions
Theoretical lens
Data collection
Data analysis
Write-up
Validation

Translated into
practice

Figure 2.3: Factors to consider in formulating a design. Adapted from (Creswell, 2003)

The key decisions involved in determining which research design to follow includes the level of interaction between the qualitative and quantitative methods; the relative priority of the two methods; the timing of the methods in relation to each other and the procedures for mixing the methods (Creswell & Plano Clark, 2011).

Strategies of inquiry provide detailed direction for the method of a research design (Creswell, 2003). The mixed methods approach calls for a sequential or concurrent strategy of inquiry. As two modes of data collection (quantitative and qualitative) are performed, the researcher needs to decide in which order the data will be gathered. In this study, the researcher decided on a concurrent strategy of inquiry as the data can be collected at the same time, analysed separately and then joined together. The researcher collected the qualitative and quantitative data from the winery at the same time and then joined the sets of data together. Further qualitative data is then gathered by means of interviews for the validation of the framework.

2.3 Collecting data in mixed methods research

It is, therefore, important to develop a strategy for collecting the appropriate data, in the appropriate manner to answer the research question(s) sufficiently. As stated in the introductory chapter, this study aims to answer several sub-questions, in addition to the main research question. The objectives set in the study are also aligned to answer all these questions. Due to the complexity of mixing research methods, rigorous planning and strategising are necessary to complete all the desired outcomes in the available time. This section will elaborate on the data that was collected and the ways in which this was done.

2.3.1 Procedures for collecting data: Qualitative methods

a) Planning the research

The first phase of conducting research is to develop a plan and build a strategy to conduct the research successfully. This phase is vital to understanding the problem, selecting the research sites and recognising potential issues. The researcher established the research problem through combining prior experience in the wine industry with news articles, industry conferences and informal discussions with industry players. The researcher then set out to find a winery to work with, which would be able and willing to supply the necessary data.

b) Obtaining permission

After finding a winery which would be able to supply the necessary data, the researcher explained the extent of the research and the data required. As stipulated in section 2.6 of this document a non-disclosure agreement (NDA) was put in place to protect the privacy of the winery. The winery agreed to all the terms and the contract was signed. This contract was then brought before the Faculty Ethics Committee of Stellenbosch University for approval before the commencement of the data collection.

c) Collecting information

The **literature study** is considered a part of the qualitative data as it is used to obtain in-depth knowledge of which elements to include in the data. It also evaluates the appropriate forecasting techniques to use and how to establish them. Furthermore, it establishes which judgemental factors should be taken into consideration when doing forecasts. The literature study also gave information on SKU classification, effective demand planning and the strategic implementation thereof.

Two different interviews were conducted at the case study winery. The **structured interview** consisted of factual questions about the demand planning strategies that the winery has in place. Questions relating to strategic decision-making were also included. These were all asked to gauge the maturity of demand planning and strategy within the winery. It could later be used to explain some of the outcomes of the quantitative data. Another set of structured interviews were conducted at the end of the study to validate the framework. These interviews were conducted at multiple wineries, with the same set of questions asked. The researcher explained the framework to the selected validation wineries and then asked questions regarding the framework to validate the framework.

A **semi-structured interview** was conducted in which the researcher asked the management of the case study winery for an explanation and sequence of processes within the winery. These

included the flow of information and products within the winery and to and from the winery, as well as the time taken for these processes.

For a full account of the questions asked within the interviews, please refer to Appendix A.

d) Recording the data

During both the structured and semi-structured interviews, the researcher followed predetermined interview protocols. Due to the fact that this is a new field that is being introduced to the typical wine industry players within the research scope, the researcher made sure to explain the purpose of the research to the interviewee and how the interview questions tie into the research project. The interviewee was allowed to ask questions before, during and after the interviews.

The reason for choosing interviews above surveys or questionnaires was that the researcher could be present to ask probing questions should an interviewee's answer be unclear or answered insufficiently. Probing questions are used to keep the researcher unbiased, so as not to read anything into the answers, but rather to have it explained by the interviewee. It also keeps the interview data more reliable, as the researcher does not leave any room for interpretation because all answers are fully explained. A list of commonly used probing questions is given in Table 2.1.

Table 2.1: Common cognitive probes used in interviewing. Adapted from (Willis, 2005)

Type of Probe	Question Examples
Comprehension/ Interpretation	What does the term forecasting mean to you?
Paraphrasing	Can you repeat that question in your own words? Do you understand the question completely?
Confident Judgement	How sure are you about the statement you have just made?
Recall Probe	How do you remember that specifically without consulting the papers?
Specific Probes	Why do you think that your forecasting is accurate?
General Probes	How did you arrive at that answer? Was that question difficult to answer?

All the interviews were recorded on a voice recorder and transcribed by the researcher. This helps the researcher to be more involved and present in the interviews and respond by answering any questions or asking the correct probing questions, instead of focusing on getting all the data written in the short amount of time. The audio recording also keeps the interviewee engaged in

the interview and questions raised, as the interviewee does not need to wait for the researcher to write down the answers.

2.3.2 Procedures for collecting data: Quantitative methods

In the procedures for collecting qualitative data, the *planning the research (2.3.1 a)* and *obtaining permission (2.3.1. b)* remained the same in the quantitative procedures.

c) Collecting information

The researcher collected **sales data** from the winery for the years 2011 to 2015. The sales data are kept on record at the winery and were collected in digital format. The winery could not supply demand data for those years because they had not collected it. Demand data refers to the placement of orders that could not be fulfilled because of stock-outs. Furthermore, **Income Statements** and **Balance Sheets** for the years 2011 to 2015 were also collected digitally, along with the **supplier information** of the suppliers used. This information included the cost of products, cost of transportation of products and lead times of products. These were the quantitative data collected from which the researcher developed an appropriate demand forecast and plan.

d) Recording the data

All the quantitative data was collected from the winery in digital format (PDF and Excel files). These documents were kept on the researcher's computer, to which only the researcher has access. This was the data used from which a demand planning framework was built.

2.3.3. Data collection in convergent parallel design

Within the convergent parallel research design, which was chosen by the researcher, both the quantitative and qualitative data were gathered in the same phase of the research. Both sets of data were collected at the same time and analysed separately. Only when developing the appropriate demand planning framework, were the two datasets merged. Both datasets were gathered from the same winery to make conclusions about the decision-making system as a whole. The criteria for selection of the wineries will be provided in Chapter 6, the Case Study Chapter.

2.4 Analysing and interpreting data in mixed methods research

In mixed methods research, quantitative data needs to be analysed quantitatively and qualitative data needs to be analysed qualitatively. The researcher analysed each dataset separately and then

combined the datasets and analysed it to answer the research question and achieve the research objectives.

2.4.1 Procedures in data analysis: Qualitative methods

a) Preparing the data for analysis

The audio recordings of the interviews were **transcribed** into documents, in order for them to be analysed. From this, it was simpler to give a holistic overview of the winery as described in Chapter 6.

b) Exploring the data

A general understanding of the interview data was obtained through reading the transcripts. Notes were taken on important, good and bad practices. These were also linked to possible outcomes of the quantitative research. The holistic picture of the winery was formed in the researcher's mind.

Through reading the transcripts of the processes within the winery, the researcher could categorise different aspects and make notes on the processes. From this it was possible to construct a basic process flow map.

c) Analysing the data

The data gathered from the structured interview was divided into concepts and relating aspects connected to it. These aspects were connected to the concepts by the researcher to connect the data easily with the quantitative data.

d) Representing the data

The qualitative data is represented together with the quantitative outcomes to link the two datasets. The results of forecasting and planning are linked with the processes in the winery and the influence of the one on the other. The background and strategic and tactical planning of the winery are described in Chapter 6, where a report is given about the outcomes of the interviews.

e) Interpreting the results

After the results had been merged, the researcher interpreted the findings of the framework and the outcomes in the case study. The results were measured against the set objectives of the framework. Did the framework achieve the desired outcomes? Did the framework adhere to the specifications? Did the study achieve its objectives?

f) Validating the data and results

The framework derived from the winery was then evaluated by several other wineries to validate whether the framework is feasible and desirable in small to medium-sized wineries. The framework was improved as new aspects were added from other wineries. These validation wineries ultimately gave recommendations as to the usability and practicality of the framework.

2.4.2 Procedures in data analysis: Quantitative methods

a) Preparing the data for analysis

All the data received in digital format was organised in Microsoft Excel in such a way that it was easy for the researcher to analyse and work with. Any irregularities on the spreadsheets were questioned and corrected or eliminated. All data in PDF format was captured in Microsoft Excel to increase the ease of use and effectiveness of analysing the data.

b) Exploring the data

The sales data was explored by drawing up **Pivot tables** in **Microsoft Excel** to compare the corresponding elements with each other. Thereafter it was much simpler to group SKUs into product families, to identify patterns, do calculations and compare product families.

c) Analysing the data

The data was analysed in **Microsoft Excel**. From the Pivot tables and the Bill of Materials (BOMs), the necessary calculations could be done to group SKUs into product families. Next, the product families could be classified and forecasting tested on the data, using the historical year 2011-2014 to do forecasting and the 2015 year to measure the accuracy in the demand planning.

d) Representing the data

The data analysis is represented in Chapter 6 by means of comparative tables and graphs.

After the classification of SKUs into product families (which is also depicted in Table 6.3), the product families were classified according to the nine classes (ABC/XYZ), then the forecasting was done and tested. All of this is represented in **tables** and **graphs** for the reader to visually understand and interpret.

2.4.3. Data analysis in convergent parallel design

In Figure 2.4 a study diagram of the outline of the research is given. The data collection and analysis procedures are depicted briefly in this figure to illustrate how the procedures work together.

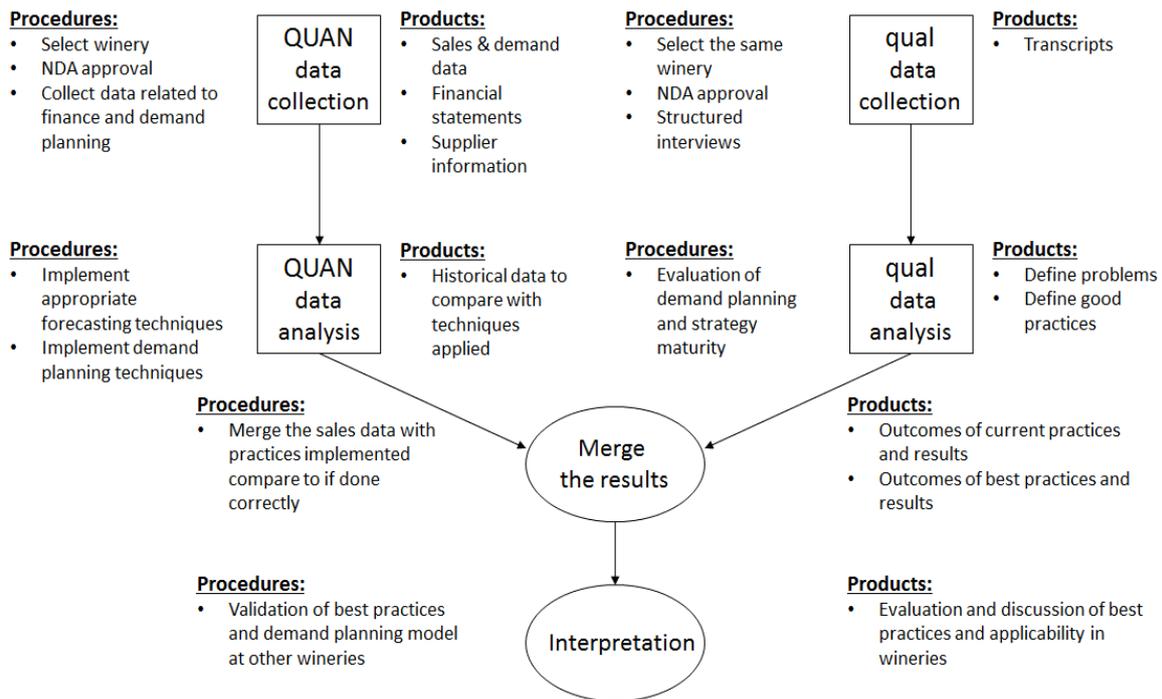


Figure 2.4: Convergent design study diagram. Adapted from (Creswell & Plano Clark, 2011)

2.5 Criteria for the evaluation of research

According to Bryman & Bell (2016), it is important to consider the quality issues that might occur in research. The main issues in management research are those of reliability, replication, and validity.

2.5.1. Reliability

The reliability of a study is a measure of the repeatability of the study and whether the concepts that are measured are consistent. Reliability is particularly concerned with quantitative methods (Bryman & Bell, 2016) regarding the consistency of results. Do the measures provide the same results? In this study, the researcher aims to have reliable measures which can be easily measured in other wineries, with the same attributes, to give the same results. The purpose of the study is to find a reliable way to measure demand and build a plan according to that. A framework is developed which can be used in various wineries, therefore it should be tested in other wineries to be a reliable model.

2.5.2. Replicability

The replicability of a study is dependent on how well the researcher articulates the research process that was followed (Bryman & Bell, 2016). Although this study is not replicated from a

previous study, the researcher aims to make this study replicable in other similar alcoholic beverage industries, like breweries and distilleries, which could also benefit from the outcomes of the study. This could be done by following the same procedures used in this study.

2.5.3. Validity

Validity can be defined as the integrity of the conclusions of the research and can be considered as the most important criteria for evaluating research (Bryman & Bell, 2016). In this study, the validity of the framework is tested at other wineries based on the outcomes of the case study.

The researcher approached several wineries to validate the feasibility and practicality of the framework. The framework was explained in the validation interviews and the researcher then asked questions about the framework. These questions can be found in Appendix A.

When considering validating the framework, sampling was an important factor. The participants' involvement at wineries, years of experience in the wine industry and educational background is summarized in section 6.11.

2.5.4. Role of the researcher

The role that the researcher plays in collecting qualitative data is usually much bigger than in quantitative data collection. This can be ascribed to the fact that the researcher is involved in the collection of the data and can draw conclusions of situations. The researcher might also interpret the way that people behave in situations that follow. Thus, it can be said that the researcher can be biased due to our human nature and it can be reflected in the results. The qualitative data collected in this study, however, leaves no room for interpretation as mostly factual questions and no interpretive questions were asked in structured interviews. Probing questions are also asked during interviews to eliminate the possibility of the researcher drawing conclusions from certain reactions. There is very little room for the researcher to have an influence on the results that have been obtained. It is purely factual, although the researcher does play an interactive role.

2.6 Ethical considerations

The purpose of research is usually to develop, understand and improve the situation that is being studied. Therefore, one could say that causing harm, discomfort or invading the privacy of participants in the research would be contradictory to the purpose of the research. In this study, two potential ethical issues were identified and the necessary practices were put in place to prevent these issues.

The issues relate to each other and they are regarding the **lack of informed consent** and the **invasion of privacy**. To ensure that the winery from which data were gathered understand the

project and its implications, an introduction regarding the project was proposed to the winery. They had the opportunity to ask questions and raise concerns about the project and the data required. This was all put into writing. Due to sensitive financial data that were required from the winery a non-disclosure agreement (NDA) was put in place to protect the privacy of the company.

2.7 Chapter conclusion

This chapter gave an overview of which research methodology and design was an appropriate fit for the specific research problem. The relevant approaches to research were discussed and the methodologies followed in this study were explained. A strategy for the study in terms of research steps for both quantitative and qualitative research is outlined. The chapter concludes with the role the researcher plays in this study and the ethical issues considered.

Chapter 3

Wine industry landscape

3.1 Chapter introduction

This chapter aims to give the reader an understanding of the South African wine industry landscape. It introduces the industry, with a specific focus on the opportunities in the industry, market segments and planning phases within the winemaking process. The wine supply chain and WISE aims are also mentioned. Furthermore, the wine-specific attributes are explored as well as other industries with overlapping attributes to the wine industry to learn from their planning techniques.

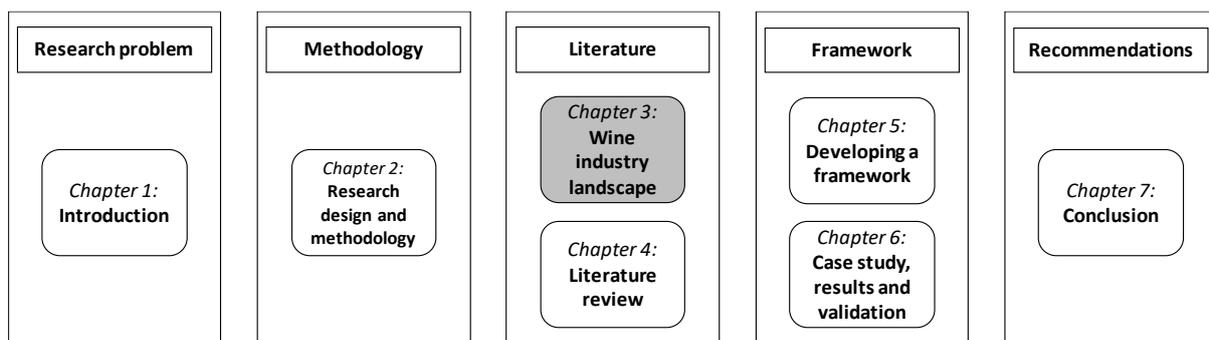


Figure 3.1: Thesis outline

3.2 State of the South African wine industry

South Africa is a big player in the worldwide wine industry. Since the abolishment of apartheid in the 1990s, the export market opened up for South African wine producers and this market has been a large source of income for producers. After the deregulation of the industry, the focus has also, in a large part, shifted from quantity to quality – with which South African premium wines are making a name locally and abroad. Although large producers still increase revenues by selling volumes and keeping costs low, the smaller producers need to find a way to be profitable by selling premium and super-premium wines.

The total area under vine for wine production in South Africa is currently 94 545 ha (SAWIS, 2018) and declining yearly. The decreasing hectares of vineyards could do the industry good in moving towards a market-driven approach according to the WISE aims. This will counter the oversupply of wine, driven by production and then ‘dumping wine at cheap prices in our export markets’ according to Anton Smuts, Chairman of VinPro. Anton further commented that such action ‘hurts the industry as a whole’ (Loots, 2017). Especially with the production cost increases (mentioned below), it makes sense to focus on quality rather than quantity, push wine prices up and thereby improve the image of Brand South Africa. The total planting and uprooting of vines from 2007 to 2017 is illustrated in Figure 3.2.

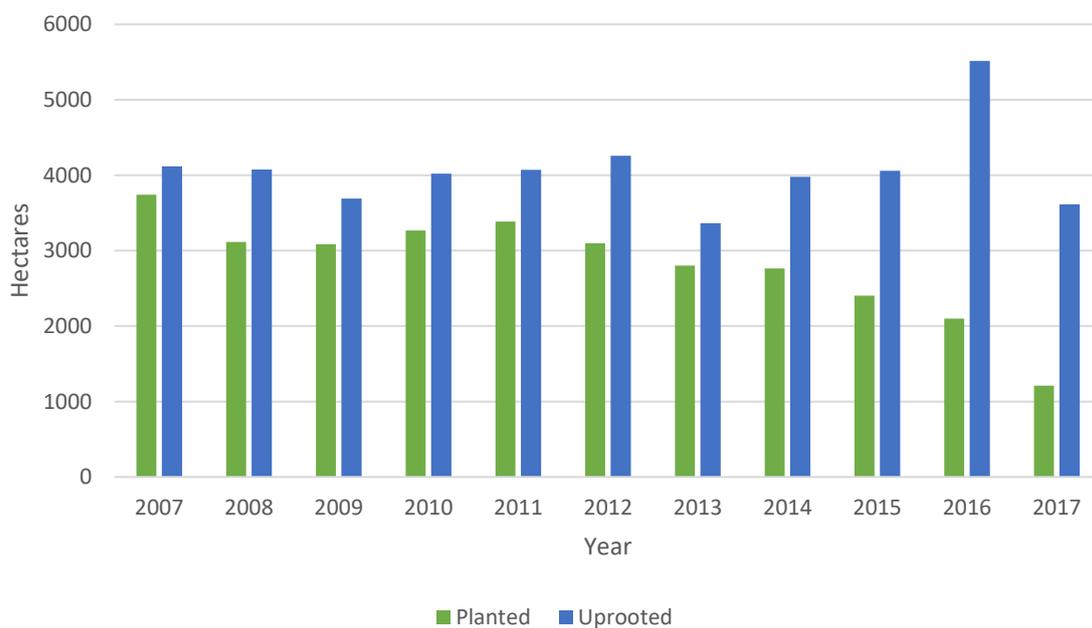


Figure 3.2: Wine grape vineyards planted and uprooted (Adapted from SAWIS, 2018)

The problem that most wineries and producers are facing is the steep increase in production and manufacturing cost – both of which have more than doubled in the last ten years (see Table 3.1)

and are also above the Producer Price Index (PPI). What is cumbersome is that the income (total and R/ton), has not doubled over the last ten years, making this a shortfall for producers (also being far below the PPI). Wine prices need to increase to keep up with the ever-increasing production costs.

Table 3.1: Production and manufacturing costs vs income (Adapted from SAWIS, 2018)

Year	Total grape production		Total producers' income		Average income		Weighted average production cost		Average manufacturing cost				PPI
									Packaged		Bulk		
	Tons	Rand	R/ton	Index	R/ha	Index	R/litre	Index	R/ton	Index	R/ton	Index	
2005	1171632	2643812150	2257	100,0	20643	100,0	5,36	100,0	642	100,0	642	100,0	100,0
2006	1301579	2642113837	2030	90,0	21332	103,3	7,79	145,3	583	90,8	583	90,8	107,7
2007	1351447	2852543089	2111	93,5	22125	107,2	5,35	99,8	687	107	687	107	119,5
2008	1425612	3319899014	2329	103,2	23578	114,2	5,92	110,4	724	112,8	724	112,8	136,6
2009	1347620	3648903196	2708	120	26580	128,8	8,86	165,3	812	126,5	812	126,5	136,6
2010	1261309	3619398130	2870	127,2	28585	138,5	9,05	168,8	971	151,2	971	151,2	144,8
2011	1302530	3553495891	2728	120,9	30582	148,1	10,44	194,8	958	149,2	958	149,2	156,9
2012	1414483	4131387152	2921	129,4	32439	157,1	14,57	271,8	1058	164,8	1058	164,8	166,5
2013	1498243	4820691029	3218	142,6	35739	173,1	13,74	256,3	1076	167,6	1076	167,6	176,5
2014	1519708	4727030678	3110	137,8	38674	187,3	14,75	275,2	1224	190,7	1224	190,7	189,8
2015	1477091	4792934343	3245	143,8	41635	201,7	17,96	335,1	1260	196,3	1260	196,3	196,6
2016	1405259	5030088313	3579	158,6	44390	215							210,4
2017	1437261	5827438668	4055	179,7	47513	230,2							220,5

South Africa's export market has grown significantly over the last 10 years, with a total of **448 million** litres exported in 2017 (see Figure 3.3). This represents a growth of 4,7% in total exports in 2017. While the majority of the exports were bulk wine, with the ratio currently at 61:39 for bulk: packaged exports (WISE, 2018b), the packaged export segment also showed growth for the first time since 2014 (SAWIS, et al., 2018).



Figure 3.3: Exported volume of wine (2006–2017) (Adapted from SAWIS, 2018)

The problem, yet again, is that although export volumes are increasing, the value of exports has decreased by a total of 3% (which consists of an increase of 4% for bulk wine and a 5% decrease for packaged wine). This is concerning from a South African wine industry perspective as production and manufacturing costs are increasing significantly (as seen in Table 3.1), but wine prices are decreasing (WISE, 2018b).

The local wine market in South Africa has also seen a steady increase in volume in recent years, with a total consumption of **450 million** litres of wine in 2017 (Figure 3.4). Although wine is gaining market share in South Africa it is still just behind Ready to Drinks (RTDs) at 450 301 737 litres and far behind the beer market at 3.2 billion litres in 2017 (SAWIS, 2018).



Figure 3.4: Domestic wine consumption (2006–2017) (Adapted from SAWIS, 2018)

What is particularly positive to see about the local wine market is that it grew in volume and in value in all segments in 2017. The high, medium and standard price segments grew by 9.3%, 5.3% and 17.9% respectively in terms of value, to bring about a total 8.6% increase (or R13.2 billion) in sales (WISE, 2018b).

In conclusion, the export and domestic market for the South African wine industry is growing in terms of volume, but it is concerning that wine prices are lagging and therefore wine value seems to be stagnant. Even more concerning is that the production and manufacturing cost of wine is increasing rapidly. Wine producers could be looking more anxiously into cutting unnecessary expenses and creating increased value for consumers in the near future.

3.3 WISE Aims

The Wine Industry Strategic Exercise (WISE) was formulated by the wine industry representative bodies (VinPro, Salba, Sawis, Wosa and Winetech) in 2015 to develop a strategic plan to achieve the 2025 ideal state of the South African wine industry. After a literature review and surveys in the industry, six work streams were developed within which industry role-players needed to identify the current situation as well as the ideal future state. The work streams aimed to address main questions regarding transformation, profitability, market share and government support (Augustyn & Heyns, 2016). WISE set the following goals for 2025 (see Table 3.2). This framework mainly aims at converting wineries towards a market-driven approach rather than production driven, but also at increasing the wineries' Return on Investment (ROI). This is done through

improved planning and decision-making. By improving planning and decision-making, wineries will be fulfilling customer needs in appropriate volumes. Thus, adding desired value to products, whilst minimising unnecessary costs.

Table 3.2: WISE aims (Adapted from Basson, 2015)

2015	TARGET	2025
2%	Producer return on investment	CPI +5%
Production driven	Business model	Market and value-chain driven
1.5%	Black-owned land & water	20%
330 million litres	Local wine sales	430 million litres
60:40	Exports bulk: packaged	40:60
20%	Ethical accredited volume	100%
2 Free trade agreements	Market focus	Agreements for key markets
1%:2%:5%	Export markets USA: China: Africa	7%;7%;10%
R 6 Billion	Wine tourism	R 15 Billion
R80 million: R11 million	Industry: Government levies	Matched funding
275 000	Employment levels	375 000

In 2018, VinPro shared at their yearly VinPro information day how the wine industry is doing in terms of these goals. Although it is positive to note that some of these goals have been met (like the local wine sales already surpassing the 2025 goal) or are moving towards completion, there are also those goals that have worsened, probably the most cumbersome of these are the profitability of wineries that has decreased to less than 1% ROI (WISE, 2018). By attempting to improve demand planning (as in this framework), unnecessary costs can be reduced, thus increasing the profit.

3.4 Defining the wine supply chain

A part of the complexity of the wine supply chain can be seen in Figure 3.5. The grape grower tends to the vines and ensures the quality of the grapes. They supply the grapes to the wine producer, the 'manufacturer' of wine. The finished product (wine) is then packaged or sold as bulk wine or juice. In all three of these phases, the raw material suppliers supply the goods to produce the grapes, juice, wine and finally packaged wine. The distribution of finished wine could then take a number of routes – the first decision being about whether the wine is destined for the export or local market. The export wine routes through a freight operator to an importer, who then distributes amongst retailers and restaurants. The local wine is distributed in various ways,

either through a finished goods distributor or directly to a wholesaler, retailer, restaurant or final consumer.

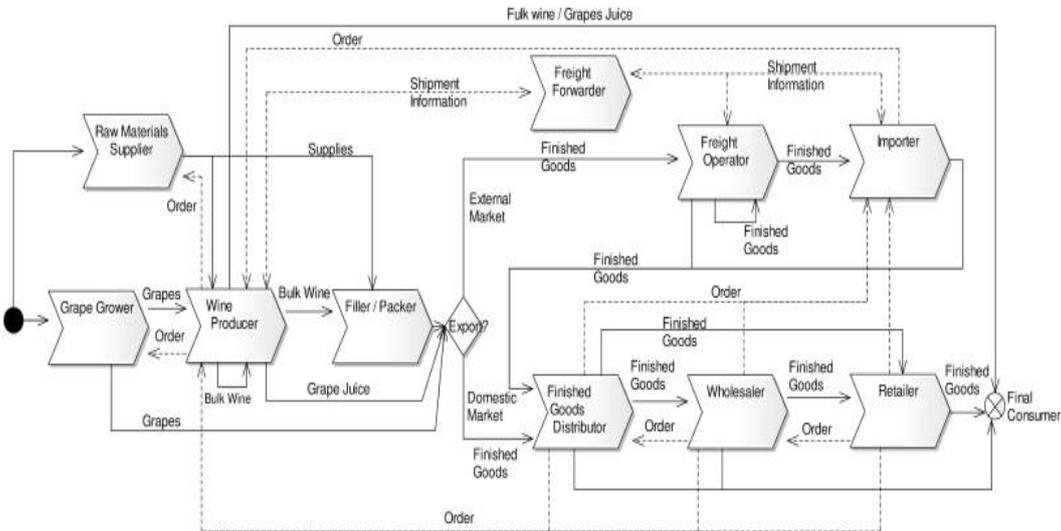


Figure 3.5: Wine supply chain (Garcia, et al., 2012)

Each one of these 'role-players' forms a part of the supply chain. And not all wines can be modelled on the same supply chain but must be strategised differently to serve customer needs (Fisher, 1997), thus resulting in multiple supply chains in one organisation. The 'role-players' are also a part of the demand management system in which communication is extremely important. All the various functions should communicate freely about the demand that is available and demand that is needed (Davis, et al., 2006).

Although very few studies about the wine supply chain are available, there has recently been some activity with regards to benchmarking (Bhagwat & Sharma, 2007), performance measurement (Garcia, et al., 2012) and customer segmentation (Wen, et al., 2010), to name a few. In order for the wine industry to move forward and become competitive in other beverage markets, they will need to start optimising this complex supply chain.

According to supply chain specialists (Gunasekaran, et al., 2004; Estampe, et al., 2013), supply chain management creates value for customers, companies and stakeholders. This is a key factor for success in any company, including those in the wine industry. And since the supply chain encompasses all the processes from the raw material producers (grape farmer) to the end consumer (wine drinker), the successful management of all of these processes can create value which will ultimately lead to higher profits and increase in market share.

3.5 Defining the planning phases in winemaking

As mentioned in section 3.4, the wine supply chain extends from the suppliers' suppliers to the end user. The part of the supply chain that a company needs to plan for is dependent on which fraction of the supply chain a company occupies. As the focus of this study lies with the winery as the manufacturer, the planning phases during winemaking are considered in the following paragraphs.

3.5.1 Procurement

Grapes are essential in the production of wine. For a winery to supply the demand for wine, they need to plan how much grapes they need and where it will come from. In some cases, a winery owns the vineyards which produce the grapes; in other instances, they buy grapes from growers with whom they have contracts. Additionally, the grape supply can come from both sources.

In South Africa, for a wine to be labelled as an 'Estate' wine, the wine needs to be grown, made and bottled on the estate (Gazette, 2015). The 'Estate' brand carries the assumption that it is a wine of superior quality. Numerous producers, therefore, try to conform to this idea regardless of the actual quality and price implications.

Planning with regards to the amount of grapes needed from year to year must be done meticulously. The logical way would be to start at the end and work backwards – in other words, determine the demand for the next year and source grapes accordingly.

When a company owns vineyards, they can control the crop by vineyard management and have a good estimate of how big the crop will be for the next growing season, by July/ August during the pruning season. The winery will then be able to make a calculation as to how much of these grapes, by cultivar, are needed, if additional grapes should be brought in or if some of the grapes need to be sold. This is a complicated process in the vineyard as every cultivar is different. The cultivars differ in terms of the way they grow; their nutritional and water requirements; canopy management requirements; different flavour profiles according to the soil, climate and how they are managed; the typical yield of the cultivar; how much they are worth; how much is available, etc. All these factors and more need to be considered when estimating grape production by cultivar and the buy-in and selling of grapes. Wineries usually have long-standing contracts with growers from whom they buy grapes. These contracts need to be revised every year as demand changes. A winery cannot afford to buy excess grapes for which they do not have the demand or on the other hand, have too much demand with not enough supply (which is why sales and demand data should be analysed before procurement).

Procurement of dry goods and additives for the winery can also be planned based on the demand for wine. As the winery has now calculated how much wine will be needed and how much grapes will be processed, the winemaker can estimate the additives and dry goods that are needed for the process based on the rate at which additives are used.

3.5.2 Production

The volume of production has been calculated based on demand versus supply in the vineyard, as per section 3.5.1. Planning in terms of the workforce can be done months before harvest to ensure enough hands are available during harvest. Furthermore, a capacity calculation should be made in advance, to ensure the winery has enough capacity to process the grapes.

The complexity of winery production planning is influenced by the amount of fermenting and storage vessels available (and the timelines for which these are needed). The capacity of vessels available (the capacity per vessel is different, for example small barrels of 50 litres vs 120 000 litre tanks) should also be taken into account as well as when and for what each will be used. Different cultivars, and even the same cultivars from different vineyards are usually kept separate during fermentation and will only be blended at a later stage – this should also be kept in mind when planning.

If the winery does not have enough capacity, it can rent space at another facility or expand if it appears to be a long-term problem. If the winery has too much excess capacity, space can be leased to another winemaker for additional income.

3.5.3 Bottling

During bottling, most of the value is added to the wine, as packaging is the most expensive part of winemaking (see Table 3.1 for the R/litre packaging costs). Thorough planning should go into the bottling of wine. Wineries ought to postpone the bottling of wine for as long as possible to keep overproduction to a minimum. As long as the wine is kept in a tank, it can still be sold as bulk wine, should the demand for that wine not exist as planned.

A tight schedule must be available for when to bottle and when bottles should be ordered, so that the winery can get the best price for ordered bottles, without having too many empty bottles around or too much wine in bottles. Cash tied up in bottles (or make-to-stock inventory) is a widespread problem in the wine industry. As the industry is cash-flow sensitive, the winery must have a definitive tactical plan as to how they manage inventory. Inventory management should be an area of future research but is outside the scope of this study.

During bottling the correct number of capsules, corks and screwcaps should be available. These are also costly and should be ordered in exact amounts when they are needed.

Another consideration to be taken into account is when a winery does not have bottling and labelling facilities on site and need to make use of a mobile system. These need to be booked in advance and they usually also ask a surcharge on bottles below a certain number. This could lead to a winery having more stock on hand than what is needed, because their facilities are not that flexible.

3.5.4 Packaging

Packaging generally consists of labels and boxes. Labels and boxes can be ordered after the bottling materials are purchased as the bottles will spend a minimum of two weeks in the cellar or warehouse before they are sold. The printing of labels is expensive, and the order must be double-checked again and again before it is sent to the printers. It is advised that just enough labels for the current bottling be ordered. Even though some money can be saved when ordering more labels at once, this can be an expensive exercise if those labels are never needed.

Boxes are generally not that expensive and do not take up too much space. They are usually also standardised and can be used for the next year's stock if there are too many boxes. Therefore, boxes can be bought according to economies of scale, but based on the demand plan for the year and not on an ad hoc basis.

3.5.5 Warehousing/transport

Planning must be done to distribute wines at lower costs and warehouse finished stock efficiently. Wineries can consider a third-party logistics company for the transport of the wine and exports, as well as considering transporting the wine themselves if responsiveness is a strategic consideration.

Warehousing can be considered in various provinces as well as overseas to minimise transport costs if there are frequent small deliveries in other provinces or overseas. The warehousing of finished stock can be extremely expensive if owned or rented due to the space it takes up and the cooling facilities necessary to keep wine at the correct temperature. Being responsive whilst cutting costs is a consideration for wineries. Another consideration is being available on demand. The possibility of running an effective e-commerce wine shop, as the online wine market is growing rapidly could assist with this.

3.6 Opportunities in the wine industry

Numerous opportunities exist in the wine industry, from an industry (supply) perspective as well as the consumer (demand) perspective. The following section looks at opportunities that are created as a result of these two streams.

3.6.1 Industry (supply) opportunities

Wineries should aim at increasing sales at higher price-points if they wish to be more profitable. Some wineries are just interested in selling their wine in the first place. An important aspect wineries should consider in selling more wine to the right customers, is to evaluate the opportunities that exist in different markets. Once applicable markets and opportunities have been identified, a winery can decide whether to exploit these opportunities or not. As with all decisions in a business, the winery should keep a record of decision-making and the reasoning behind it. The effect of decisions can then be tracked year after year to make better decisions in the future.

In South Africa, VinPro and the WISE task group have set out to identify and explore the market segments and specific consumer trends. They have also partnered with Wine Intelligence to draw on some consumer and market insight. In searching for wine industry reports defining opportunities in the industry, multiple sources draw on different consumer trends, developing markets and consumption growth in countries. Some information can be found on SAWIS and VinPro's websites respectively as well as trend evaluation through the WISE recommendations. PwC also publishes a 'Wine Industry Insights' report yearly which contributes towards an understanding of the state of the industry as well as suggesting improvements and noting already evolving practices. It would be beneficial for wineries to have a report by one of the main industry bodies, like Wines of South Africa (WOSA), which summarises the most valuable opportunities (and threats) in the industry yearly. In this way, wineries would be able to exploit opportunities with more confidence and success. These also need to be identified within each specific winery, which will be discussed later.

As one of the WISE aims is to increase and build the domestic market as well as the export market to Africa, China and the USA (Augustyn, 2016), a global perspective on the market trends should be established. By combining the data of two companies, Euromonitor International and Wine Intelligence, wineries draw on their consumer global trend reports to make sense of the trends and possible opportunities in the wine industry.

3.6.2 Consumer (demand) opportunities

Everybody's lives seem to get busier and all the normal tasks seem too much to fit into a day. And as anything can now be found online and ordered instantly, the consumer is used to convenience and wants more convenience since it fits into their schedule (Kasriel-Alexander, 2015). As with the wine business, wine is getting more convenient by providing unit-sized containers (187ml) and easy-to-open packaging (Wine Intelligence, 2015).

Consumers are also interested in doing something for 'the greater good' or the environment, so called 'brand activism' – thus attracted by products or brands which enable this (Kasriel-Alexander, 2015). For example, a hotel which offers discounts to clients who lend a hand at community service or a wine company that recycles corks to donate clothing to people in need (Wine Intelligence, 2015).

A trend amongst consumers is that they are individualistic and feel they are unique and therefore want to be treated in that way (Wine Intelligence, 2015), or have the product that they purchase reflect that. It is going against the mainstream and developing their own sense of style and taste. Therefore, discovering something new and unique and having an opinion about it is important to consumers.

The modern consumer is also very health and environmentally conscious, using products which are better for them and the environment. Organic and sustainably grown wines with less additives are a definite choice for health-conscious consumers. The beer industry is also pursuing this trend claiming that they only use the freshest ingredients and no preservatives (Wine Intelligence, 2015).

Buying local and fresh has been a developing trend. This ties in with the health consciousness of consumers, thus being able to buy food fresh and healthy. Locally also means that you sourced it from its origin which is seemingly important to consumers (Wine Intelligence, 2015). South Africa can use this for developing the local market as well as increase wine sales from the farm for tourists.

Furthermore, the Rosé trend is on an upward spiral. This drink has become immensely popular especially in the USA (which is the largest wine-consuming country in terms of litres). Fortune.com reported Rosé from France has grown 58% in 2015 (in the USA), and a staggering 4852% from 2001 (Kell, 2016). Consumers are also willing to spend more on quality Rosé and the premium Rosés are also growing faster than the lower-end 'cheap' Rosés (Kell, 2016).

In general Nielson (2018) forecasts that Rosé, Prosecco (a cheaper Italian alternative to Champagne) and alternative packaging will be the major trends in 2018 (Nielsen, 2018). Locally,

the Rosé trend is still growing as it is globally. From the South African Wine Quarterly, it is seen that Rosé has made a steady growth in local consumption (see Figure 3.6) and seems to now be stabilising.

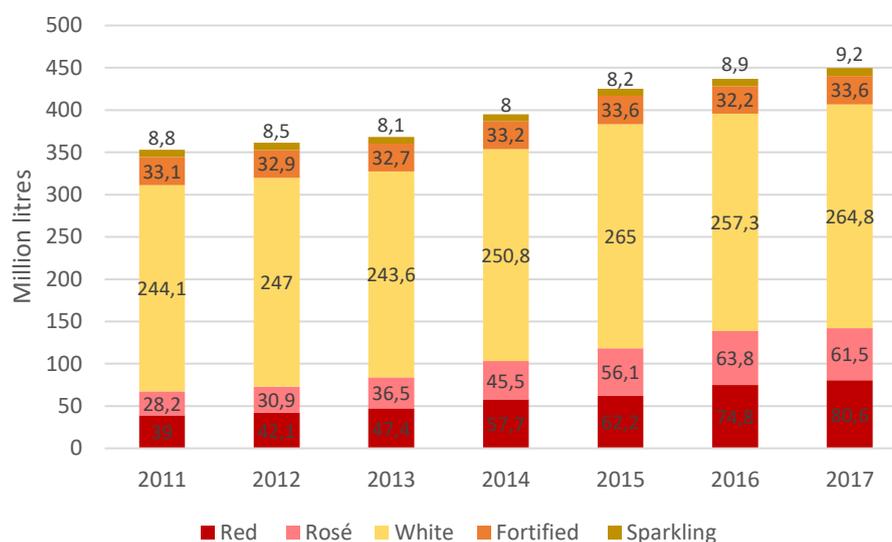


Figure 3.6: Wine consumption trends (BER & SAWIS, 2018)

Only this year's consumption will show if this category has reached saturation or if it will continue to grow (BER & SAWIS, 2018). According to well-known Sommelier, Alpana Singh, the Rosé trend is not likely to go anywhere, but will continue increasing (Jacobs, 2018).

In conclusion, wineries should have a clear idea of who their customers are and where they are in terms of creating the value that those customers are seeking. They should also anticipate how they can improve on this and how this will influence the winery's product offering in the next two to five years.

3.7 Wine-specific attributes to consider in the planning process

Wine is a complex product made by a complex process. It also plays in an extremely competitive market. Wines have to compete against other wineries in South Africa, international wineries and of course all other forms of alcohol. Apart from making sure that the consumer buys wine instead of anything else, planning to fulfil that selection must be done meticulously. This section discusses the complexities wineries face as well as attributes unique to the wine industry.

It is difficult to classify wine as a product into a specific category. Some wines can be considered a commodity, with wineries trying to produce the same wines year after year and the demand for this product remains relatively constant. However, wine in its natural sense will be different year after year. This is due to the fact that every growing season is different and that the vine changes

with age – amongst other factors. Higher end wines belong in this category and are usually not classified as a commodity, but rather a luxury item or even a collector's piece.

As this study focuses on small and medium-sized wineries, attributes regarding these wineries will be discussed.

3.7.1 Wine can only be produced once a year (long lead time)

Since wine grapes are at optimal ripeness during late summer to the end of autumn, wine needs to be made during this time of the year and a wine can therefore only be 'manufactured' once a year. Since the Northern and Southern Hemispheres seasons differ, there are essentially two times in a year when grapes are harvested, but in different hemispheres. The whole year prior to the harvest time is in preparation for the next harvest, tending to the vines to make sure the wine will be of the best quality.

This preparation time should then be used to plan the next harvest to ensure that just enough grapes are available for the market demands. Demand planning is therefore crucial in ensuring that not too much or too little wine is produced per cultivar during harvest. As numerous cultivars are produced per winery and these cultivars are even further divided into different products, this raises the complexity of planning. To simplify these numerous products, a classification system ought to be beneficial in planning. Wine does not have the luxury like beer or juice or spirits to be produced at any time when demands are high. No, wine has to be planned to fulfil a whole years' supply, and in the case of aged red wines – thinking and forecasting even further ahead.

3.7.2 Short product life cycle, as every year is in effect a new product

Due to the fact that every year and growing season is different and that vines change with age, every vintage will have a different wine as a result. Therefore, the life cycle of the product is short as the wine changes from year to year even though the packaging and marketing remain the same.

This will also effect a quality and taste change to the wine, for better or for worse. It depends on the growing season, the climatic conditions, the soil and the vines – none of which are predictable. This complicates planning even more, because up until the day of harvest, it is difficult to pinpoint exactly what it will be like.

3.7.3 Production costs for smaller wineries are higher

In the vineyard, these wineries focus on quality. Their production cost per hectare may be the same or higher than a large producer, but their yields are much smaller, making their unit costs much higher.

The same happens in the winery; unit costs are higher, asset efficiencies are lower, and they do not really have a lot of bargaining power with bulk wines and suppliers as their production volumes are smaller.

3.7.4 Packaging is extremely expensive

This applies especially to high-quality glass bottles, which are what most small to medium-sized wineries use. Packaging, including the bottle, label, cork or screwcap and capsule can cost wineries more than the actual wine that is inside the bottle. Therefore, having wine bottled accounts for a large amount of cash tied up in inventory. And being unable to sell those wines can lead to enormous losses.

3.8 Demand planning in industries similar to the wine industry

To evaluate whether some practices from other industries will be valuable, the researcher considered industries with similar attributes to the wine industry. These are the attributes which make them particularly difficult to forecast and plan. The technology and apparel industries were investigated for this purpose.

3.8.1 Technology industry

The technology industry is a rapidly growing industry, but with technology evolving so quickly it seems also a difficult sector to forecast and plan. Often such a strong focus is placed on the tactical plan that the long-term strategic planning is neglected (Langabeer & Stoughton, 2001). The following characteristics of the technology industry seem to overlap with the wine industry:

- Short product life cycles with some long lead time parts (Langabeer & Stoughton, 2001).
- International market for products, requiring transport and thus affecting lead times.
- Economic climate and trends influence demand. A luxury product with seasonal demand fluctuations.
- A limited number of suppliers to supply components to several manufacturers. This can lead to stock-outs, longer lead times or supplier unreliability.
- End consumers are individuals.

Since a parallel can be drawn between the technology and wine industry there certainly will be practices for planning to be learnt from this industry. However, characteristics that make technology easier to plan is the ability to manufacture and source parts at any time (thus not dependent on a growing season); the necessity for a vast amount of technology items in everyday life for business and personal life (not all products are seen as luxury); the relatively lightweight

and small size of products making it easier to distribute and the ease of modifications to a product in a short time frame.

3.8.2 Apparel industry

The textile industry can be divided into three categories namely: home textiles, apparel/fashion and technical textiles. The apparel industry is the most significant in terms of volume, but it is also very specific (Thomassey, 2010). The apparel or as some scholars say, fashion industry, is discussed here because it has numerous challenges that overlap with the wine industry. Although the apparel industry is quite a large industry worldwide, many of the challenges they face are the same as those evident in small and medium-sized wineries.

In Table 3.3 it is evident that the fashion industry is up against some challenges, especially when it comes to sales forecasting and planning. This has been an area of interest for a number of years and the experts have researched some techniques that could make this process a bit easier. Thomassey (2010) suggests that the *aggregation of sales* to the family level of SKUs can have a positive impact on forecasting. Still, the problem remains that there is a lack of historical data (Nenni, et al., 2013), due to the ever-changing product offering. Although Thomassey (2010) suggests that *time-series forecasting* can work on aggregated product families, he proposes that the classification of the SKUs is more important than the actual time-series techniques. We can therefore conclude that if time-series models are used, that classification is a crucial part of the process.

While time-series models are being used by some apparel manufacturers, most researchers suggest the use of Artificial Neural Networks (ANN) for sales forecasting. ANN is rated as the most sophisticated and accurate compared to traditional forecasting methods, but it is more time-consuming and difficult to implement (which needs more skill) (Yu, et al., 2011). Thus, not suited to be implanted by small and medium sized wineries' current employees.

A study of the supply chains of small to medium-sized apparel companies in South America indicated that only 30% of them do formal forecasting and only 20% measure their forecast errors. And when forecasting is done, it is very much an isolated process. One of the things that these small to medium-sized apparel companies do well is to have *online visibility* about their supply chain demand requirements (Jaramillo & Teng, 2006). Suggested improvements are strategic alliances with other companies and the improvement of transparency in the supply chain.

Table 3.3: Apparel and wine industry challenges. From (Raman & Fisher, 1996; Lummus, et al., 1998; Jaramillo & Teng, 2006; Thomassey, 2010; Nenni, et al., 2013; Thomassey, 2014)

Challenge Description	Apparel industry	Wine industry
Volatile demand	With mostly fashion items, whereas jeans and white T-Shirts demands should be relatively stable.	Especially rare and unique wines. Cheaper, everyday drinking wine should be more stable.
Seasonality of sales	Linking with the short product life cycle as the seasons and trends change quickly.	Generally, more white wine is sold in summer and more red wine in winter. This should be taken into account, but also that international sales have different seasons.
Lack of historical data	Big issue in the fashion industry as trends are rapidly evolving and new items that have never been sold before are being produced.	This is an issue when launching a new wine on the market. There is no way to predict sales.
Long lead times	From design to production is a one-year process and production to product being sold another year. Therefore, planning is critical but also difficult. The international market for goods can also increase lead time due to transportation.	The wine starts in the vineyard. It takes four years for a newly planted vineyard to produce a crop. Wine can only be produced once a year. White wine is usually only sold six months after harvest and red wine after two years.
Short product life cycle	Fashion items are sold for such a short period of time as seasons and trends change rapidly.	Wine does not have such a short life cycle as fashion, but compared to the production life cycle, it can be quite short, especially if there is a limited production and wine sells out quickly.
High impulse purchasing (individuals)	Since individuals are the end customers, there is little to predict when a customer would buy a product on impulse.	Difficult to predict wine sales as wine is bought for example for a special occasion, for everyday drinking, a gift, etc.
Competitive market	There are thousands of fashion brands in the market, thus making it difficult to compete or to predict the competition's strategy and product offering.	There are thousands of wine brands across the globe and even in South Africa the variety is vast. It is also difficult to predict the competition's strategy and how the customers will react.

Thomassey (2014) suggested some characteristics to be considered when doing sales forecasting. The forecast horizon, product life cycle, the aggregation of product families, seasonality of demand and various *exogenous variables* (economic climate, weather and trends) were the characteristics he recommended to analyse when doing demand forecasting.

From this section the researcher gained insight into how demand planning can be structured in the wine industry, that aggregation of SKUs is important and that time-series forecasting could be a good match. It also provided a valuable suggestion being that online visibility of supply chain requirements can be helpful. This will especially assist in inventory management which is a suggested future area of research.

3.9 Chapter conclusion

Chapter 3 gave background to the South African wine industry and wine as a product. It gave some background into the wine supply chain and the planning phases during winemaking. During the planning phases of winemaking, the interaction between the operational and tactical planning of the ordering of dry goods, scheduling of bottling, etc. should be structured to ensure that the decisions are made based on the tactical plan. A brief overview of the opportunities and trends in global markets was investigated, especially those that are relevant to wine sales. Finally, the unique attributes of wine were discussed as well as the attributes and similarities of the technology and apparel industries to learn from their planning systems.

Chapter 4

Literature review

4.1 Chapter introduction

This chapter gives an overview of the elements used to build the framework. The reasoning behind the various elements is also explained and ways in which to implement the framework elements. It serves as an introduction to concepts needed for structuring demand planning and the possible execution barriers associated with this supply chain planning process.

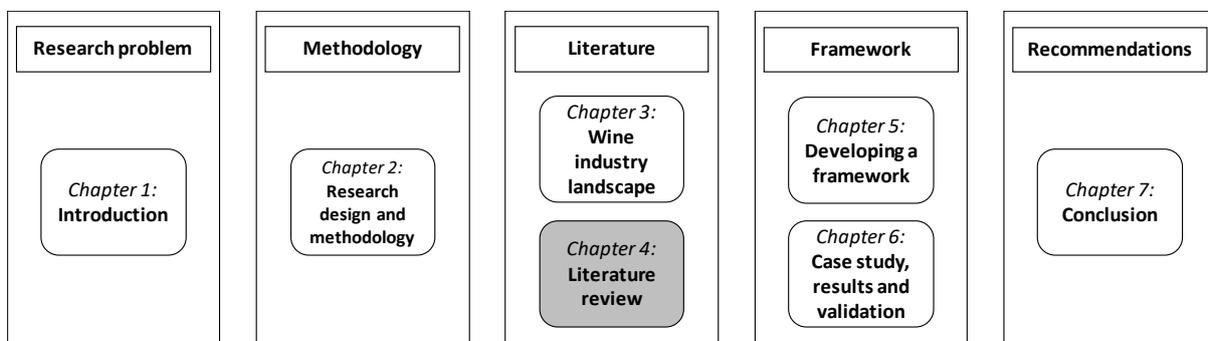


Figure 4.1: Thesis outline

4.2 Supply chain management

A supply chain (SC) of a company encompasses the flow of products and information between the suppliers' supplier and the end customer. There are many definitions and descriptions of supply chains and supply chain management (SCM). Essentially SCM is the management of SCs to create value. Today it is no longer companies competing with each other, but rather SCs (Martinez-Olvera & Shunk, 2005). Therefore, the effective management of SCs can create competitive advantage, customer satisfaction, value and profitability for a company. In Figure 4.2, Mentzer et al. (2001) illustrate SCM as a function of how the SC elements interact with each other, which delivers fruitful outcomes if these elements are managed successfully.

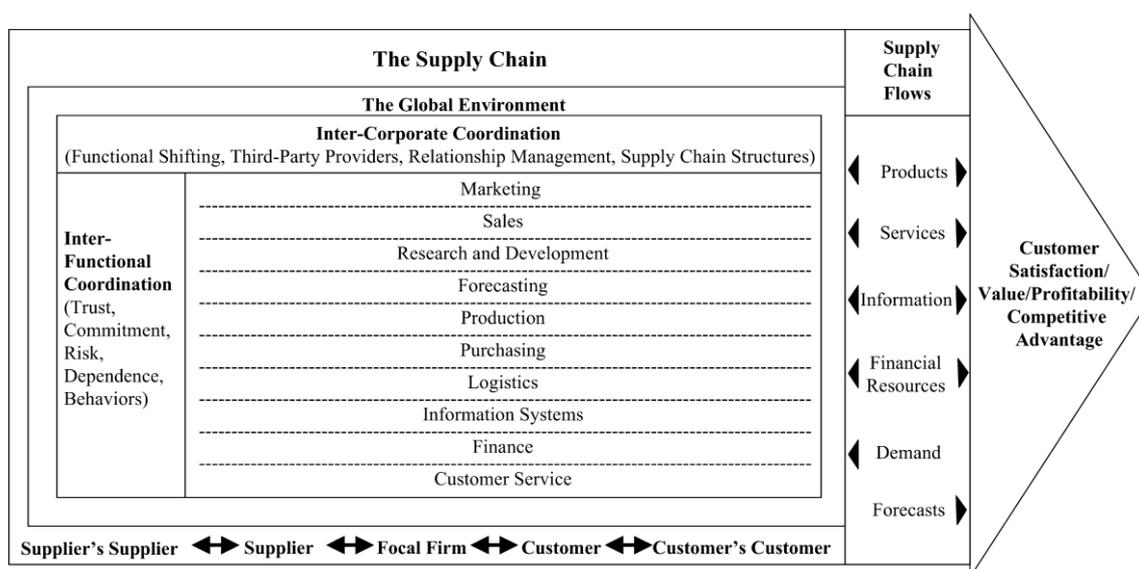


Figure 4.2: A model of supply chain management (Mentzer, et al., 2001)

In Mentzer et al.'s model of SCM, customer satisfaction, value, profitability and competitive advantage are outcomes of a successful supply chain. This model proposes that the 'supply chain flows' (products, services, information, financial resources, demand and forecasts) between the supplier's supplier and the customer's customer by means of 'inter-corporate coordination' and the assistance of 'inter-functional coordination' can achieve these outcomes. Thus, as forecasting is a part of the 'inter-corporate coordination' where demand is received from the customers and forecast can be provided by the company to fulfil the supply, it assists in achieving customer satisfaction, value, profitability and competitive advantage.

SCM is said to create value for customers (Estampe, et al., 2013; Gunasekaran, et al., 2004; Mentzer, et al., 2001), reduce costs and increase market share (Ferguson, 2000). Therefore, it ought to be a worthwhile practice to investigate or adopt should a company aspire to achieve such

goals. There are numerous practices and suggested methodologies by which a company can improve the management of their supply chains and company.

The Supply Chain Council (SCC) also developed a reference model for supply chain management – the Supply Chain Operations Reference (SCOR) model, which offers a comprehensive framework for SCM (SCC, 2012). It is used to describe the business activities associated with fulfilling customer demand. This model has been able to describe and provide a basis for supply chain improvement for multiple companies, large and small.

It uses the building blocks of six management functions – plan, source, make, deliver, return and enable – to describe and guide every function in the SC. The SCOR model is represented in Figure 4.3. It illustrates how these six functions interact with each other and with the role-players in the supply chain and extended supply chain (suppliers' suppliers and customers' customers). From the SCOR model it is also clear that planning plays an important part in all the processes and between all role-players. From Figure 4.3 it seems as if the 'Plan' function governs the extended supply chain and all its functions and should therefore be done first to ensure timely and accurate execution.

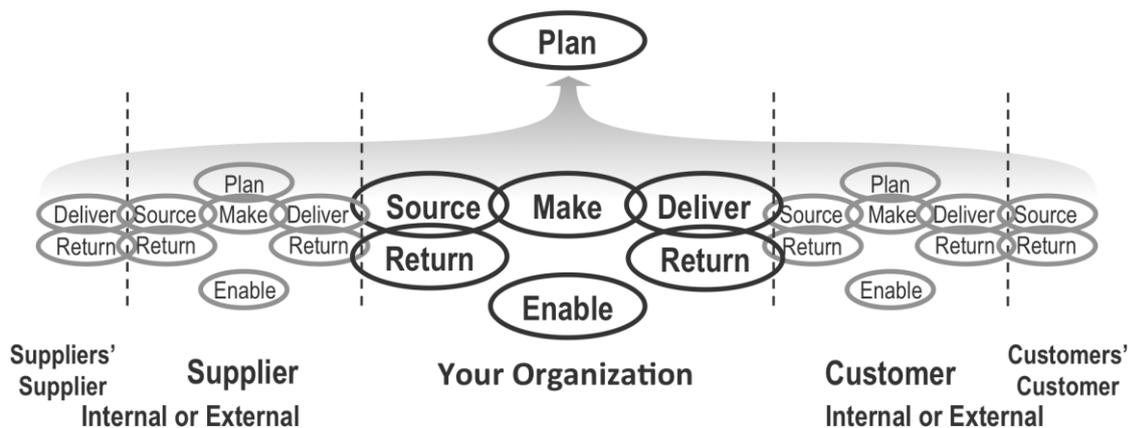


Figure 4.3: SCOR model (SCC, 2012)

It does make sense that any and all processes start with planning. In the same way that it would be disastrous to build a house without a blueprint and a plan, it would be disastrous to do business without a plan. It could work for a while, but sooner or later the walls will come tumbling down. A company should thus have a plan or strategy on how they want to create value for their customers and fulfil demand.

4.2.1 Business strategy

Strategic planning and a clear business strategy are crucial parts of business success and direction. It is also argued that organisations can improve their effectiveness if they are able to anticipate business environment challenges and opportunities and be able to quickly respond to those challenges and opportunities (Steiner, 1979). According to Cousins et al. (2008), this is still the case (Cousins, et al., 2008). The design and implementation of a strategic plan is also not too difficult or time-consuming – a recent case study by Recardo (2016) illustrates this. He had worked with a manufacturing company to build a strategic plan – they developed a multi-year strategic plan, including an overview of the industry, the company and a detailed action plan for implementation. Within four months the implementation had already begun.

Numerous companies have a misperception about strategic planning. They often confuse strategic planning and financial planning. Strategic planning is concerned with the vision, direction and competitive advantage a company wishes to create (Recardo, 2016). Armstrong (1983) endorses this by defining strategic planning as the analysis and setting of objectives – what a company wants to achieve and by when. Strategic planning can also be illustrated in relation to human talent. Kaufman (2016) claims that human talent should add value to everything a company produces and delivers. Therefore, strategic planning can also be concerned with the development of human talent. Human talent should be developed strategically and applied in the right direction to achieve company objectives. In conclusion, Eisenhardt (1999) states that strategic planning is about determining where the company wants to go and deciding on how to get there.

The strategy can be divided into long and shorter-term plans. Long-term plans can include markets the company wishes to enter or leave, which products or services they want to offer and the areas in which they want to grow. Shorter-term plans are more marketing related, like the pricing of products, when and where to have promotions, how to package products and the message they convey to customers (Recardo, 2016). Shorter-term strategy can thus be the way to which to react to value opportunities. Value opportunities thus form an intricate part of strategic planning and business models.

It is necessary to identify the gaps between what is and what should be. The means, solutions and processes should be addressed to close the gap in results (Kaufman, 2016). The strategic plan should identify and justify what an organisation wants to become. Clear guidelines and objectives should be set to work towards a common goal.

The strategic plan can be developed in terms of three environments: mega, macro and micro (Kaufman, 2016). The mega environment refers to strategy within society, the macro

environment is concerned with the organisational strategy and the micro environment strategises the individual. A company which focuses their strategy in and around all of these environments should be more successful than companies following a more isolated approach.

Armstrong (1983) recommended that formal planning should start with the planning process rather than with data. In this way, planning provides the strategies to handle the data that is provided. Each of the steps of the planning process should also be accompanied by an explicit procedure for gaining commitment (Armstrong , 1983). The strategic plan should also be a process, not just a one-off occurrence. The beginning and the end of the plan should be linked and be a continual reiteration of the process (Recardo, 2016).

Top management plays a vital role in the development and execution of strategic plans. They must initiate action in the plan and define the given roles (Recardo, 2016). Companies usually pursue many objectives and planners should recognise all the important elements of the strategy and its objectives (Armstrong , 1983) (Mintzberg, 1994a).

An organisation ought to recognise and define all measurable performance terms and metrics (Kaufman, 2016). This is important in tracking change and progress in the process of strategic planning. It also assists in linking business processes to certain objectives and outcomes. Metrics should be used effectively and incorporated in every decision (Recardo, 2016).

Although strategic planning is a highly acclaimed practice by experts and academics, there have been some concerns by some among them. Although the drawbacks can be avoided, management should be aware of the pitfalls so as to avoid them. One of the recurring drawbacks of formalised strategic planning is that it can restrict creative thinking and ideas (Mintzberg , 1994). Another challenge of written objectives and planning is that they can create tension and political problems in the workspace (Armstrong , 1983). Managers that are attentive to such drawbacks can easily avoid them.

Effective strategic decision-making can have an influence on the success of a company. Eisenhardt (1994) did studies to evaluate if there is a difference in strategic decision-making between very successful, and less successful top management teams. She found that more successful teams made effective strategic decisions. They achieved this by the following common traits:

- Enhancing the ability of managers to identify opportunities and threats earlier by building intuition. This can be done by having regular meetings, sharing data and keeping track of metrics and performance measures.
- Sustaining timeliness of decision-making and ensuing a conclusion is reached in the set time frame.

- Do not keep company with political behaviour which can waste time and limit openness and creativity.
- Inspire healthy conflict to improve the quality of decisions and ideas without wasting time. Regular meetings also regulate this practice by familiarising all parties with each other, which leads to openness and trust.

4.2.2 Supply chain strategy

Since the successful management of a company's supply chain can achieve competitive advantage for a company, and the business strategy is about how the company intends to create value, then aligning the business strategy and supply chain strategy (SCS) is critical in achieving success.

According to Perez (2013), there are four elements to be considered that contribute to the SCS. Firstly, the marketplace or how manufacturers, suppliers, customers and economic factors influence the competitive factors of any industrial sector. Then the company's unique value proposal or how the company positions itself strategically in terms of supply chain to gain market share. Perez also suggests managerial focus and internal processes to be critical in the supply chain strategy – the processes aimed related to plan, source, make and deliver and the decision-making processes of management and how they interact with each other (Perez, 2013).

Fisher (1997) proposed two main types of products which should each be approached in a unique way from a supply chain perspective. Table 4.1 summarises the difference in Fisher's functional and innovative products.

Table 4.1: Functional vs innovative products (Fisher, 1997)

	Functional	Innovative
Aspects of demand	Predictable demand	Unpredictable demand
Product life cycle	More than 2 years	3 months to 1 year
Contribution margin	5% - 20%	20% - 60%
Product variety	Low (10-20 per category)	High (often millions)
Average margin of error in forecast at the time production is committed	10%	40 - 100%
Average stock-out rate	1% - 2%	10% - 40%
Average forced end of season markdown as percentage of full price	0%	10% - 25%
Lead time required for made-to-order products	6 months to 1 year	1 day to 2 weeks

What Fisher and Perez suggest is that a supply chain should be set up according to the market and product characteristics. For example, a company that aims to sell an innovative product and win the order by being responsive to the demand, needs to have the supply chain set up that they either have stock on hand or the manufacturing should be set up in such a way that stock can be easily and quickly available.

In Perez's supply chain roadmap, he summarises the six different types of supply chains. The supply chains associated with functional products are efficient, fast and continuous flow, while the supply chains associated with innovative products are agile, custom configured and flexible (Perez, 2013). These strategies link with the various types of products in terms of their characteristics to create value for the customer and competitive advantage for the company. For example, a winery should implement an efficient supply chain strategy with wines that are produced in high quantities, with stable demand and small profit margins; whilst a responsive supply chain strategy would be best suited to low volume production with high profit margins, where the value is created for the customer by being as responsive as possible to demand.

4.3 SKU classification

Stock Keeping Units (SKUs) is the term used for the smallest manageable unit in a company. It is common for companies, especially retailers, to have thousands of SKUs in stock. To forecast and plan demand for each individual SKU is near impossible. Methods of grouping SKUs together have therefore been created to streamline planning and manage inventories better (Teunter, et al., 2010). Williams was one of the first to see the need of SKU classification in 1984 (Williams, 1984).

The literature regarding SKU classification indicates that this is a field that still needs to be explored and expanded. There are a number of key academics and researchers interested in the field of SKU classification – A.A Syntetos, J.E Boylan and R.Q Zhang, are among the most renowned in the literature. Though it is a relatively new field, with the earliest noteworthy publications appearing from 1984, major cost reductions, improvements in inventory management and forecasting have proven the methodology to be effective.

Although many studies in SKU classification have been done for the management of spare parts, a wider variety of industries should be able to benefit from it. Naylor suggested that classification is especially important in the maintenance industry (Naylor, 1996) since parts are critically important and it can be very costly to have equipment downtime. SKU classification thus assists in managing inventory and reaching high service levels (Teunter, et al., 2010). Other industries on which this methodology has been tested include: electronics (Heinecke, et al., 2013), automotive (Heinecke, et al., 2013), military (Heinecke, et al., 2013), household appliances

(Bacchetti, et al., 2013), motor spare parts (Boylan, et al., 2008), the chemical industry (Boylan, et al., 2008), aerospace spare parts (Boylan, et al., 2008), car part accessories (Teunter, et al., 2010) and DIY retail (Teunter, et al., 2010), to name a few. These industries all have a large numbers of SKUs to regulate and therefore, as shown by research, benefit from SKU classification to improve forecasting and inventory management. Boone et al. also noted that companies suffer due to the implications of poor forecasting and inventory policies (Boone, et al., 2008). The researcher believes that these classification methods could greatly benefit wineries in making sense of the multiple SKUs that they manage.

Various SKU classification methods have been tried and tested. Researchers investigated the different methods that exist and developed numerous strategies to alter the methods to fit a specific industry. The two main classification systems can be divided into single criterion classification (like the ABC approach) and the multi-criteria (various classification leading to multi-groups). This can be done with or without SKU aggregation.

4.3.1 Product family grouping (SKU aggregation)

Since the forecasting of demand for every individual SKU is time-consuming and exhaustive and aggregated forecasting is much more accurate, grouping SKUs into product families ought to be a good practice. The aggregation of SKUs can be done in numerous different ways. It is based on the idea that SKUs with the same characteristics should be grouped together.

SKUs can be grouped together based on their product families or product types. Product types refer to products with similar costs associated with them (unit costs, holding cost, direct costs), productivities (labour hours per unit of product) or seasonality (O'Reilly, et al., 2015). Product families are classified as “groups of items that belong to the same product type and share similar setups” (Bitran & Tirupati, 1989). Thus, product families are usually made in the same way or have the same characteristics – like families they can also have the same origin.

The large number of SKUs present in a manufacturing environment, due to packaging and market demands, finds that the grouping and classification of SKUs can assist in formulating and implementing improved strategies (demand planning, inventory management, customer service, etc.) (van Kampen, et al., 2012). The grouping of SKUs into product families or product types will thus assist greatly in the strategic and tactical planning of a company, while the SKU-level planning will be operational planning. In effect, after the tactical planning of aggregated SKUs (in product families or product types), SKUs can then be individually planned operationally if necessary.

In wineries multiple SKUs exist as a result of various different sizes of bottles and different labels, but all contain the same wine. To reduce the number of SKUs for further classification these SKUs can be grouped according to the bulk wine from which they are made. See the explanatory example in Figure 4.4.

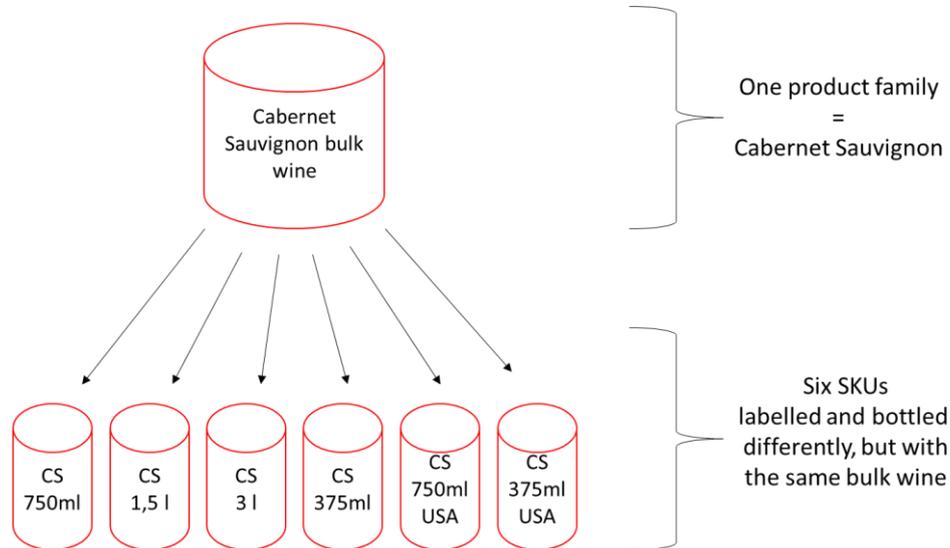


Figure 4.4: Product family grouping

After the aggregation of multiple SKUs into fewer product types or families, these aggregated product families or types can be further classified into multiple classes based most commonly on demand volume or value, timing, customer or product characteristics (van Kampen, et al., 2012). This classification is used mostly for improved decision-making and production strategy in inventory management and demand forecasting. Firstly, the decision needs to be made if the product family or SKU will be classified under a single or multi-criteria.

4.3.2 Single criterion vs multi-criteria classification

Teunter et al. (2010) argue that a single criterion classification system is superior because of its simplicity (Teunter, et al., 2010). Although Teunter et al. take four parameters into account (demand volume, holding cost, shortage cost and average order quantity) in their single criterion classification, it is still shown to be efficient, based on an inventory cost analysis. These parameters are used to classify SKUs into ABC categories – thus known as a single criterion. Teunter et al. improved with this work upon Zhang et al.'s single criterion classification (Teunter, et al., 2010). The original ABC approach was based on the principle of Pareto, which described the 'inequality of distribution of income' (Flores & Whybark, 1987). This distribution is usually according to three classes, but more can be used, up until at most six classes (Teunter, et al., 2010). Pareto's principle was originally described as the 20/80 principle, where 20% of the items had

80% of the volume and vice versa. The distribution of A, B and C items is now usually represented in the ratio of 20%, 30% and 50% of items respectively (Jacobs & Chase, 2014) (Slack, et al., 2007) (Stevenson, 2007).

The single criterion SKU classification methodology is thus simple to use once the classes have been established. To establish class sizes and cut-off values a number of different methodologies are mentioned here. Based on the work of Pflitsch (cited in Teunter, et al., 2010) demand volume is a more effective criterion to use than demand value, especially for managing service levels and reducing inventory. The study criteria that Teunter et al., used in 2010, ranked SKUs based as follows:

$$x = \frac{bD}{hQ}$$

Where b is the criticality measure by shortage costs, D is the demand volume, h is the unit holding cost and Q is the order size. This is the first work to take b (the criticality measure of shortage cost) into account. Any SKU classification methodology should assist in assigning accurate forecasting methods to each group and thus controlling inventories more efficiently. Numerous multi-criterion SKU classifications have also been developed.

Multi-criterion SKU classification methodologies like linear programming, Analytical Hierarchy Process (AHP) and Operations-Related Groups (ORGs) are widely used (Teunter, et al., 2010). These can be very complicated in most cases and thus difficult to implement by a non-expert. Simpler classification methods are also available and might be easier to implement with a limited skillset. Several of these methodologies have attempted to improve inventory management, improve forecasting and facilitate decision-making.

Bachetti et al. (2013), developed a hierarchical multi-criteria classification model to be applied in the spare parts industry of a specific home appliances manufacturer. As no set classification classes are defined, this model is more adaptable to different situations. The only risky part of the model could be that the personnel at companies should be able to identify the classes to consider.

The specific framework that has been developed by Bachetti et al. (2013), aims to select the criteria that might affect logistics related choices regarding forecasting and inventory management. After this, it is proposed to suggest the specifications for the forecasting model to inventory policy combinations for each class that is derived to have the company that implements the framework be able to choose from more than one possible approach (Bacchetti, et al., 2013). If there are choices available to each specific group that has been formed, this makes it easier for the personnel to make an informed decision about forecasting and the behaviour of products. It

is also insightful to see which products do not perform well and which need a marketing boost or to be discontinued.

Bacchetti et al. (2013) proposed the following criteria to be implemented in the classification model:

1. Sales cycle phase
2. Response lead time
3. Number of orders
4. Demand frequency
5. Part criticality
6. Part value

These six classification criteria led them to have twelve different classes of SKUs which could each be assigned a specific forecasting and inventory management strategy (Bacchetti, et al., 2013). The researcher agrees that this can be a very effective classification methodology, but that there is some room for error if an expert is not assigning the correct classes to products. Therefore, a single criterion can be easier to use when the formula just needs to be plugged into the data. On the other hand, this methodology might be more accurate and adaptable than a single criterion.

Yamashina (1989) argued that analysing the 'sales cycle phase' which products are in, can assist in the prediction of future demand. They suggested that four or five life cycle phases be analysed, but less can also be used. (Persson & Saccani, 2009), extrapolated on that by adopting cut-off times for these different phases. Bacchetti et al. (2013) used only three phases and achieved an accurate classification model.

By incorporating the lead time with respect to the replenishment time for suppliers, it can easily be interpreted if and how much inventory should be kept on hand. If the lead time for making a product is larger or equal to the replenishment lead time from suppliers it is not necessary to keep inventories of dry goods (Bacchetti, et al., 2013). However, if the lead time to make the products, in this case, wine, is larger than the promised delivery or response time, inventory needs to be kept on hand.

Bacchetti et al. (2013) reckons that this multi-criteria classification model is relatively simple to explain to managers, and also much 'richer' than an ABC approach. SKU classification, forecasting and stock control performance form a complex linkage and can benefit immensely from further empirical investigations and analytical work. The human qualitative factor can be the defining factor in such a classification system, but the 'judgemental' factor will be present in most classification methodologies. Syntetos et al. (2009) explored the value of judgemental factors.

Some of these factors need to be incorporated into the demand planning of wine. The researcher believes that the error of this factor can be minimised by proper record-keeping and information sharing.

4.3.3 Classification of SKU based on demand volume

The most commonly used method for classifying SKU based on demand volume is the ABC approach. According to ABC, SKUs are classified according to their demand volume, mostly 20:30:50 – where 20% of the products will be A products, 30% B products and 50% C products. In turn the A products will have the highest demand volume and the C products the least. The Pareto principle is said to be highly effective and easy to use (Grosfield-Niry, et al., 2007; Scholz-Reiter, et al., 2012).

In Teunter et al. (2010), it was found that significant improvement was made in cost reduction when six classes were used rather than three. This was proven in addition to the already large cost savings achieved with implementing SKU classification. Classification is usually used in terms of service level improvement or cost reduction. Although Zhang et al. (2001), implemented the ABC classification from an inventory perspective on the assumption that cycle service levels are measured by the probability that an order arrives on time, Teunter et al. (2010) measure this in terms of fill-rate. The advantage of using fill-rate rather than cycle service levels is that it directly reflects the service as experienced by the customers. The cost approach includes service restrictions in the form of penalty costs incurred when demand is not met – of which the objective is then to minimise the total cost (including penalty and inventory costs). This leads to the same set of cost service efficient solutions as described by the corresponding service approach (Silver, et al., 1998). Teunter et al. thus implement this cost reduction approach in an attempt to minimise the total cost (inventory holding cost and penalties on back-ordered demand) (Teunter, et al., 2010).

To classify SKUs based on demand volume, the volume per time period in question should be listed along with the SKUs (when using multiple periods, averages must be used). The total volume must then be summed together. In theory, 20% of the items or 80% of the volume, will be classified as A items. However, there will be a clear distinction between high volume items and the medium volume (B) and low volume (C) products following. The separation is almost never exactly on the 20:30:50 ratio, but this is a rough estimation for general distribution. Every dataset is unique and should be handled accordingly (Grosfield-Niry, et al., 2007; van Kampen, et al., 2012).

4.3.4 Classification of SKU based on demand volatility

Boylan et al. (2008) focused on finding optimal forecasting methods for demand patterns, thus classifying products according to demand patterns. When defining non-normal demand patterns (something that would regularly occur in small to medium-sized wineries), the literature is not consistent in the definition. Williams defined it as the “variance of the number of orders, order sizes and lead times that should be taken into account” (Williams, 1984). Gelders & Van Rooy (1978), however, defined it simply as the magnitude of demand over a calendar year. Boylan et al (2008) took most of the literature into account, together with practical trials, to establish intermittent demand, which forecasting to use when and which is the best cut-off value to use (Boylan, et al., 2008). After categorising and defining different types of intermittent demand into intermittent, slow-moving, erratic, lumpy and clumped, Boylan et al. found it easier to assign forecasting methods to the different classes. Their classification is illustrated in Figure 4.5.

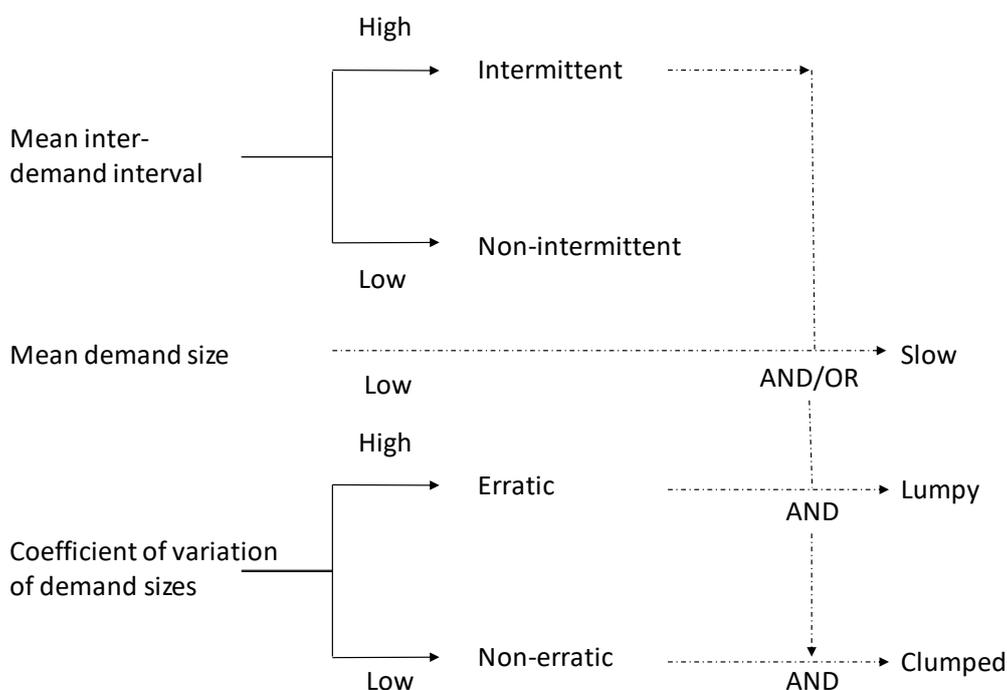


Figure 4.5: Categorisation of non-normal demand patterns (Boylan, et al., 2008)

Boylan et al. (2008) also found it more logical to first compare alternative estimation procedures, then identify the regions of superior performance for each one of them and then define the demand patterns based on the method’s comparative performance (Boylan, et al., 2008)

This research also recommends that if the mean demand interval (p) is greater than 1.25 forecast revision periods then Croston’s method (Refer to 4.4.1) should be used rather than Simple Exponential Smoothing (SES), based on simulated Mean Squared Error (MSE) (Boylan, et al.,

2008). Thus, conditions for superior forecasting should first be established and then be categorised demand-based on the results. This also demonstrates the identification of mean inter-demand interval as a categorisation interval, rather than a specification of break-even point. Figure 4.6 illustrates the demand-based categorisation for forecasting.

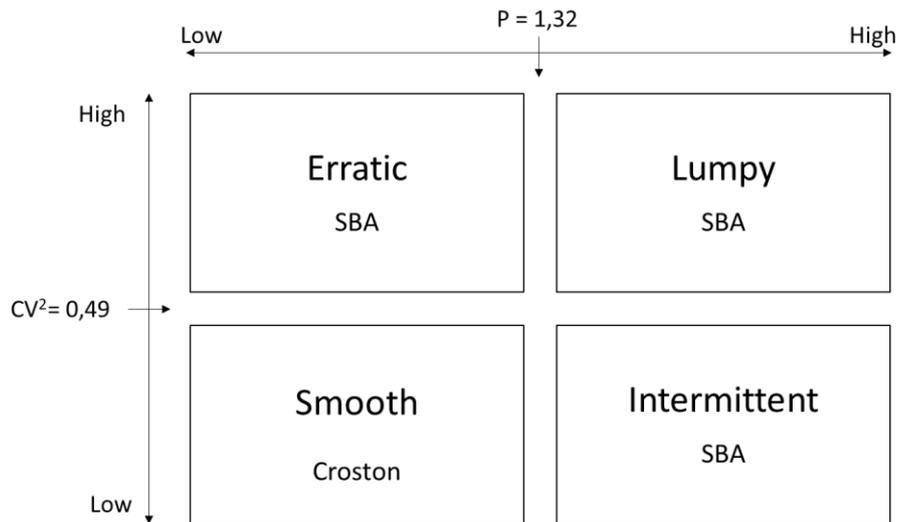


Figure 4.6: Demand-based categorisation for forecasting (Boylan, et al., 2008)

As mentioned before, this is not a field of study that is commonly addressed in the literature and therefore the adoption of one criterion over another is not addressed in the literature. Similarly, the operationalisation of classification methods, the specification of classes, the number of classes and the determination of cut-off values are not decided upon (Bacchetti, et al., 2013).

Syntetos et al. (2005), classified demand patterns to be analysed when dealing with demand frequency. This step then requires matching the grouped demand into different frequencies. Demand patterns are calculated by the coefficient of variation (CV) and certain cut-off values are chosen for groups.

The CV is widely used in the literature to measure the stability of demand. A lower CV indicates a stable demand and a higher demand indicates fluctuating to sporadic demand, with X being stable demand items, Y being fluctuating demand items and Z, sporadic demand items (Scholz-Reiter, et al., 2012) (Pekarčíková, et al., 2014). CV is computed as:

$$CV = \sigma / \bar{x}$$

Where σ is given as the standard deviation:

$$\sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \bar{x})^2}$$

The cut-off values for an XYZ classification are given as (Scholz-Reiter, et al., 2012):

- X classification: CV smaller than 0.5
- Y classification: CV between 0.5 and 1
- Z classification: CV larger than 1

Dhoka & Choudary (2013), consider the negative aspects of using a XYZ classification. They consider it inappropriate for new products since the product will automatically be a Z item. The same goes for seasonal demand items; the demand would seem to be fluctuating, but it is doing so with control (Dhoka & Choudary, 2013). When doing classifications these items thus need to be either excluded or emphasised to be handled in a different way.

4.4 Demand planning

Demand planning forms an intricate part of understanding the customer, the customer's perception of products and what future sales and revenues will look like. With this knowledge, a company can improve customer relationships and service (Ganesan, 2015) – a step towards winning and keeping customers, thus increasing revenue. According to (Moon, et al., 2000) most companies do not see the importance of accurately forecasting and planning customer demand, thus losing out on the prospect to exploit these business opportunities. Furthermore, Cecere (2013) elaborates on the fact that most companies do not understand the functioning of demand planning within their business. It seems they do not understand the process of demand planning and are confused as to how to move forward. Research at 'Supply Chain Insights' revealed that it is currently by far the planning department within companies that is most misunderstood, most frustrating and producing the least satisfying results (Cecere, 2013). Clearly, there is a misconception about the advantages and proper implementation of demand planning within businesses. Even more so in small to medium-sized enterprises, where skills and knowledge are more often lacking.

Planning and forecasting were always done intuitively until the late 1950s when more formal planning methods appeared on the scene (Armstrong, 1983). This was an approach with more science and math to it than guessing. But the term Supply Chain Management (SCM) was used commercially for the first time in 1982, which introduced concepts such as demand planning and integrated supply chain planning. These were innovative approaches, compared to the previously

isolated approach which kept every segment of the business separate (Cecere, 2013). Although the isolated approach is still very common in numerous companies worldwide, experts believe that a more integrated approach will be the leading way of the future.

4.4.1 Demand forecasting

Demand forecasting can thus be built on the classification of the SKUs. Forecasting demand is never 100% accurate, but it is a step in the right direction. From a forecast, decisions can be based on figures, rather than a guess and thus move toward improved planning. It is a practice that has been around for many years and is especially popular, nay crucial, in the Fast-Moving Consumer Goods (FMCG) industry amongst others. There are also a vast number of different forecasting techniques which can be used to forecast demand, dependent on the attributes of the product, market and seasons, etc. To put it plainly, some forecasting techniques forecast better on a certain type of data or product than another. But to find the perfect forecasting technique to product match can be difficult. These forecasting techniques can also be quite complex and should thus be suited to the skills available at a company. Therefore, to have a unique forecasting technique for each SKU can be too demanding. The SKU classification thus assists in categorising SKUs to use less forecasting techniques more accurately.

Johnston & Boylan (1996) suggested that inventory management should be based on demand forecasting, which in turn should be done according to the various SKU classifications. The first study that aimed to solve this problem in a similar way was Williams's 'Stock control with sporadic and slow-moving demand' (1984) for the effective management of SKUs using a five-quadrant solution. This five-quadrant technique is illustrated in Figure 4.7. Williams based his five-quadrant solution on the principle of variant partition, where the variance of lead time demand is analysed through its components. These components are the variance of a number of orders, the variance of order sizes and lead time length variance.

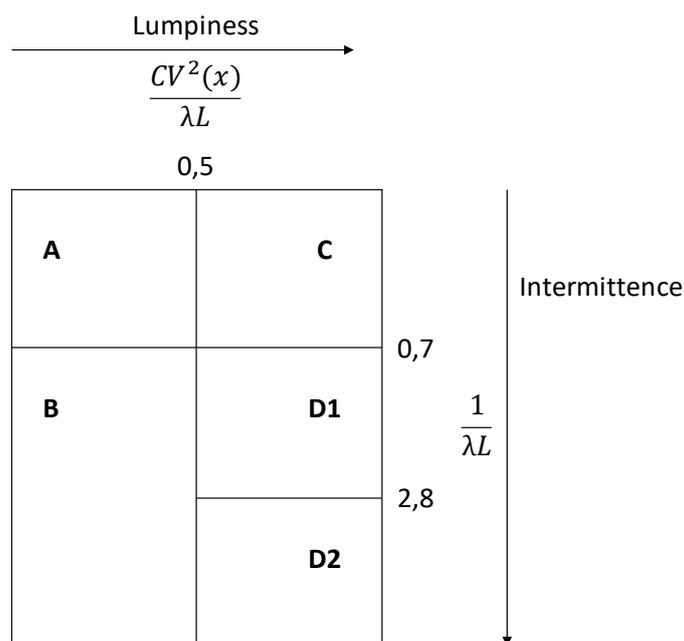


Figure 4.7: The five-quadrant technique for classification (Williams, 1984)

Syntetos et al. (2005) defined the classification according to demand patterns and also estimated appropriate and measured cut-off values. The work of these researchers (Syntetos et al.) improved on almost all the work of Johnston and Boylan (1996). Although Johnston and Boylan (1996) considered the Croston method to be more suited to intermittent demand and Simple Exponential Smoothing (SES) better for fast demand items, Syntetos et al (2005) extended this research. Johnston and Boylan (1996) also carried out some comparisons with respect to the methods' simulated Mean Squared Error (MSE). They found that Croston's method is better for an inter-demand interval of bigger than 1.25 forecast review periods. An intermittent demand interval would thus be defined as an inter-demand interval of larger than 1.25 and for any patterns with a demand interval smaller than 1.25 would be fast. The average inter-demand interval is calculated by summation of the intervals between non-zero demand periods divided by the number of non-zero demand periods.

Syntetos et al. (2005) extended this work by considering theoretical MSEs rather than simulated ones. They also considered three estimators and developed a two-parameter classification scheme. In the end, the results are validated in an empirical fashion (Syntetos, et al., 2005).

Time-series forecasting

Time-series forecasting is defined as a set of observations measured at consecutive points of time. Forecasts then provide the future values of the time series on a specific variable such as demand volume (Paul, 2011).

The systematic component of any forecast contains a level, trend and a random component and these can be found in different combinations in forecasting methods. Chopra et al. (2013) presents it as follows:

Multiplicative: *Systematic component = level x trend x seasonal factor*

Additive: *Systematic component = level + trend + seasonal factor*

Mixed: *Systematic component = (level + trend) x seasonal factor*

Time-series methods to consider for various situations include a moving average, simple exponential smoothing, Holt's model (trend) and Winter's model (seasonality).

The *moving average* (which does not display any trend or seasonality) is defined by the periods within which it 'moves', for example if the last N periods will be used in the forecast, it will be called a N-point moving average and will be calculated as follows:

$$L_t = (D_t + D_{t-1} + \dots + D_{t-N+1})/N$$

Where L_t = Level of period t; D_t = Demand at period t; N = number of periods considered in the forecast.

When a new period is added to the forecasting equation the oldest one is discarded, thus staying within the N periods determined.

Simple exponential smoothing is suitable for demand data that show no trend or seasonality as is the case for the moving average. The initial estimate for L_0 is given as the average of all historical data in n periods since no trend or seasonality is assumed. Simple exponential smoothing is thus calculated with the following:

L_0 is calculated first -

$$L_0 = \frac{1}{n} \sum_{i=1}^n D_i$$

The forecast for all future periods is then given as the current level, L_0 :

$$F_{t+1} = L_t$$

After observation of the demand for period D_{t+1} for period t+1, the level can be estimated:

$$L_t = \alpha D_{t+1} + (1 - \alpha)L_t$$

And the level for t+1, where the most recent observations are weighted higher in the weighted averaged of past demand observations:

$$L_{t+1} = \sum_{n=0}^{t-1} \alpha(1-\alpha)^n D_{t+1-n} + (1-\alpha)^t D_t$$

Where α is the smoothing constant between 0 and 1. The higher value of α is more responsive to recent demand observations and a lower α is more stable.

When demand has a trend, but no seasonality, *Holt's model* can be used to forecast demand. To get the initial level and trend of the demand data, a linear regression can be run in the form of:

$$D_t = at + b$$

Where b is the estimate of demand at period $t = 0$ and is the initial L_0 . The slope a is the rate of change thus the trend, T_0 , at period $t = 0$.

Because the demand has a trend and no seasonality, regression can be used since the underlying relationship between demand and time is linear.

The forecast for future periods is thus expressed as:

$$F_{t+1} = L_t + T_t \quad \text{And} \quad F_{t+n} = L_t + nT_t$$

After demand in period t has been observed, level and trend in period t can be expressed as:

$$L_{t+1} = \alpha D_{t+1} + (1-\alpha)(L_t + T_t)$$

$$T_{t+1} = \beta(L_{t+1} - L_t) + (1-\beta)T_t$$

Where α is the smoothing constant for the level between 0 and 1 and β is the smoothing constant for the trend between 0 and 1.

Winter's Model is used when demand data has a trend and seasonality. To obtain the seasonal factor, demand needs to be deseasonalised to run a linear regression, and find the level, trend and seasonal factor. Demand is deseasonalised by the following:

When p is even:

$$\bar{D}_t = \frac{\left[\left\{ D_t - \left(\frac{p}{2}\right) + D_t + \left(\frac{p}{2}\right) + \sum_{i=t+1-\left(\frac{p}{2}\right)}^{t-1+\left(\frac{p}{2}\right)} 2D_i \right\} \right]}{(2p)}$$

When p is odd:

$$\bar{D}_t = \sum_{i=t-\left[\frac{p-1}{2}\right]}^{t+\left[\frac{p-1}{2}\right]} D_i / p$$

Where p is the periodicity (the number of periods after which the seasonal cycle repeats).

When the demand is deseasonalised, a linear relationship between the deseasonalised demand, \overline{D}_t , and the period given as follows, which gives the level and trend at $t = 0$:

$$\overline{D}_t = L + T_t$$

From the deseasonalised demand the seasonal factor, S_t , can be estimated as the ratio of actual demand against deseasonalised demand:

$$\overline{S}_t = \frac{D_t}{\overline{D}_t}$$

Now, to implement Winter's model using the seasonal factors, the forecast for future periods is given by:

$$F_{t+1} = (L_t + T_t)S_{t+1} \quad \text{And} \quad F_{t+l} = (L_t + lT_t)S_{t+l}$$

After demand in period t has been observed, level, trend and seasonal factors in period t can be expressed as:

$$L_{t+1} = \alpha \left(\frac{D_{t+1}}{S_{t+1}} \right) + (1 - \alpha)(L_t + T_t)$$

$$T_{t+1} = \beta(L_{t+1} - L_t) + (1 - \beta)T_t$$

$$S_{t+p+1} = \gamma \left(\frac{D_{t+1}}{L_{t+1}} \right) + (1 - \gamma)S_{t+1}$$

Where α is the smoothing constant for the level between 0 and 1; β is the smoothing constant for the trend between 0 and 1; γ is the smoothing constant for the seasonal factor between 0 and 1.

Croston's method

Croston's method, which was established in 1972, estimates the mean as demand sizes using Simple Exponential Smoothing (SES) after every demand occurrence. Then the ratio of the size to interval estimates is used as an estimate of the mean demand per unit time period (Boylan, et al., 2008).

Croston's method was the first to be developed to forecast intermittent demand (Croston, 1972). He reckoned that assessing demand probability and demand size separately was more accurate and is given in the following:

$$\text{If } D_t \neq 0 \text{ then } \begin{cases} Z_{t+1} = \alpha D_t + (1 - \alpha)Z_t \\ V_{t+1} = \alpha q + (1 - \alpha)V_t \\ Y_{t+1} = \frac{Z_{t+1}}{V_{t+1}} \end{cases}$$

$$\text{If } D_t = 0 \text{ then } \begin{cases} Z_{t+1} = Z_t \\ V_{t+1} = V_t \\ Y_{t+1} = Y_t \end{cases}$$

Where D_t is the actual demand observed at period t ; Z_t is the estimate for the mean non-zero demand size for period t ; V_t is the estimate of mean interval size between non-zero demands. The current number of consecutive zero-demand periods is given by q and Y_t is the estimate of mean demand size (including zero demands). The smoothing constant, α , will be more responsive to demand if it is larger and more stable if it is smaller.

Croston has been proven to be biased by Syntetos and Boylan (2005), but still remains a selected methodology for the calculation of intermittent demand. It is used in sophisticated software systems and still gives satisfactory results. The Syntetos-Boylan Approximation (SBA) developed by Syntetos and Bolyan to remove the bias from Croston's method (Syntetos, et al., 2005) can also be used for forecasting intermittent demand. This method, however, like Croston's method, is more complex than time-series methods.

In conclusion, time-series models are easier to use than Croston's method and SBA. They can also be easily applied to numerous situations. However, they are not very accurate in forecasting intermittent demand. Therefore, the research suggests the use of SMA, SES, Holt and Winter's models for forecasting most of the stable demand (Winter's model will most likely not be applicable in forecasting yearly aggregates, since seasonality is not a factor). The chances that a high-volume wine with an intermittent demand pattern exists are small, but in these cases expert advice from forecasters should be sought and used with implementing Croston and SBA, since these are high volume items which can have a big impact on the financial bottom line. The small volume items with intermittent demand patterns can be forecasted though a combination of SES and causal forecasting (using judgement in forecasting).

Forecast errors

Numerous forecast errors exist to measure the accuracy of forecasting methods. This is a useful tool to establish which forecasting methods are the most appropriate in different situations. It also gives an indication of if the company is constantly over- or under forecasting. Chopra & Meindl (2013) explains forecast errors as follows:

In the most basic sense a forecast error (E_t) would be the difference between the actual demand (D_t) for period t and the forecasted demand (F_t), given as:

$$E_t = F_t - D_t$$

But since demand accuracy needs to be calculated at least the length of the lead time in advance, having the previous month's forecast error when the lead time is three months, does not help with planning. Therefore, other measures of error have been developed.

The *Mean Squared Error (MSE)*, can be related to the variance of the forecast error and can be used as:

$$MSE_n = \frac{1}{n} \sum_{t=1}^n E_t^2$$

The drawback of the MSE is that it penalises big errors greatly, because all the errors are squared. MSE will be useful when large errors in forecasting will be very costly and the gains from accurate forecasts are not that remarkable.

Mean Absolute Deviation (MAD) can be used when the cost of a forecast error is comparative to the size of the error. It is also a better error measure to use when the forecast error does not have a symmetric distribution. MAD can be calculated as:

$$MAD_n = \frac{1}{n} \sum_{t=1}^n |E_t|$$

The *Mean absolute percentage error (MAPE)* is particularly useful in measuring the forecast error of demand with seasonality and fluctuating demand. MAPE can be calculated as:

$$MAPE_n = \frac{\sum_{t=1}^n \left| \frac{E_t}{D_t} \right| 100}{n}$$

To measure the bias of forecasts, the *tracking signal (TS)* is a useful measure. When TS is smaller than -3.75 it is under-forecasting and if TS is larger than +3.75 it is over-forecasting. We compute TS as:

$$TS_t = \frac{\sum_{t=1}^t E_t}{MAD_t}$$

According to (Goodwin & Lawton, 1999) and (Syntetos, et al., 2005), MAPE is generally the best and most widely used measure of error due the fact that it is presented in a percentage and not a unit of measure. On the other hand it is not the best measure of error for intermittent demand as well as demand that is symmetrical (Syntetos, et al., 2005); (Makridakis, 1993). The tracking signal can also be successfully used to measure the bias of a forecasting method (Chopra & Meindl, 2013).

In conclusion, the research suggests the use of MAPE as the primary forecast error. The MSE can then be used as a secondary measure and the tracking signal is to be used for measuring bias. By using the tracking signal a winery can determine if it is over- or under-forecasting continually and adjust volumes accordingly.

4.4.2 Demand management

Demand management forms a part of the tactical planning and fits in with demand planning and forecasting. The management of demand can be considered a strategy in which demand is managed or controlled. This strategy should be documented and revised yearly, to keep it relevant and updated.

Demand management can be seen as the strategy to influence market demand or manipulate forecasts in the right direction (Blanchard, 2008). In other words, a winery wants to produce and sell more wine, so they produce it with the idea of having regular promotions at a discounted price. In effect, they manage the demand by strategically lowering the prices. In a situation where the demand unexpectedly exceeds the amount of stock on hand, a winery can push up the prices or sell wines on an allocation basis to avoid stock-outs (Chopra & Meindl, 2013).

The main factors influencing the timing of a promotion according to Chopra & Meindl (2013) is the impact that the promotion has on the demand, the cost of holding the inventory, the cost of changing the level of capacity and the product margins. Companies thus need to decide which factors favour promotions in the high- or low-demand seasons and how this will influence their strategy and operation (Chopra & Meindl, 2013).

It is thus suggested that the demand management strategy be well planned out for if and when unexpected demand occurs or does not occur. This strategy can also be tied in with the value opportunities available in the industry. If there is a trend for a certain wine, a winery can decide to promote these wines at better prices. Or if they are attempting to enter a new market or bring a new product to the market, demand can be better planned if a strategy to manage this is available.

The three factors that influence the increase in demand are 'market growth', 'stealing share' and 'forward buying'. When a promotion is on a premium wine it can increase the consumption relative to other wines in their offering and relative to their competitors in the market, thus increasing market share and 'stealing share' from competitors. During a promotion it can also have the effect that customer who were going to buy anyway, buys earlier because of the promotion, thus just shifting the demand earlier (Chopra & Meindl, 2013).

These promotional factors can thus be planned before production begins as a part of the strategy or as a result of overproduction. In the case of wine, discounted prices are not a good idea because they harm the brand image and the winery struggles to increase prices again the next year (Anonymous, 2016; Conde, 2018).

The demand management is therefore implemented after forecasting but strategised before the demand occurs. It is incorporated into demand planning along with demand forecasting to improve supply chain functions, reduce the bullwhip effect and improve relationships along the supply chain (Mentzer, 2006).

4.4.3 Creating the demand plan

Planning tools for demand and supply chain planning are essential in directing numerous decisions regarding the supply chain and customer management. Demand and supply strategies that are not aligned cause expensive logistical problems – under- or oversupplying – which in turn negatively affect the bottom line (Hübner, et al., 2013).

According to Wallace and Stahl (2008), demand planning can be one of the most challenging tasks in Sales and Operations Planning (S&OP). This is not only because of the complexity and uncertainty of the process, but also as a result of the numerous people that have to give input for the plan (Wallace & Stahl, 2008). Demand planning is the first process in supply chain planning (Chen, et al., 2007) and also S&OP (Figure 4.8). After data is gathered to start the S&OP process, demand planning is the first step to get the process underway. After demand is forecasted and planned, the supply planning can be done to establish how and by when stock needs to be finished and in which amounts. Resource requirements and capacity planning can then be done as inputs to the meeting before the official S&OP meeting. Suggestions and recommendations are given and decisions are made before the plan is presented in the executive meeting. Here the final plan is decided upon to implement.

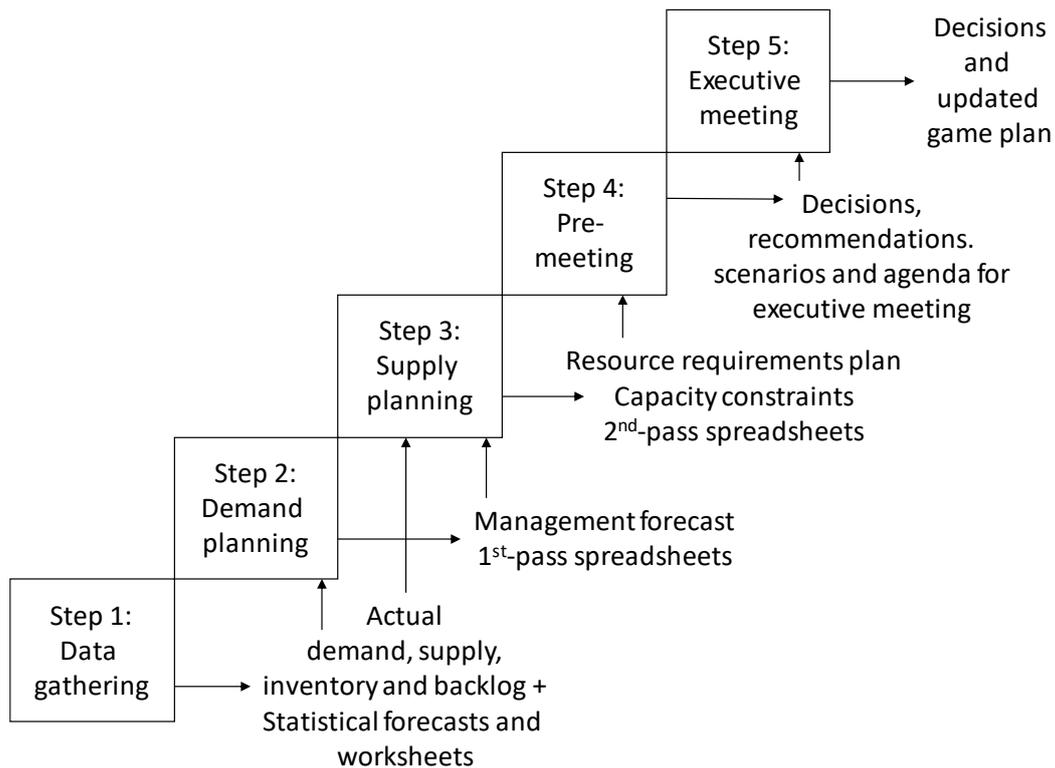


Figure 4.8: The five-step S&OP process (Wallace & Stahl, 2008)

The sales and marketing team is usually responsible for creating the demand plan and ensuring demand forecasting is done as accurately as possible (Mentzer & Moon, 2005; Ganesan, 2015). In some companies, a dedicated demand manager ought to be appointed, but with smaller companies and especially companies new to the field of demand planning (Sheldon, 2006), this function would be regarded as one of the many other functions of another role. This typically happens when demand planning does not enjoy priority, which might lead to detrimental effects in meeting demand.

The demand planning process can be a reiterative process, continually adding and changing factors incorporated in the demand plan for improvement. Tom Wallace and Bob Stahl are among the most celebrated authors in the demand planning and S&OP field, writing numerous books and articles, consulting and lecturing. Their writing on the steps of a successful demand plan is followed here (see Figure 4.9).

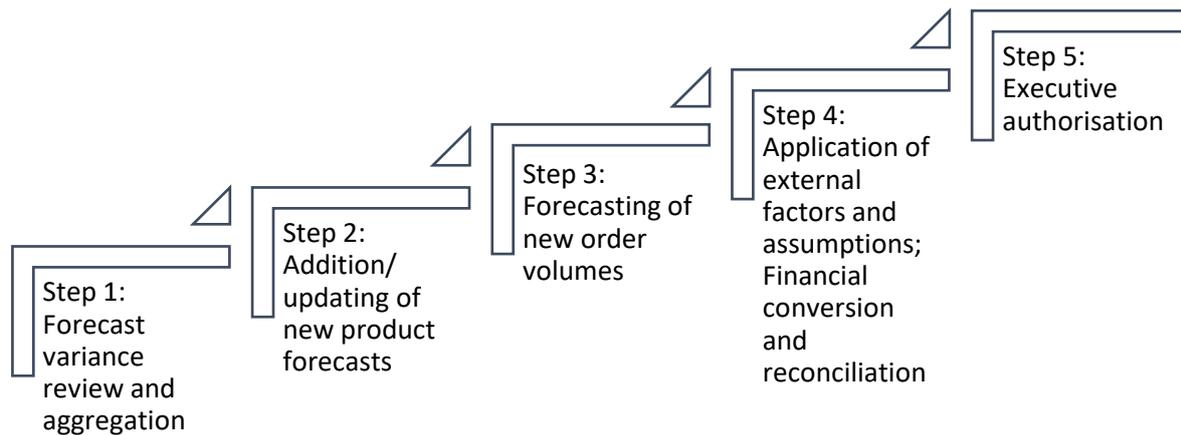


Figure 4.9: The demand planning steps (Wallace & Stahl, 2008)

After the initial forecast done by the forecasters, it needs to undergo a review to especially check for forecast bias and if the same bias is continually occurring. This can then be addressed in the following forecasting round.

With the inclusion of new products to be forecasted, it is necessary to include the ‘supply people’ in the forecasting process as they know the product, capacity limitations and timelines for production. The amount of sales new products will take from current products also needs to be factored in.

When make-to-order production is necessary, these numbers need to be gathered from the ‘sales people’ since they know the customers and can make a good prediction of future demand. This is also useful in normal make-to-order planning.

The external factors (competition, economic climate, new opportunities) that have an influence on demand need to be reasoned and taken into account. Any and all assumptions that are made need to be documented. Wallace and Stahl give two reasons why the documentation of assumptions is so important: To ‘bulletproof’ the plan and get buy-in from the role-players and to explain and learn from past decisions. This is thus to ensure that everyone knows where the numbers come from and can be held accountable for the plan. In this way top managers that need to make decisions about the plan can also see where the figures come from. The other important factor is that the result of the actual demand against forecast can be explained, because the decision-making thought pattern and assumptions are documented. It can then be used to learn from and eliminate future failures. The plan is then ready for sign-off.

The demand plan thus enables top management to make informed decisions on balancing the demand and supply as well as creating a platform for discussion on strategy, risk and opportunities (Wallace & Stahl, 2008).

4.5 Value propositions

In Oosterwalder and Pigneur's groundbreaking work, they establish nine fundamental building blocks around which to build a business model in the modern age. They believe that a business model should be a gateway to facilitating description and discussion, to have everyone talking about and understanding the same thing (Oosterwalder & Pigneur, 2010). At the heart of this type of business model is a building block that they call 'Value Propositions'. This encompasses value that is created by the product or service the company offers for specific market segments. Understanding what specific market segments see as value, can assist the company to create that value, thus winning market share and increasing revenues. The author endorses the idea of creating value for specific market segments and understanding customer needs. 'Value Propositions' is definitely a building block that most wineries should incorporate into their business models to increase revenues. This is yet another way in which the South African wine industry can move from a production-driven to a market-driven approach.

The author explored the idea of identifying value creating opportunities in the wine industry. In a sense, these are opportunities that exist in the wine industry, created by the market segments to be exploited by the wineries, which in turn, increase revenues. The opportunities that exist have been mentioned in Chapter 3 and will be explored further in Chapter 5 when the framework is developed.

According to Oosterwalder and Pigneur, they reckon that customers choose one product over another to fulfil their needs. These needs can be either a price point, quality, branding or added features or benefits. Needs like these should be identified by companies, in order for them to deliver on the expectation and make their revenues grow. They elaborate even further on these value propositions by including 'newness', 'customization', 'performance', 'design', 'price', 'status' and 'getting the job done', 'cost reduction', 'risk reduction', 'accessibility' and 'convenience' into possible ways to create value (Oosterwalder & Pigneur, 2010).

Thought change leader, Simon Sinek, also shared some relevant views on selling products in his popular video, 'Start with Why'. He argues that most customers buy a product or use a service because of why the company does what it does, not about what they do or how they do it (Sinek, 2009). The concept of selling a story and making customers believe why they need a certain product, makes them want to buy a product. The author supports these ideas and suggests that this is especially the case in selling luxury products as these are not basic needs to survive. Wine also falls into this luxury product category all the more when competing against other alcoholic beverages in South Africa, which do not endorse a wine-drinking culture but tend to focus more on beers and spirits.

As mentioned in 4.2.2, Perez also suggests the unique value proposition to be a main element in the company's supply chain strategy. He describes it as the company's 'competitive positioning' in terms of their supply chain and suggest the approach that a company should have 'order qualifiers' and 'order winners' as mentioned by Alex and Terry Hill (1995) (cited in Perez, 2013). This can be defined as the minimum requirements for a product to be chosen (order qualifier) or a product that is differentiated from others (order winner). Identifying the 'order winners' and incorporating them into the company's unique value proposition by identifying their key drivers should be incorporated into the supply chain practices to create that value (Perez, 2013). Thus, value can be created by the company's supply chain, by structuring and aligning the strategy appropriately.

A business model should thus revolve around this ongoing quest to add value to products in a way that customers need it. The idea is also not to trick customers into buying products that do not live up to the standards they propose but rather structuring the strategy in such a way that endorses characteristics that the customers buy into. And the product should essentially enforce the decision to ensure repeat orders.

This research also identifies the value opportunities that exist in the market and incorporates the exploitation of these opportunities into demand planning. It is therefore important that the winery establish a well-documented plan of cause and action due to value opportunities. In the beginning, these assumptions would be rather hit and miss, but as the database grows, accurate estimations can be made regarding the magnitude of the impact of value opportunities on demand. As mentioned in section 4.4.3 the documentation of these decisions and actions regarding value opportunities is of critical importance to learn and grow in future decisions and planning.

4.6 Strategy execution

The execution of a strategic plan is one of the major stumbling blocks in strategic planning. Even if an organisation develops a strategic plan the chances that they will implement it successfully are dim (Crittenden & Crittenden, 2008). The strategic or business plan described in section 4.2.1 should thus be accompanied by a strategy execution plan.

There can be numerous reasons as to why strategy execution fails. Some of the basic and most common execution barriers can be easily overcome if management is aware of the pitfalls. Various authors rate communication to be a major execution barrier (Heide, et al., 2002; Peng & Litteljohn, 2001). They reckon that communication is one of the main barriers in strategy

execution and that strategic planning can only succeed if it is communicated explicitly to all role-players.

Commitment and consensus about a strategy go hand in hand with communication. This is also an aspect that can be a barrier to strategy execution. A lack of shared understanding hampers the effective execution of strategy (Noble, 1999). Usually, understanding cannot be increased without communication. Employees that are not involved and committed lead to poor execution as a result of the example set by other employees and management (Yang, et al., 2009).

If a strategy is poorly created, good execution is not possible (Hrebiniak, 2008). Therefore, strategy formulation should be excellent for implementation to be successful. Eisenstat and Beer (2002) also endorse this barrier by claiming that an unclear strategy and conflicting priorities also lead to a failed execution (Eisenstat & Beer, 2000).

In overcoming these strategy execution barriers, organisations can enjoy the benefits of implementing a successful strategic plan. Experts and academics also propose ways in which barriers can be removed. Kaufman (2016) suggests that the company should overcome the resistance to change and get into a habit of changing routine or plans regularly to get more creative. Employees should also be encouraged to be open to innovative ideas. This idea is strengthened by Moran and Brightman (2000), by suggesting that companies should adopt change management as a part of the company culture. Change management is defined as the process of ongoing renewal of direction, structure and capabilities (Moran & Brightman, 2000). Change often leads to improvement and fresh ideas which can add value to any team. Employees that are engaged, interested and involved in their work are more likely to perform excellently in executing strategy (Lee, 2012). Since they are passionate about the company and the way in which the company treats them, these employees sell strategy more effectively. Lastly, collaboration between different companies or different sectors within a company means they can learn from each other and share knowledge to overcome barriers and improve execution of strategy in the future (Gray, 1989).

4.7 Chapter conclusion

This chapter, along with Chapter 3, served as the basis of the demand planning framework. It discussed the elements that the framework will be built upon. It started off by introducing the supply chain and confirming the place of demand forecasting and planning within supply chain management. The business and supply chain strategies were also shown as valuable aspects within this. To simplify the numerous SKUs to be worked with, a classification system was introduced by means of SKU grouping into product families and then the classification of these

families according to volume and demand volatility. Demand forecasting and management was contextualised within demand planning and the process of demand planning. The chapter concluded by discussing value propositions and the importance of effective strategy execution.

Chapter 5

Developing a framework

5.1 Chapter introduction

The literature analysis is used as the basis of the proposed demand planning framework for small to medium-sized wineries. This framework will be implemented at a case study winery to evaluate its applicability and benefits. The chapter builds on the previous chapters about demand planning and the wine industry. It commences by giving an overview of why and how the framework was developed, as well as revising the objectives of the framework as stated in Chapter 1. The scope of the framework is also clearly defined. Thereafter, the framework is discussed step by step, following a process approach.

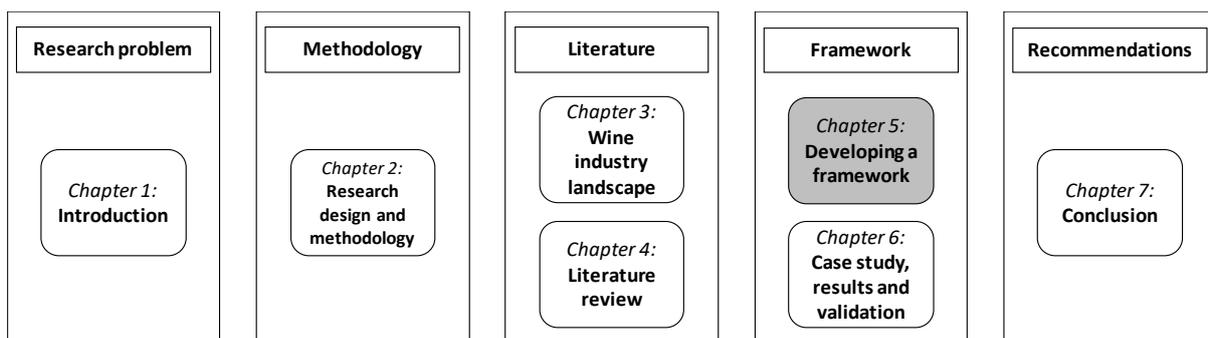


Figure 5.1: Thesis outline

5.2 Introduction

From the literature, one can argue that the wine industry is complex – both from a product and process perspective, especially in small to medium-sized wineries where products are more specialised and demand is fluctuating. These wineries' products can usually be classified as luxury items – hence the difficulty in forecasting and planning demand. Furthermore, the wine has an extremely long lead time since it can only be produced once a year. Thus, long-term planning (more than 12 months ahead) should be done as accurately as possible in order for wineries not to lose out on sales due to shortages or on the other hand, to have a surplus of wine.

5.2.1 Purpose of the framework

The framework is developed to assist small to medium-sized wineries in making informed and improved decisions by implementing demand planning and management effectively. In the long run, the framework could improve profitability. The framework operates on the strategic and tactical planning level. It aims to move the South African wine industry towards a market-driven approach, as opposed to the production-driven approach it is currently following. This is one of the Wine Industry Strategic Exercise (WISE) aims for 2025 (Augustyn, 2016) which this research targets to address. Another aim of WISE, which is also associated with demand planning, is to have supply and demand in equilibrium (Basson, 2015). This, however, is not very significantly influenced by small and medium-sized producers. The volume of wine that wineries produce in South Africa is illustrated in Table 5.1 (this table is formulated as average volume). This illustrates how small an effect small and medium-sized wineries have in terms of bringing supply and demand into equilibrium. In effect, the framework can also assist in increasing the price of wines from South Africa, by managing demand through pricing rather than discounted prices due to an oversupply of wine.

Table 5.1: Volume of wine produced by SA wineries (Adapted from SAWIS, 2018)

Categories (Tons of grapes crushed - 2017)	Volume of wineries			
	Total Volume	Private wine cellars	Producers cellars	Producing- wholesalers
1- 100	11 200	10 700	-	500
>100 - 500	50 100	47 700	300	2 100
>500 - 1000	31 500	30 750	-	750
>1000 - 5000	174 000	153 000	12 000	9 000
>5000 - 10 0000	120 000	30 000	67 500	22 500
>10 000	585 000	45 000	510 000	30 000
TOTAL	971 800	317 150	589 800	64 850

Small to medium-sized wineries do not usually have a dedicated demand planner due to the limited size of production. This often leads to demand planning and management functions being spread across various role-players or even ignored completely. The framework is thus designed to be easy to use and adaptable to most situations. The aim is that it can, therefore, be easily implemented by a winery's current personnel as the skillsets occupied by smaller wineries are usually limited. Small and medium-sized wineries would usually employ workers with a broader skillset, rather than a specialist.

During a systematic search of the literature in online databases (EBSCOhost, Science Direct, Scopus and Emerald), a framework for demand planning and management in the wine industry could not be found. Since the literature on engineering, business, operations and supply chain within the wine industry is very scarce, various combinations of the keywords listed in Table 5.2 were searched for.

Table 5.2: Keywords searched for in online databases

Keyword 1	Keyword 2
Wine	Demand planning
Winery	Demand forecasting
Cellar	SKU classification
Wine industry	Best practices
	Sales and operations planning
	Decision-making
	Supply chain
	Postponement strategy
	Tactical planning
	Strategic planning

Keywords were searched for in combination to ensure that no relevant sources were missed. The framework is thus developed to address this need for a framework to implement effective demand planning and management in small to medium-sized wineries, and thereby improving profitability and managing production.

5.2.2 Framework development

The framework is developed based on the literature study performed in Chapters 3 and 4. Literature on product family grouping, product classification, demand forecasting, planning, management and Sales and Operations planning (S&OP) in industries with overlapping attributes to the wine industry is used to build the framework. These industries have been discussed in the

previous chapters. Furthermore, the framework made use of industry reports to establish the state of the wine industry as well as the direction in which it is moving.

In the case of the wine industry, magazine articles and critics' opinions are also valuable in terms of gauging the trends, opportunities and threats in the industry. Industry role-players and experts were also consulted for opinions and inputs as this is a true reflection of what is happening in the industry and how processes are managed. Personal experience of the researcher also contributed towards the study in terms of practical implications of decisions and processes. The researcher is a qualified winemaker, with numerous years of experience in various wineries, locally and abroad. These wineries range from small 20-ton wineries to large 6 000-ton wineries. Several problems on the business and process side have been identified by the researcher through personal experience.

The framework is built around the concept of a linear process where inputs are transformed to outputs by means of a process. The process also needs certain enablers (skills, resources or knowledge) to function optimally as well as controls (metrics, procedures or instructions) to be governed by. An example of such a process is given in Figure 5.2.

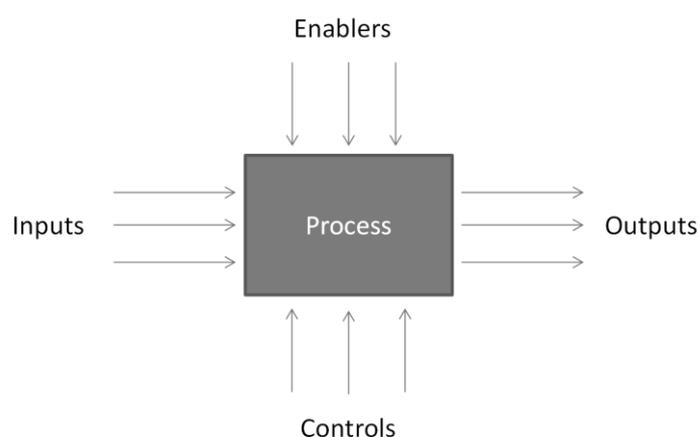


Figure 5.2: Input, process, output flow

According to the Oxford dictionary, a framework is 'a basic structure underlying a system, concept, or text'. This study is thus concerned with creating a structure underlying the 'system' or 'processes' of demand planning in the wine industry. This framework is designed to be implemented at small and medium-sized wineries and not large and cooperative wineries like Distell, DGB and KWV. The framework and each of the components within the framework makes use of the 'Input-Process-Output' flow. It will be discussed step by step, and within each step, the necessary inputs, process, outputs, controls, enablers and objectives will be stated to ensure the process is followed correctly and accurately. In some cases, relevant examples can also be given

to illustrate a concept. The process of designing the framework will be based on ideas from bigger companies, literature and experience, which are then moulded for the small and medium-sized wineries as defined by the case study in Chapter 6.

The framework will be implemented in the industry by means of a case study in Chapter 6. It will be applied to an actual problem/situation at a winery to get more input and feedback into the framework and make relevant improvements. The validation of the framework will then be done by consulting with other similar wineries, industry representatives and role-players. The validation is concerned with the feasibility, comprehensibility and need for the framework.

5.2.3 Framework objectives and features

The previous sections introduced the reason for the framework as well as the methods used for the development thereof. The framework objectives are developed through the research objective stated in section 1.6:

The research aims to develop a practical decision-making framework to implement at small to medium-sized wineries, especially aimed at improving demand planning.

- Establish industry and winery value opportunities.
- Determine decision-making and classification criteria for selecting demand forecasting methods.
- Consolidate value opportunities, forecasting and planning into a structured framework that is easy to use, easy to understand and has the flexibility to apply to multiple situations.

The literature review, together with applicable information obtained from industry experts and personal experience, provide satisfactory information to propose a decision-making framework which will be validated in practice. The framework aims to reach the set objectives. The feasibility and practicality of the framework will also be judged during validation.

As derived from the research objectives, the framework should have the following features:

- Feasible: The framework should achieve the desired outcomes, which in this case will be to improve decision-making, demand planning and record-keeping.
- Practical: The framework should be easy to use and understand.
- Holistic: The framework should consider as many aspects as possible of decision-making within demand planning of small to medium-sized wineries.
- Adaptable: The framework should be easily adaptable to multiple situations. The framework thus serves as a guideline.

- Structured: The steps in the framework should be logically arranged and easy to follow.

Wineries are faced with difficult decisions regarding the demand and supply of wine every day. These decisions are mostly made intuitively, as there is no formalised framework, guideline or decision-support tool which wineries can use to make more informed decisions about balancing demand and supply. Therefore, this framework should provide them with a logically structured, easy-to-use approach to decision-making and record-keeping. The feedback step at the end of the framework gives a winery the result of their improved decision-making. It also captures the decisions and inputs used in the decision process. Thus, learning from mistakes and improving future decisions, and assisting them to use the process repetitively. This also increases the chance of more wineries adopting the framework, as it can be implemented by their current personnel.

Besides providing a structured decision-making framework, which addresses the multiple steps in planning and managing demand, the framework also provides insight into the interaction between the different steps of the framework. At each decision-making node, the appropriate enablers and controls for processes are also listed where necessary. These are used to ensure the necessary resources are available and the metrics are in place to monitor the processes.

5.2.4 Framework scope

The scope of the framework is stated explicitly here to define the boundaries of the research. This is summarised in Table 5.3. The study is limited to small and medium-sized wineries (processing less than 1 000 tons of grapes). The focus is to empower the smaller wineries to be profitable within their current capacity by streamlining their business processes. Strategic and tactical planning, that is longer-term, high-level planning, is included in the study. The operational, or short-term, planning remains outside of the scope of the study. Furthermore, the opportunities stated within the framework serve as a mere guideline to an approximate answer rather than a specifically tested outcome. These opportunities need to be reviewed constantly and the guidelines given here can assist in that. The major fields of study included in the framework are SKU grouping, product family classification, demand forecasting, planning and management. Inventory management will be a field of study for future research.

Table 5.3: Summary of framework scope

Criteria	IN	OUT
Wineries	Small/medium-sized wineries	Cooperatives, wholesalers, large cellars
Planning horizon	Strategic, tactical	Operational
Opportunities	Guidelines for all	Specifics for individual cellars
Inputs/ outputs	SKU grouping, product family classification, demand forecasting, planning and management	Inventory management, S&OP

5.2.5 Building the framework

This section builds the in-depth framework step by step. It aims to present these steps in a logical way as depicted in Figure 5.3. This illustrates the flow of the framework from initiation to end. As indicated by the feedback loop, this process reiterates itself for continuous improvement. It aims to be flexible to various situations, thus considering changing factors and inputs as the process progresses.

The framework starts by identifying the generic value opportunities that exist in the wine industry. After the identification of opportunities for all industry players, the winery then needs to establish which opportunities are applicable to them with regards to their current product offering. They also need to explore opportunities that can be exploited by them with minimal expenditure of either capital, capacity or time. The winery then needs to decide how these available opportunities will be included in planning and how it will influence planning. These assumptions will be difficult to make at first, but as the record-keeping data grows, these decisions will become much easier.

For ease of forecasting the multiple SKUs are classified into product families. The product families are then classified according to volume using the ABC approach. Thereafter the product families are classified according to demand volatility using the XYZ approach, which then in effect results in only nine classes to forecast.

The demand is forecasted, with appropriate forecasting techniques, based on historical sales data. A demand management strategy is then put in place to manage demand.

The output of the framework is an 18-month demand plan for a specific vintage based on the forecasting and the value opportunities incorporated. The framework concludes with guidelines to successful strategy execution.

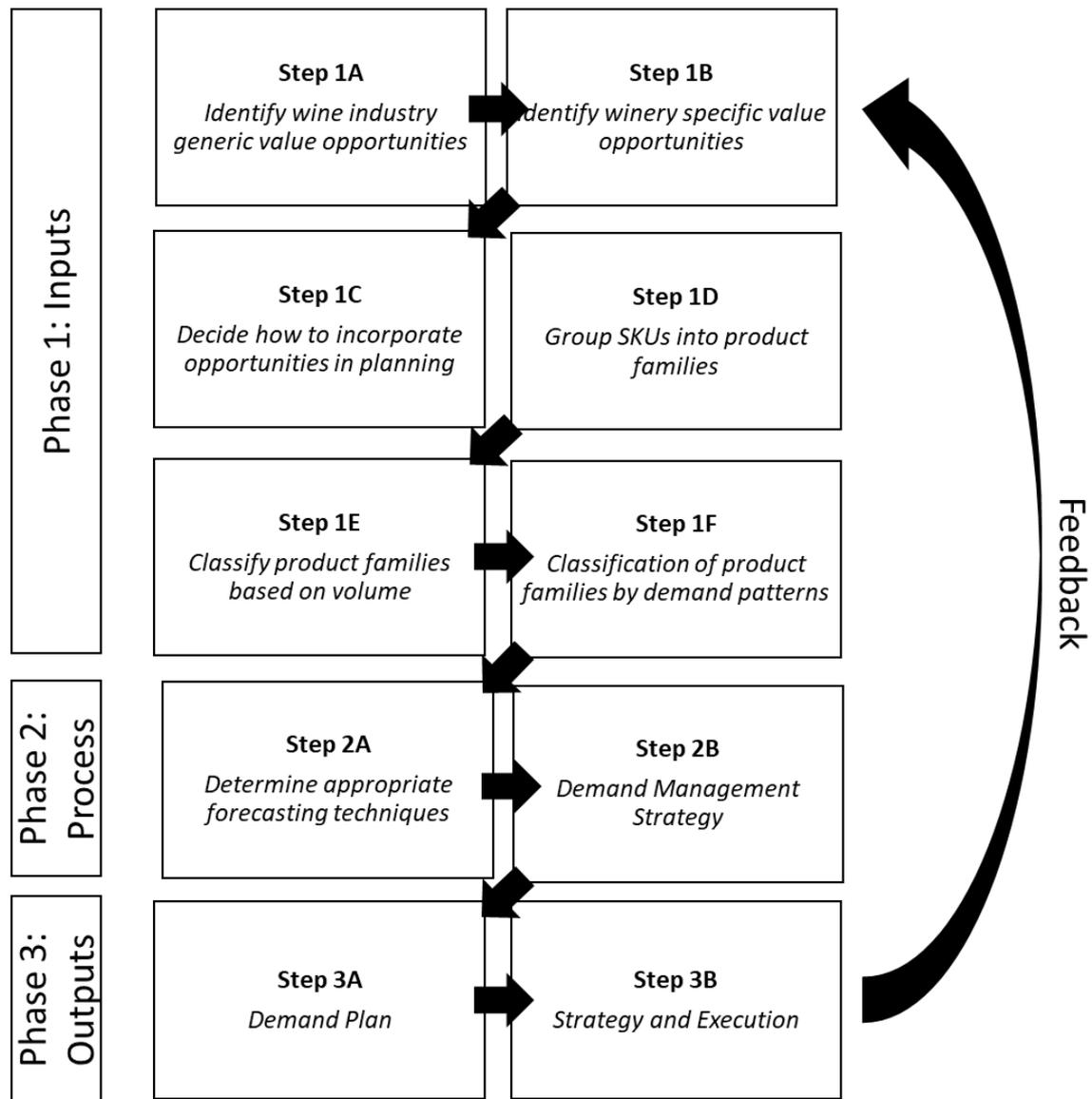


Figure 5.3: Flow of framework

5.3 Phase 1: Inputs

The inputs phase serves as the foundation of the decision-making framework. All decisions that need to be made within the framework need to consider the elements of the inputs phase. Phase 1 considers the value propositions and opportunities that the wine industry and winery specifically need to incorporate into their decision-making. The other 'Input' consideration is how to group SKU's into product families and then classify the product families according to volume and demand patterns. The methods for classification are based on other industries with similar attributes, because no classification methods in the wine industry have been tested or recorded in literature.

5.3.1 Value proposition

The value proposition of a company to its customers defines how the company intends to create value through its products. It is therefore important for the company to identify all the opportunities through which they can create value and thus increase revenues. Usually, there is more than one way to create value for customers and different customer segments expect different value propositions. Different customer segments include retail, restaurants, direct sales, wine clubs, etc. Thus, when planning production these segments should be considered when making decisions. To create the value customers desire, and by minimising waste in the process, a company ought to identify and plan around the opportunities to create value. The South African wine industry can benefit from identifying opportunities in the various markets that they serve to be more competitive globally, as well as increasing revenues locally. Brand South Africa needs to be promoted by creating the value that customers expect for various customer segments.

The most important value opportunities are acknowledged by first identifying the industry's opportunities and thereafter the winery's specific opportunities. Unique opportunities can be identified within the wine industry compared to other industries. The opportunities may also vary between countries, mainly due to differences in the economic, political or cultural climates. The framework also establishes the procedure for incorporating the effect of these value opportunities in demand forecasting and planning.

Step 1A: Identify wine industry generic value opportunities

The framework commences by identifying the industry generic value opportunities in Step 1A. These value opportunities are factors that have an overall impact on the way a business performs financially and operationally, within the wine industry. Businesses usually do not have control over these opportunities created by the industry but intend to fulfil customer needs by creating value and thus generating revenue through these opportunities. Figure 5.4 represents the process of Step 1A.

Objective: To establish which opportunities exist in the wine industry at any given point in time and to which degree do these influence demand in wineries? A process should be developed by which these factors are documented and followed.

Inputs: Industry reports, magazine articles, industry role-players' opinions and sales statistics can be useful in determining which opportunities exist in the wine industry. General trends that exist in all consumer products and especially luxury products should also be evaluated and taken into account. Market conditions can also be a useful indicator of opportunities and trends. Ideally these opportunities and trends can be summarised and presented to wineries regularly by one of the wine industry representative bodies.

Methods: It should be someone's dedicated task to gather as much information on market trends and opportunities as possible. This can be done by regularly checking the industry pages for news, reading wine magazines, attending industry seminars, tracking general trends in the world as well as monitoring the winery's own sales data.

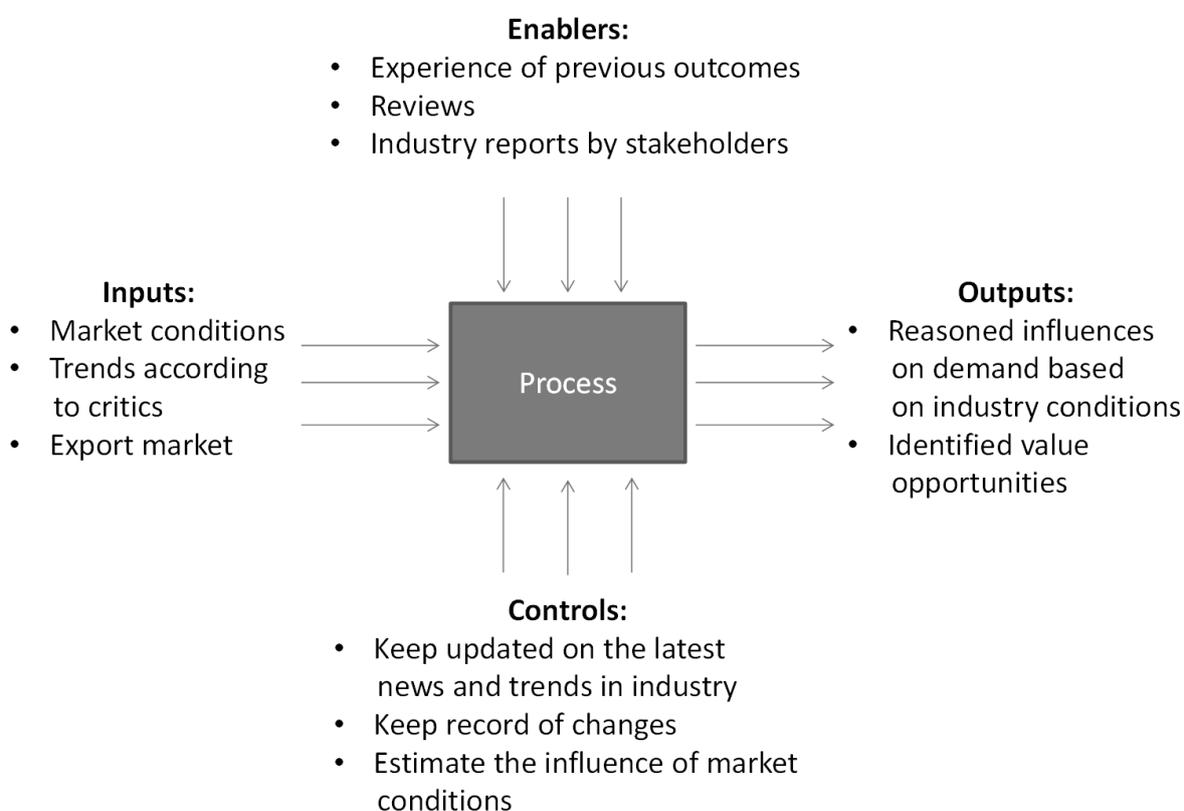


Figure 5.4: Process of Step 1A

Outputs: A report that presents all identified opportunities and trends in the wine industry and in general. These opportunities (geographical and customer segment opportunities for all industry players) and trends will be reasoned with applicable references and updated monthly.

Example: Through the gathering of data, a report is put together explaining the industry opportunities and current trends in South Africa, our major export markets and the markets we aim to target. Although detail market analysis is not the primary focus of this thesis, some example opportunities have been identified from the literature studied in Chapter 3, i.e.:

- The South African domestic wine market is growing, in premium and ultra-premium categories.
- Rosé is still seeing an increase in sales in the USA, in South Africa it is stabilising.
- Boxed wine sales are increasing in the USA.
- Nigeria is a possible opportunity for sparkling wine and red wine producers.

- China is still experiencing growth in premium red wine consumption, although the ultra-premium wines have seen a decline due to government regulations.

Step 1B: Identify winery specific value opportunities

Although there are several value opportunities available in the wine industry, each winery has different attributes and is in various stages of maturity. And within each one of them, value opportunities exist. The winery thus needs to strategise how they can adjust their own capabilities to be geared towards targeting specific opportunities. The task for every winery is to plan on how to create value for current customers and future customers (keeping current customers and winning new customers). Within this, planning must be done accordingly.

A winery can commence the search for value opportunities (geographical and customer segment opportunities the winery wants to target) by assessing what they currently have. Table 5.4 summarises what a winery might consider creating value, depending on what their customers define as value. This can be related to any aspect of the business which can enable processes to create value.

Objective: Identify opportunities that can be exploited because of the capabilities within a winery which can possibly add value currently or in the future to customer value proposition. Establish what is being done right and what can be done better. A process should be developed by which these factors are documented and followed.

Inputs: The generic value opportunities established in Step 1A will be used to generate the winery specific opportunities that a winery can focus on. This is based on their product range and production capabilities.

Outputs: Industry and winery specific opportunities are established. The opportunities can now be categorised and influences reasoned. As the database of record-keeping grows, these decisions should become more accurate. The next step suggests a process of incorporating these opportunities into planning.

Table 5.4: Value opportunities to consider (Compiled from literature in Chapter 3)

Aspects to consider	Value opportunity	Example
Grapes	Trending varieties?	Rosé, Prosecco (sparkling wine), Grenache, Cinsault.
	Quality/ health considerations?	Less additives, organic wine.
	Price considerations?	
Capacity	Excess capacity?	Space is available to grow.
	Possibility to expand?	
	Growth opportunity?	
	Small batch production?	
Facilities	Estate title considerations – quality brand status?	Quality grapes bought in will not be ‘Estate wine’.
	Customizations?	Customers ‘making’ their own.
	Timeliness of delivery/sales?	Own delivery service.
	Accessibility?	Various shops, supermarkets.
Knowledge	Using internal staff as far as possible.	No outsourcing of activities.
	Value-add and non-value add tasks.	The use of specialised labour to do non-specialised tasks can be a waste.

Example: Because a winery is capable of producing premium red wine, it can look into China and Nigeria as possible markets for growth. From the example list in Step 1A the winery can either get into contact with Chinese and Nigerian importers to work with (if they have not entered the market yet) or try to grow these markets (if they are already present in the market).

Step 1C: Decide how to incorporate opportunities in planning

The reason for evaluating opportunities for wineries is to incorporate the effect it will have on the demand for wines. This needs to be considered when planning demand. This step is crucial in documenting and evaluating influences on demand. When deciding on the influence opportunities will have on demand, this needs to be reasoned. For example, managers cannot predict a 15% increase in market share when only 10% of the market is available. Every decision needs to be documented and reasoned to keep track of actual changes and influences. At the beginning of the documentation, this might be a hit and miss estimation, but as data grows and if it is recorded accurately, estimations should become more on target.

Objective: The objective of this step is to outline the possible effects that these opportunities can have on the demand for the wine and how it should be reasoned. Once this is established, forecasting can be done, and this factor incorporated into planning.

Inputs: Information gathered in Step 1A and 1B and reasoned here to attach a percentage to the opportunity. After a couple of years of tracking these, a percentage would be easier to arrive at. Thus, the long-term benefit of starting a thorough record-keeping system (of decisions made, the influences it had, changes made, etc.) would be to have more credibility and accuracy of decisions made. The winery will ultimately be making decisions with more confidence. But, in the first year of recording these decisions, a number would have to be reasoned.

Method: List all the possible opportunities that can have an influence on demand and specify which ones will be applicable to the winery as well as the magnitude of the influence. The magnitude of opportunities is estimated by the winery as a percentage increase or decrease that they expect based on market factors. When estimating a magnitude, the winery should be able to reason this percentage based on facts or data. An example is given in Table 5.5.

Another tool to estimate the influence that opportunities will have on demand is to use a heat map. The researcher suggests a heat map that plots the probability that the opportunity will occur and the size of the influence that it can have.

Table 5.5: Opportunities table example

Opportunity	Applicable	Magnitude	Reason
Trending cultivar	Yes	5%	Grapes available on the farm, intensive marketing, new markets.
Bulk export market growth	No	N/A	Does not export bulk.
Wine show awards	Yes	15%	Won plenty of awards in previous year(s), which will increase sales.
Rosé trend	Yes	10%	Rosé sales are still increasing and experts believe that Rosé will continue to gain market share. This trend should be monitored closely.
Overall health of the industry	Yes	3%	There is an increase in domestic sales; products targeting this market can possibly expect growth.

Outputs: A list of reasoned influences on demand. This list should be continually updated to keep influences up-to-date and applicable. The expected outcomes of opportunities should also be weighed against the actual outcomes to make more accurate future predictions. The framework assists in making wineries aware of how important record-keeping can be in an attempt to make more accurate future decisions.

Example: The possible growth in the Chinese and Nigerian markets for premium red wine, will be considered a feasible opportunity for this winery. The grapes and capacity are available to produce extra wine for these markets. The winery then estimates this at a 5% growth and keeps record of this decision for future reference. Without historical data, the growth is unsure and is a guess, but with record-keeping, these decisions can be made with more confidence in future. It is also better to rather underestimate the growth and manage sales by price increases, than the inverse which we can be harmful to the brand. This will be discussed in Step 2B.

5.3.2 SKU grouping and classification

The framework relies on the aggregation of SKUs into product families and the classification of those families. The aggregation of SKUs into product families assists in forecasting and planning demand on a strategic and tactical level, rather than planning the SKUs, which would be more operational. By forecasting and planning aggregated product families, a better idea of the volume of bulk wine that would be required every year to meet demand, can be generated (see section 4.3.1). Product families can then further be classified on the ABC methodology based on volume (see section 4.3.3) and according to the XYZ methodology based on demand volatility (see section 4.3.4). These methodologies assist in assigning appropriate forecasting techniques to demand behaviours.

The grouping of SKUs and classification of product families aims to assist in making better decisions regarding forecasting, planning and production strategy, amongst other business processes.

Step 1D: Group SKUs into product families

Demand forecasting and planning on an aggregated product family level will assist in doing long-term tactical planning more accurately, i.e. plan the bulk wine for the coming years based on previous years' sales. The operational month-to-month planning can then be done based on the SKUs.

Most of the time, wineries have a lot of SKUs because they bottle the same wine in different size bottles or they have the same wine under different labels. In effect, the bulk wine is still the same and therefore, the longer-term planning is just considered with the bulk wine that makes up those SKUs, through aggregation of the SKUs. The operational bottling and labelling planning for SKUs can be done closer to the due date of release.

Objectives: This is the first step in simplifying and then reducing the amount of forecasting and planning that needs to be done. By aggregating the SKUs into product families, forecasting should

also be more accurate (Chopra & Meindl, 2013). The objective of this step is thus to group all SKUs accurately into their product families.

Inputs: To classify SKUs accurately, the Bill of Materials (BOMs) of all products are needed. This is used to identify which bulk wine belongs to which SKU.

Methods: List all the product families, i.e. bulk wines produced by the winery in question. Then, assign the SKUs to the appropriate product family as per the BOM generated by the winery.

The sales data for the various SKUs belonging to one product family is also summed together in order for the total demand or sales of a specific product family to be established. Now it is easier for the winery to forecast wine for the next year, because the bulk wine volumes have been estimated, and SKUs can be planned monthly in the operational plan.

Outputs: Aggregated product families are the main output of this step. The sales data of the aggregated product families are also presented in a more simplified way because the number of product families is much less than the number of SKUs. The winery can thus identify the distinct volume differences between product families and make better decisions on how to approach these.

Example: A winery produces seven different SKUs from the same bulk wine, for example the same Cabernet Sauvignon is split between the SKUs. The SKUs are unique usually because of the different bottle sizes (750ml, 1.5l, 3l, etc.) and different labelling (export specifications, private buyer, etc.). In this step, the historical sales for these seven items are then grouped together into one product family, Cabernet Sauvignon. The demand for the aggregated product family can then be forecasted, which literature suggests, should be more accurate.

Step 1E: Classify product families based on volume

This framework considers the traditional Pareto-based or ABC classification system for product family classification based on volume. It is the simplest and easiest to use, which is also an objective of the framework. Thus, winery management should list all product families in descending order, based on volume. The product families are then divided into different categories – A, B and C. ‘A’ products are those with the highest volume and ‘C’ products are those with the lowest volume, whilst ‘B’ products take up the volume in between. This was derived from the Pareto principle which estimates that 80% of the value of products sold, will only represent 20% of the product families. The remaining 20% of the value of goods sold is then represented by 80% of the product families (Craft & Leake, 2002), making some of these product families redundant. The classification of product families based on this system is illustrated in Figure 5.5.

This is thus useful in identifying whether some of the SKUs need to be discontinued or suggest how planning and forecasting can be done more accurately.

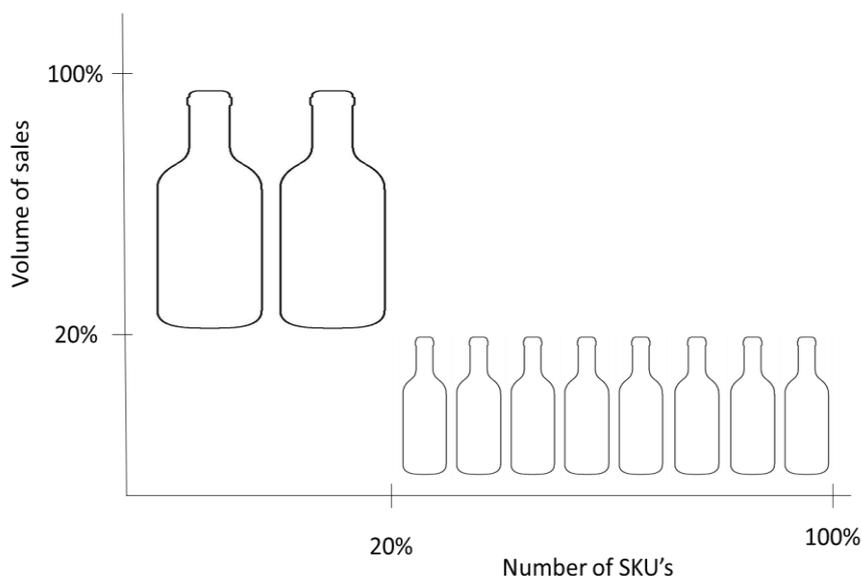


Figure 5.5: Pareto classification

The ABC classification was then later considered to be even more precise in giving this “vital few and trivial many” more definition, by assigning a 20:30:50 ratio (number of SKUs) in the form A:B:C classification (Craft & Leake, 2002).

Objectives: Categorise every product family to belong to an A, B or C product-group. Product groups should have the same characteristics. Also, getting rid of product families that have too little or no demand. Alternatively, planning the decisions regarding these products in a different way.

Inputs: The sales volume data will assist in categorising the products into volume classes.

Methods: The aim of the framework is to assist wineries to improve decision-making with regards to demand planning. It should be easy to use and practical. Therefore, the Pareto-based classification is used. This is based on quantitative data from sales history.

To categorise product families in order, the sales volumes of each SKU are necessary – this is summed together in Step 1D, to have the volumes of product families. The product families are then categorised according to volume: from the highest volume product, according to sales data, to the lowest volume. A percentage of the volume is then divided into A, B or C classes. ABC usually uses a ratio of 20:30:50 (number of SKUs) (Slack, et al., 2007; Stevenson, 2007) and wineries should attempt to get as close as possible to this ratio when classifying product families.

The ABC classification should be reviewed yearly, as this is a bulk wine forecast which is done yearly. The operational forecasts done monthly should pick up on changes in volume and reported, to be adjusted in the future tactical plan. The importance of record-keeping is yet again highlighted here.

Output: The output of this step is to have all products classified as A, B or C products. Where A is the highest volume products and C the lowest volume products. According to Pareto, the outcome is expected to have fewer A products and a lot of C products.

Example: According to the volume in historical sales (of the aggregated SKUs in product families) these product families are then ranked from the highest volume to the lowest volume. The first 20% of SKUs are then considered A items, the next 30% are B items and the last 50% are then classified as C items. Let's say the Cabernet Sauvignon mentioned above ranks as the fifth highest product family out of a total of 30 product families the winery has. This wine thus falls within the first 20% of product families and is classified as an A item.

Step 1F: Classification of product families by demand patterns

After the volume categorisation of product families, the demand pattern for each product group is selected. These products are classified as having a stable demand, fluctuating demand (sometimes due to seasonal factors) or sporadic demand.

Objective: The categorisation of product families based on their demand patterns into X, Y or Z classes, where X is stable demand, Y is fluctuating demand and Z is sporadic demand patterns.

Inputs: Historical demand data is used here to determine how stable or unstable the demand of products is.

Methods: By using the ABC classification categorisation along with analysing the demand fluctuation, managers can make informed decisions according to the classification system presented in Figure 5.6. A combination of various decision-making criteria will eventually ease the process of determining the best forecasting method.

Product families are classified as X items (stable demand), Y items (fluctuating demand), Z items (sporadic demand). Demand volatility is estimated by calculating the coefficient of variation (CV) of demand. The bigger the CV, the more fluctuating the demand.

Output: This is the last step in categorising the product families appropriately. The manager should now have a better understanding of the behaviour of each product family and can

therefore, group them easily together, to find a more uniform, generic forecasting technique per category. These classes are named accordingly, as per Figure 5.6.

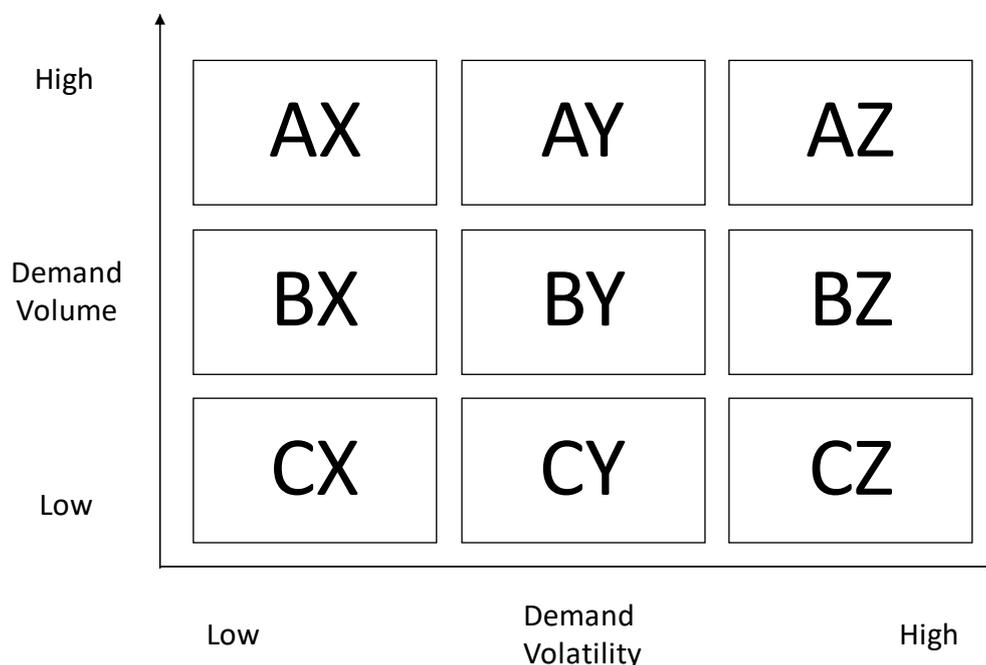


Figure 5.6: SKU classification (Adapted from Pekarčíková, et al., 2014)

AX products would theoretically be the easiest product to forecast and CZ items the most difficult (whilst not having such a big impact as AZ items). The researcher also suggests more time and accuracy spent in forecasting AX items, since it will have the largest impact on cost-reduction, capacity and facility resources, although in some instances smaller volume items (C items) might have higher margin and thus cause increase in revenue.

Example: Firstly, the CV of all product families is calculated as per section 4.3.4. Product families with a CV of smaller than 0.5 are classified as X items, Y items have a CV between 0.5 and 1 and for a CV of larger than 1, items are classified as Z. Our Cabernet Sauvignon example has a CV of 0.4 and is thus classified as an X product family. Combining the volume and demand volatility classes, we can then conclude by classifying the Cabernet Sauvignon in question as an AX product family.

5.4 Phase 2: Process

Phase 2 can be considered the process phase. This is where the inputs are converted to outputs or results by means of calculations. The calculations used here will mainly be forecasting equations to determine if demand for specific categories of wine can be established and if it will have financially positive results.

During the Inputs phase, up to nine different classifications of products were ultimately established based on volume and demand volatility. Although a winery might not have all the mentioned classification classes, the classes are made available here if they are needed. Various demand forecasting techniques are available for different situations and in some situations, forecasting may not even be possible. The aim of this section is to match forecasting techniques specifically to different wines, which will be tested during the case study.

As stated by Pycraft and Singh (2013), control or management also plays a fundamental role in executing demand strategies. Control is more concerned with adjusting the plan closer to execution date due to the reality in which the planning now plays out. Planning is thus done further into the future, whereas control is concerned with the present which is more operational in nature and thus outside the scope of the study.

The researcher considered demand forecasting techniques applicable to the different wines. Thereafter, planning and management of demand are evaluated and recommendations as to which the best technique is to be implemented for specific wines. The model suggests that these methods are not only applicable to one specific situation but can be used in most wineries, should the product's demand characteristics overlap.

5.4.1 Forecasting techniques

Forecasting techniques and their appropriateness to particular situations form an essential part of this study. Since this study aims to improve winery profitability by implementing demand planning, forecasting of demand needs to be done as accurately as possible. It is also known, as discussed in section 4.4.1, that forecasts can never be completely accurate and that no one technique works the same in every situation. Therefore, it is sensible to consider different techniques for every situation. To make the choice of technique easier, Table 5.6 assigns techniques to different products, depending on demand. This methodology is, however, not completely fail proof, and techniques should always be tested beforehand.

Table 5.6: Assignment of forecasting techniques to SKU classes

	A	B	C
X	Time-series techniques*	Time-series techniques*	Time-series techniques*
Y	Croston /SMA	Time-series techniques*	Time-series techniques*/ Causal forecasting
Z	Croston /SMA	Croston /SMA /Causal forecasting	Causal forecasting

**Time-series techniques include: Simple Exponential Smoothing (SES), Simple Moving Average (SMA), Holt's Model and Winter's Model.*

Step 2A: Determine appropriate forecasting techniques

Objective: The objective is to determine appropriate forecasting techniques that match specific demand patterns in wine. Each of the predetermined product family classes needs to have a best practice technique that matches that specific class best. It needs to be noticed that a one-size-fits-all approach is usually not accurate and needs to be tested beforehand.

Input: Previously determined demand variation and product categorisation based on historical demand are used in the forecasting. The literature on appropriate forecasting techniques is consulted to make informed decisions. Based on this classification that is described above, each one of the nine different classes needs to have a specific forecasting technique that works best for that situation. The guideline to a suited forecasting technique is given in Table 5.6, but these techniques need to be validated by each winery individually. The winery personnel would be required to perform the techniques as set out in this study.

Methods: In this step, the input of demand patterns is used to forecast demand in the future based on the historical data. The key is to identify the correct demand pattern and forecasting technique suited to that situation. It can be determined by applying a technique to the dataset and measuring its accuracy through forecast errors. The aim of giving these guidelines in the study is that it can be implemented by the winery's current personnel. It requires basic numerical and Excel skills.

As discussed in the literature, there are various models developed to forecast demand. When applying any of these demand forecasting models it is necessary to check if they actually forecast demand in the right direction. The appropriateness of the models is evaluated by means of forecast errors.

Every particular wine's demand, as categorised in section 5.3.2 (Step 1E & 1F), is forecasted with techniques proposed by literature. Thereafter it is tested for accuracy by means of sales forecasting performance measurements. The forecasting techniques proposed in Table 5.6 are a guideline for which techniques could be appropriate for the specific items. Due to a lack of literature on forecasting in this specific field, these techniques still need to be broadly implemented in the wine industry to test their applicability and accuracy. This, however, forms part of future research and will not be covered in this study.

Outputs: Matched demand forecasting techniques to different demand pattern scenarios. These techniques' performances are also measured by forecast errors.

Example: We have now classified the Cabernet Sauvignon as an AX product family. From Table 5.6 we should use time-series forecasting methods to forecast this product family. First, we draw

a graph with the historical years on the x-axis and the volume of sales per year on the y-axis. From this graph it would be easy to see if the product family has a trend or seasonality. From section 4.4.1, Holt's model should be used for data with a trend, Winter's model if the data has a trend and seasonality and simple exponential smoothing or a moving average if no trend or seasonality exists. Since seasonality is not applicable in the forecasting of yearly demand, we only test Holt's model, moving average and simple exponential smoothing. We implement these in Excel and as discussed in section 4.4.1 on the previous four years' sales data and using the most recent data as the forecasted demand to test the forecasting methods. The forecasting errors are then measured in Excel for the three forecasting methods, as per discussion in section 4.4.1. The forecasting model with the lowest MAPE is used as the technique to be implemented for future demand.

5.4.2 Demand management

Demand management ensures the timely execution of the demand plan, by incorporating all available data and estimations. Management of demand usually consists of the operationally focused inventory management and stock control processes, which falls outside of the scope of this study. The strategy of how demand should be managed forms a part of the demand plan and will be incorporated into the framework. This step considers some factors to be taken into account and how to incorporate them into planning.

Step 2B: Demand management strategy

Objective: To design a strategy for demand management, whereby better decisions can be made regarding the planning of demand.

Inputs: Demand forecasts as obtained in the previous section as well as other judgemental factors that need to be taken into account. These vary from season to season and should be re-evaluated continuously. The value opportunities considered in Step 1A, 1B and 1C should be considered as well as the patterns in demand. Data regarding changes in demand and possible causes for the change in demand from the previous years will be very valuable if it is available.

Methods: This step requires some research into market influencing factors. These go hand in hand with the opportunities identified in the market, but some factors may have a negative influence on the demand for products. Factors to consider include the political and economic climate, market share, overall health of the industry, trends and competitors' actions.

The table that is created in Step 1C (Table 5.5) is very useful in this regard. Managers should decide how they want to incorporate these factors and when.

As for operational decisions, inventory management and stock control are not a part of this study. The researcher only suggests some guidelines for managing demand. When demand deviates

from forecasted demand, some practices should be in place to minimise the damage. In the event of over- or underproduction of wines, a management strategy needs to be in place to counter this sudden change of events due to market factors. Pricing and promotions (Chopra & Meindl, 2013) can help in limiting or promoting wine sales – a strategy around this planning should be formulated. The amount of stock (in months) will be calculated in the demand plan. The actual sales versus forecasted sales will then be reviewed every month. According to this, the demand management strategy will be initialised if wine is selling too quickly or too slowly.

Effects of pricing:

In the event of underproduction, the volume of sales of wines can be countered by increasing the price of the wine (Chopra & Meindl, 2013), without permanently losing the customer. The balance in price increase should be found by limiting the number of bottles per person sold, but still, have sales. Especially in the wine industry, a wine can lose its listing at a retailer or restaurant when it is not available.

The wine industry should look into driving prices up and minimising production (volume reduction of 10-20%) as low wine prices are a major contributor to the struggling wine market and image of Brand South Africa. Therefore, it is advisable to rather reduce production a little, than to overproduce. Thus, control sales by pushing prices up, rather than the inverse which is harmful to the industry's image.

Effects of promotions:

In the event of overproduction of wine, promotions can be used in an attempt to sell the excess stock (Chopra & Meindl, 2013). Most white wines need to be out of the winery by the time the next vintage is ready, otherwise it will be difficult to sell, as most white wines produced in SA lose much of their fruitiness during aging. This fruitiness is the major component of white wines that consumers enjoy, hence buying them young is of the utmost importance to these customers.

Although promotions are not a desirable practice in selling wine, as this could affect the image of the wine, promotions are not all bad. It can be used to sell excessive wine, rather than lose those sales completely. The researcher recommends not cutting prices on wines, but to rather have a “get one free” promotion. The problem with cutting prices is having to increase those prices again for the next vintage. Promotions could also work better in different seasons, like putting white wine on promotion in summer and red wine in winter. It is also a useful practice in introducing non-wine-drinkers to wine when they can get wine at a better price.

Outputs: A demand management strategy by which better decisions can be made regarding forecasting of demand. This will be incorporated into the demand plan, to have the planning as close to reality as possible and by incorporating all influencing factors.

Example: The demand plan that is created for the Cabernet Sauvignon in Step 3A needs to have a demand management strategy for when wine sales are not going as planned. The winery can decide to increase the prices of the Cabernet Sauvignon, to try to decrease the demand and avoid stock-outs before the end of the product life cycle. They can also set out wine for certain shops and restaurants on allocation to avoid losing listings. When wine is not selling as planned, the winery can decide to keep some wine in tank or barrel for as long as possible before it is bottled. This gives them the option of selling the wine in bulk and avoids the risk of having too much finished inventory on hand. With the premium nature of the Cabernet Sauvignon, the winery does not wish to lower the price of wine to increase sales as these prices would be difficult to increase the following year.

5.5 Phase 3: Outputs

The output phase aims to summarise all the outcomes reached in the process phase and converting those outcomes into a plan of action. The output of the demand plan and appropriate strategy and execution guidelines form a part of Phase 3.

5.5.1 Demand planning

Demand planning considers how the demand that has been forecasted will be executed. The management of planning ensures the timely execution of the demand plan. This section is concerned with how the demand plan is put together for the winery to plan appropriate supply. In the next section, the strategy and execution of this demand plan are covered.

Step 3A: Demand plan

The development of the demand plan is based on all previous steps in the framework. It brings together the value opportunities, forecasted demand and demand management strategy to formulate a demand plan by which a winery can plan their supply.

Objectives: The objective of this step is to formulate a successful demand plan by incorporating all aspects covered in this study.

Inputs: Value opportunities and decisions on how to incorporate them, forecasting of demand and the demand management strategy are used to formulate the demand plan. If the steps in this framework are followed from 1A to 2B, all the necessary inputs are available to create the 18-month tactical demand plan per vintage.

Methods: As demand planning forms a part of tactical planning, it would consist of a plan for as far as 18 months into the future. This demand plan, however, consists of smaller planning phases within the longer 18-month tactical plan. Seeing as wine can only be made once a year, the planning cycle for the next vintage (specific year of bottled wine), needs to be done at least six months prior to the start of vintage when the size of the crop can be estimated and manipulated through vineyard management. Due to numerous climate and market factors, this plan can change quite rapidly and should be revised and updated monthly. When the grapes are harvested, and the wine has been made, the bottling or packaging schedule should be planned monthly and revised bi-weekly to ensure customer service levels are where they should be and not too much stock is kept on hand. Thus, bi-weekly updates are a part of inventory management and outside the scope of the study but are mentioned here for completeness. This is illustrated in Figure 5.7.

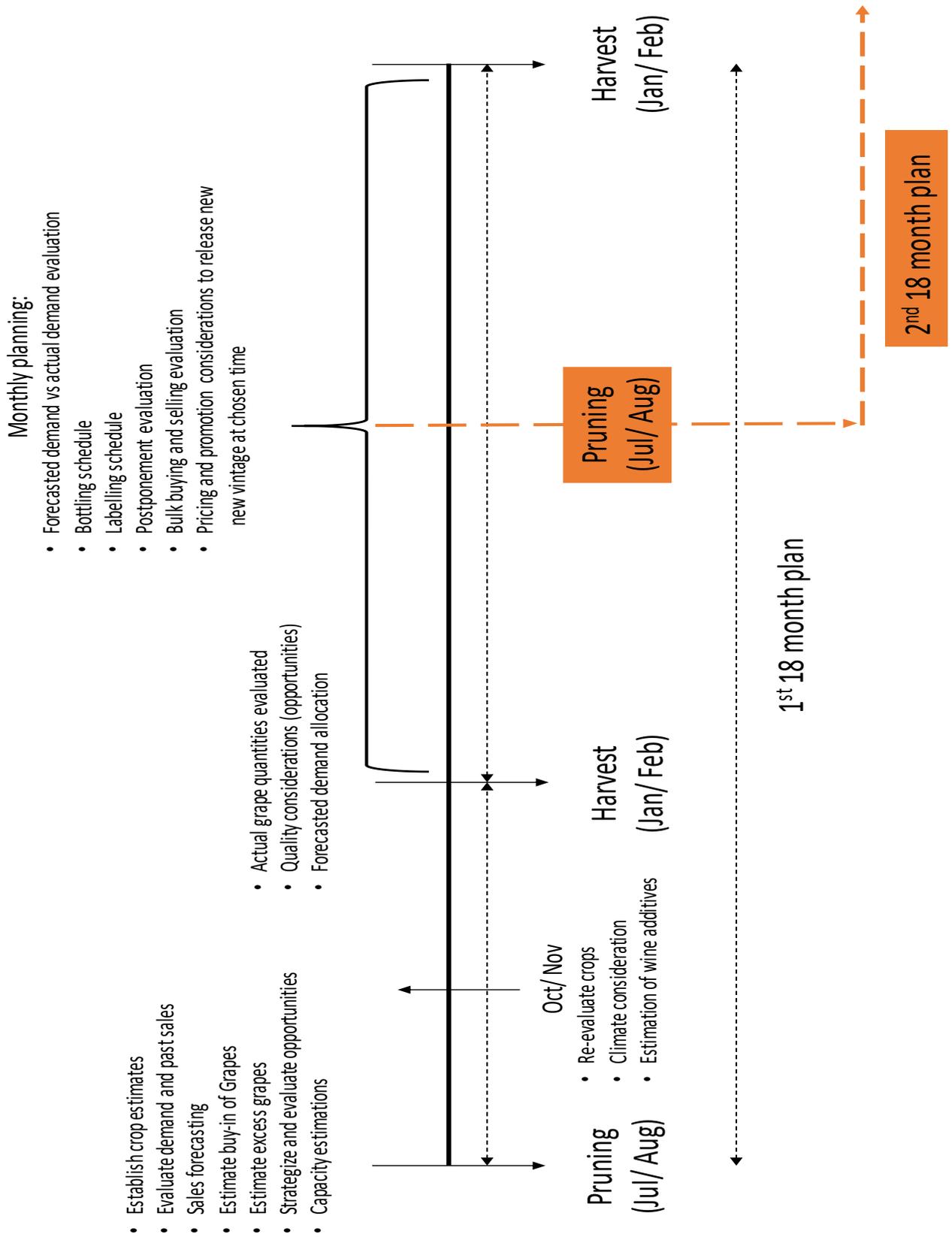


Figure 5.7: 18-month demand plan for a specific vintage

Figure 5.7 depicts the 18-month plan as a whole with recommendations about which planning should be done when. It also shows that every year the demand plan will overlap. The first 18-month plan is still running while the second one starts. In this way, planning is kept updated.

This demand planning system is continuous and can thus be used for all wines (white, red, sparkling, sweet). Although red and sparkling wines will usually spend more time in the winery due to ageing, a certain time frame for when they will be ready for release is decided beforehand by the winery. The winery should thus manage demand in such a way that all previous vintage wines will be sold by the time of release and that wines are not out of stock before then. Since the demand plan incorporates monthly revising and planning, the winery will keep track of how to manage demand, how much to produce in coming years and how to time bottling.

To establish this plan, demand should be forecasted as in Step 2A for every product family class separately. The value opportunities established in Step 1C should then be incorporated into the affected SKUs to alter the forecasting. The demand management strategy should be kept at hand to track and manipulate demand as the period progresses.

Outputs: A feasible demand plan over a period of 18 months, aggregated yearly and planned monthly. The management principles are also incorporated. The execution strategy of the plan will be discussed in the next section.

The benefits of the demand plan as the outcome of this study are:

- A detailed record of external and internal influences on demand, how decisions influenced demand and what other factors played a role in this. This is kept as historical records to be used in future planning. This is valuable to use in the future when planning production to have a more concrete estimation of percentage influence rather than a guess.
- The demand plan will assist in keeping up-to-date on which opportunities can be pursued in the industry.
- The 18-month plan encourages the winery to keep track of the performance of all product families and tracking which one's demand increases or decreases (change of class) – the evaluation of the product family classification is thus repeated yearly.
- Planning in advance also aids in preventing surprises in production or on the sales side and overcomes those more strategically and with ease if they occur.
- All these mechanisms would provide a winery with information to improve decision-making as to how much wine to produce and when.

Example: The Cabernet Sauvignon that has now been forecasted in Step 2A, needs to have a dedicated demand plan. The estimation of sales increases due to exploiting new markets

(China and Nigeria) is 5% (Step 1C); this is then added to the forecast. The management strategy will then be a function of estimating the total volume of production, establishing the date at which this wine will enter the market and a date by which the next vintage will enter the market. The difference in months is thus the product life-cycle. The winery calculates how much wine they have available (in terms of months) and has a meeting monthly to evaluate if wine is selling too fast or too slowly. The management strategy for the Cabernet Sauvignon is described in Step 2B. This then realises dependent on how the monthly forecasted versus actual demand is progressing.

Step 3B: Strategy and execution

An important part of implementing or improving a process is to have a formalised strategy by which it can be executed. It is recommended that a definite execution strategy is drawn up to ensure implementation of the demand plan. As discussed in the literature, companies tend to create excellent strategies, but often struggle to implement them. In this step, the framework recommends strategies for better planning execution.

Objectives: Development of an execution strategy for the demand planning and management of a winery.

Inputs: Using, so far as possible, inputs from the winery's employees and role-players, combined with expert knowledge in literature and the case studies of strategies that have worked in similar industries, wineries should focus on what has and has not worked in the past and try to improve on victories and eliminate failures. Winery management should try to gather as many ideas from employees and discern as to which will work best and create a formal document to execute the strategy effectively.

Methods: After the demand plan and management strategy have been formalised, a plan for successful execution is necessary. Every situation and workplace is different and therefore there is no set strategy execution methodology that works best everywhere. This step aims to give principles that can be implemented to assist the cellar to find an execution process that works and fits into their culture.

The literature reviewed (see section 4.6) indicates a number of successful execution strategies in various companies. The top execution strategies that are logical to try and implement in a winery are listed here:

- Accountability – every role-player knows what is expected of them and can be held accountable for their performance.

- Information availability – Strategic, tactical and operational planning should be easily available and visible to all employees. Definite goals should also be set and every employee must know their role in this.
- Up-to-date – News and trends in the wine industry should be known at all times and incorporated into planning to generate new opportunities or eliminate threats. It could be useful that one person is held accountable for staying up-to-date, though every employee should be encouraged to participate in building a collective wine industry knowledge base.
- Decision impact – Every employee ought to know what their actions will lead to. To have employees more engaged and committed, certain benefits can be discussed if possible.

Outputs: An execution strategy for the winery by which demand planning and management can be successfully and effectively implemented. An example of the skills needed per step, the frequency that steps need to be repeated and possible responsible persons are given in Table 5.7. Such a table should be constructed by the winery and every person responsible should be fully aware of their task.

Table 5.7: Responsibilities and skills needed per step

Step	Skills	Responsible person	Frequency
1A – 1C	Researching opportunities, trends, wine industry movements	Sales / Admin / Marketing/ Winemaking team	Monthly
1D – 1F	Knowledge of products and classification; simple calculations	General manager/ Winemaker	Once-off New product development Changing of product
2A – 2B	Forecasting and Management	Sales / General manager	Yearly
3A	Demand planning	Sales / General manager	Yearly
3B	Strategy Communication	General manager/ Winemaking team	Yearly Plan executed continuously

Example: It is a function of the sales and marketing team and the winemaking team to execute this demand plan effectively as per Table 5.7. The general manager oversees all the steps and ensures the plan is effectively executed. The general manager holds all the members accountable for their contribution to the plan and ensures all the information is up-to-date and available for all team members.

5.5.2 Feedback

As with any framework, decision-making tool or strategy implementation, feedback is essential. After every demand planning and implementation cycle, feedback of successes and failures should be analysed to improve the next planning cycle. This is very important to maintain the level of effectiveness and success in the winery.

One of the major outcomes of this framework will be to provide a structure to wineries (see Appendix D), from which they can track decisions easily. By recording decision-making and thought patterns, wineries will be able to repeat successes and eliminate failures with more success. From the researcher's experience and from informal conversations with industry players, demand plans in smaller wineries are currently lacking this ability, by not capturing decisions and thus have no feedback possibility. Feedback provides the opportunity to reflect on which decisions were effective and how decisions affected sales, which predictions were accurate and by how much.

Example: In the case of the Cabernet Sauvignon which was forecasted and planned at a 5% increase due to entering new markets where opportunities exist, the demand exceeded the supply and the winery needed to increase prices and keep stock on allocations for certain shops and restaurants. The winery still sold out of the wine two months before the end of the product's life cycle. The Chinese and Nigerian importers have already placed orders for the next vintage. The increase in production was thus underestimated and will be re-evaluated at the next planning opportunity.

5.6 Chapter conclusion

This chapter presented the guidelines by which demand planning can be implemented in small to medium-sized wineries. The purpose of the framework was established at first, after which the development of the framework was discussed. Clear objectives and features of the framework were highlighted before the scope of the framework was set. The framework was then developed in three phases. Every phase had steps with which the framework should be implemented. The framework is implemented in a case study in Chapter 6.

Chapter 6

Case study, results and validation

6.1 Chapter introduction

The main objective of this chapter is to implement the decision-making framework that was created in Chapter 5 and to validate the outcomes. This chapter discusses the implementation of the framework at a medium-sized winery in Stellenbosch, South Africa. The outcomes of the framework are tested against the proposed objectives the framework aimed to achieve. The framework was built on the literature in Chapters 3 and 4, experience and on the input from industry stakeholders and industry reports. This chapter commences by introducing the case company, stating the problem and current procedures. The framework is then implemented and validated. The framework is validated through semi-structured interviews with other industry players and wineries to ensure practicality, holism and adaptability of the framework.

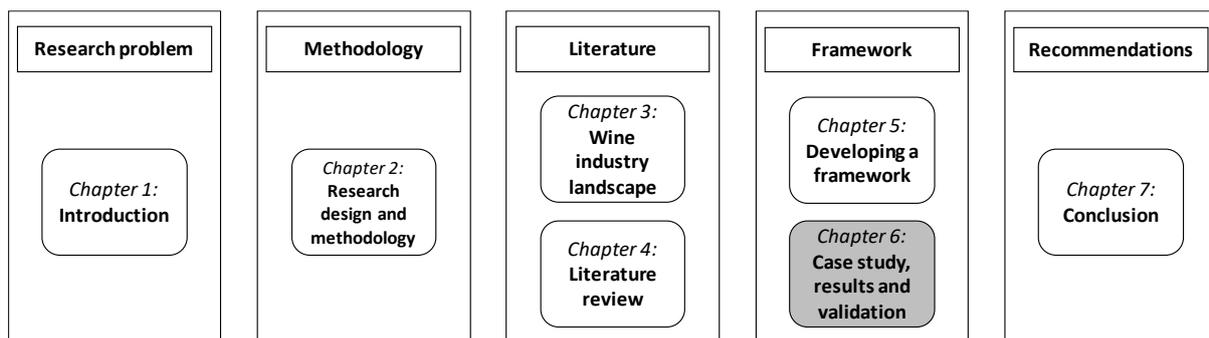


Figure 6.1: Thesis outline

6.2 Introduction

The decision-making framework developed in Chapter 5 to incorporate value opportunities into demand planning in small to medium-sized wineries, is implemented here. The planning of demand is an important practice that needs to be implemented accurately in wineries which can lead to increased profitability and optimised business performance. Since profitability is difficult to measure in such a short period, the leading indicators of profitability can be evaluated instead. Along with demand planning, the wineries should identify value opportunities to create value for customers to win more customers over or to keep current customers. The framework incorporates value opportunities into demand planning to maximise the impact of implementation.

6.3 Contextual background

Most South African wine producers currently find themselves under tremendous financial pressure (van Eeden, et al., 2012). They have to look at different practices or introduce new methodologies in the business and production fields to increase wine prices, cut costs and/or increase revenues. This framework aims to look at the wine supply chain, in particular the winery as the manufacturer, and how planning wine production can be improved by looking at historical sales and incorporating future prospects (value opportunities) into planning. Similarly, processes that need to be streamlined can be identified. Through applying Industrial Engineering practices, the researcher built a framework from which wineries ought to benefit by using the framework appropriately.

In recent years, VinPro along with many producers have realised the deep trouble the wine industry finds itself in and have put together a plan to improve industry performance. As most of the wine producers in South Africa are operating at a loss, numerous ways of increasing profitability should be considered. The researcher considered demand planning as an area worth implementing or improving to strive towards a more market-driven approach. This ought to have a positive effect on the profitability of wineries in the long run. The framework developed in the previous chapter is implemented here in a case study. The purpose of the case study is to test the framework, explain the framework further and validate the framework.

6.4 Business problem

Demand planning is principally about planning to make just enough of a product, in other words not over- or underproducing. This can thus be a valuable practice in the wine industry as the industry is very cash-flow sensitive, where over or under producing is usually customary practice

– leaving the producers either with too much wine which they struggle to sell or missing out on sales due to too small production.

This can be related to the fashion industry, where long lead times are an issue when items are selling out early. Or when end-of-season sales are necessary due to overproduction – these are usually not profitable but prevent big losses. In wine, these ‘end-of-season sales’ can be harmful to a particular brand status and limit necessary price increases the following season. Similar to fashion products the wine industry also has variations in product characteristics which, just due to vintage change, have unique taste and preference outcomes from year to year.

6.5 Case study preparation

Before implementing the decision-making framework, developed in Chapter 5, some considerations regarding the case study validation needs to be considered and noted. These factors are to be considered when implementing the decision-making framework, as they can impact the inputs and outputs of the framework. From this, further implementation guidelines and direction can be derived.

6.5.1 Case study validation

The framework is implemented at the case study winery in this chapter to evaluate whether it is implementable and what obvious benefits the framework proposes. The other objectives of the framework are then validated by means of structured interviews with other wine industry role-players. The reasoning behind the specific group of people participating in the validation is given in section 6.11. These role-players only provide judgement of whether the framework is needed, will be feasible, beneficial and easily implementable in wineries. A proper industry-wide implementation validation would have to be a part of future research projects.

6.5.2 Scope of study

As mentioned before, it is extremely important to define the barriers of the study and implementation. The scope of this study has been defined in Chapter 1 and the framework’s scope was redefined in Chapter 5.

In this case study, the researcher identified a small to medium-sized winery to validate the framework with. The winery in question was chosen based on the size of production, the variety of production (in terms of wines and styles) and different markets and customers that they serve. To maintain the anonymity of the winery they will be referred to from herewith forward as ‘The Winery’. Strategic and tactical planning and decision-making were the main aspects that the framework validated. Operational planning and decision-making were touched upon, to inform

and understand the strategic and tactical planning and decisions. Operational planning and decision-making should be considered for a future area of research.

6.5.3 Data requirements

Accurate and sufficient data from The Winery is crucial in the application of the framework. Qualitative data was obtained through interviews, questionnaires, email and telephone communication. This is used to contextualise The Winery as a whole, the aspects that are being investigated, validate assumptions that the researcher has, and answer questions not necessarily determined by the numbers. The quantitative data is obtained through sales reports and financial statements. This data was used to determine the facts and analyse the situation of The Winery. The data inputs required by the researcher are listed in Table 6.1. Although the framework could be implemented with some success without all the data requirements, by having all the data inputs the outputs would be more accurate.

Table 6.1: Data inputs required

Data inputs required	Available	Not available
Demand Data		X
Sales Data	X	
Decision-making and record-keeping history		X
Process data	X	
Cost breakdown	X	
Bill of Materials (BOMs)	X	
Strategic plan/Business plan		X
Financial Statements	X	

Throughout the data-gathering phase of the framework, it was clear that the desired data was difficult to obtain. There is an enormous gap between the desired data and available data. The following were major problems incurred whilst collecting data:

1. Inaccessible data: Data is difficult to extract from the database (EzyWine). This takes a long time. It is also not possible to export the data from this database to Microsoft Excel, which makes it difficult to use. If data can be observed in Excel, The Winery would be able to utilise the data easier and more efficiently. In Excel, easy calculations, comparisons and visualisations of data make the data more usable and readable. Because numerous wineries use this management software, it is an accurate generalisation that most wineries have this problem.

2. Incomplete/ inaccurate data: Not all the data is always recorded. Especially not data that was used to base decisions on, so there is no recorded thought pattern on how decisions were made. The Winery also did not record the true demand for products (including lost sales). So they have no clear indication of the number of wines they could have sold if it had been in stock.
3. Multiple codes for the same SKU: Some SKUs have been recorded with multiple codes, so the data for one item is the sum of multiple codes. This is confusing and can result in planning errors.
4. Difficult to understand: The data was not displayed correctly and after doing some calculations, the researcher realised that there was an error in the data. The problem could be solved easily, but this makes the data difficult to use and understand for other users that are not confronted by the data every day.

To overcome these issues during data collection the researcher used the data available in the best possible way to achieve the desired outcomes. Had all the data been available, most of the calculations and deductions would have been made much easier. The fact that all the desired data were not available, confirmed another of the researcher's suspicions. It serves as proof that The Winery does not use any of these tools, otherwise The Winery would have had the data available. The researcher also reworked the data to make it more usable and sensible. This has also not been previously done by The Winery, which means that they could not possibly have maximum output from the limited available data.

6.6 The current state of The Winery

This section forms a part of the qualitative results obtained through interviews, questionnaires and email correspondence. It assists in identifying which procedures are in place at The Winery and where there is definite room for improvement. By describing the current state of The Winery's planning and decision-making procedures, one can easily put The Winery in perspective.

Firstly, the product and information flow at The Winery are discussed, thereafter the planning and decision-making structure, procedure and practices are defined. This information was gathered during a semi-structured and structured interview with the general manager at The Winery.

6.6.1 Product and information flow

The product and information flow to, from and within The Winery are described here to understand the processes and timelines within which The Winery operates. The three principal areas of focus will be the suppliers, the company as the manufacturer, and the customers.

For The Winery, there are numerous parties involved in placing orders at the suppliers. For example, when ordering bottles, they have already decided how much wine will be made and the amounts that go into each specific bottle. The winemaker makes the decision about how much wine he wants to bottle by a set time. He then calculates how many bottles are needed and informs the general manager of how many bottles to order and the timeline in which the bottles should be delivered, i.e. how the delivery of bottles should be spread out. At the same time, the same quantity of corks, screwcaps and capsules are ordered. The wine is bottled two months before it is needed, so within those two months, there is enough time to order the labels. The Winery bottles the wine unlabelled. Labelling can be done without a technical person (like the winemaker) present and is therefore done at a different time in order not to take up skilled labour time. Wine bottles are kept for a minimum of two weeks (usually two months) at the winery before being sold, which also creates additional time for labelling. The packaging is standard and that is always kept in stock – The Winery makes use of minimum stock levels and ideal order quantities to get the best prices.

The Winery makes use of very reliable suppliers to ensure that delivery of raw materials takes place on time. If any delivery does not arrive on the promised date, the supplier will receive a phone call. In the past, The Winery has struggled with some suppliers being unreliable, but this is mainly due to not following up on orders.

The production forecasts and planning are a function of the winemaker, general manager, sales manager, managing partner and farm manager. The farm manager is essentially growing the grapes – he needs to inform about the quantity of grapes that he has, and the admin and winemaking team should inform about how much grapes are needed. Generally, the farm does not produce much more grapes than what are needed, but The Winery should look into the amount of grapes that they buy in from other producers. They have long-standing contracts with the producers from whom the company buys grapes but reckon that these contracts should be revised and some of them may be cancelled. They could also plan to sell the wine, made from those grapes, in bulk.

The general manager and sales manager look at stock levels and have a meeting about how much they should be selling and can sell. This forms a part of the monthly sales meeting. The two of them then inform the winemaker on how much to bottle for the next two to three months.

The Winery uses the following process to deliver an order, from placement to delivery. The most used channel is that the customer phones to place an order. All the order processing happens at the winery, for worldwide customers. For local orders, that is the greater Cape Town area, The Winery does the delivery. They have two vehicles that drive around, three to four times a week in Cape Town and the other two days in Stellenbosch. The customers also already know which days they will receive their deliveries if they order on a specific day. The order deadline is 3 pm is for next-day deliveries. If the customer is in Johannesburg, they have two warehouses in Johannesburg and will send the order to one of them, dependent on which one is closer to the client. The regional warehouses manage the distribution of the wines, but The Winery does the invoicing from the winery. The same goes for the Garden Route and Mpumalanga. They keep track of the stock levels weekly and monthly and are very tightly managed. They do receive some orders, but they then send them to The Winery first, to do the invoicing, and The Winery then sends it back to them to do the delivery.

The Winery receives export orders by email. All the paperwork is done in the office at The Winery. Usually, The Winery has enough stock to supply the customers within two days. The orders are usually delivered on time and in full. There are some exceptions, but those exceptions are usually because of an order that has not been packed correctly or got lost somewhere, but that happens very seldom. Customers usually inform The Winery soon if this is the case.

6.6.2 Planning and decision-making procedures and practices

The following section illustrates the existing strategic and tactical planning and decision-making practices at The Winery before the implementation of this framework. The maturity of these practices is also explained.

The Winery does not have a formal strategic business plan in place. The company has a multitude of ideas about how things should be done, but no structured plan. The general manager at The Winery does, however, feel that such a plan is crucial. Neither do they have a system according to which they make decisions, they only rely on experience to make decisions.

They have got a very clear, documented sales plan in place which stands for one year at a time, but no long-term plan. The sales and operations planning they have started implementing from 2016 to match supply and demand, at least steers in that direction. They used this to determine how much wine should be made in 2017 and how much of the wine made in 2016 should be bottled or sold in bulk. This is a very new practice and still in the developing phases.

The general manager of The Winery agrees that their new attempt towards planning has proved to be valuable thus far, even though it is still in the initiation phase. This statement is based on

the calculation that they already realised to make less wine of certain bottles which are selling too slowly. This is especially true for some of the white wines, which cannot be aged. Along with this, they realise that a strategy in terms of pricing and promotions can be adopted. The trick is to stay away from price decreases, as this is difficult to pick up again in the following years. But price increases should be made gradually so as not to alter the demand that much.

The Winery's sales plan is reviewed in meetings – weekly for the sales plan and monthly meetings about the actual sales versus forecasted sales. The Winery has only recently had their first official quarterly sales review. Based on these meetings and reviews, they plan to adjust the production plan accordingly. Their main goal is to have a production plan which they can adjust in such a way to release the new vintage at the desired time. This is a function of the amount of finished stock, stock in the bottle, stock in the tank and the sales figures. According to this, they can plan how much more or less wine is needed. They have realised that over the past years they have produced too much of some of the wines, especially the white wines. This is the total production of the wines in question, which has been bottled and labelled without reviewing the demand.

These plans are now based on actual data and not just a guess. The Winery had a big misjudgement a few years ago when they assumed that if the whole years' stock is sold out in four months, they needed to make three times as much in the next year. But in making such assumptions, not taking economical, seasonal, customer and pricing factors into account, they are still sitting with some of that leftover stock and struggling to sell it. The major problem with this is, that once the wine is in the bottle, so much more cash is tied up in that, than if it were in the tank. This is how they realised that they need a more solid plan to estimate sales and production.

They hardly ever have the problem of overproducing red wines. In fact, there is more often a shortage of red wines. Red wine is also not so tricky to sell in future, because of its ageing potential. Still, it is recommended they be careful in tying up too much cash in bottles that are not needed.

When doing demand forecasts, The Winery considers only historic demand and the amount that they want to grow markets by. This is not a calculated number but based on a target they want to achieve. So, it is a function of past demand and the desired growth and throwing all efforts at achieving those targets.

There are no forecasts made in the vineyard during pruning at The Winery. However, they have recently started to manage the vineyards in such a way to adapt to the plan of how much wine and thus grapes are needed. In addition to this, The Winery realised the importance of revising the contracts they have with growers from whom they buy grapes.

The Winery had met their target for the year's sales in terms of rand value and they were even slightly over the target, but in units, they did not meet the target. Especially for the white wines, 20–30% of each of three different white wines were produced in excess. This is thus a major concern which led to questions about their planning processes.

With regards to packaging materials, these are continuous consumption items which are available in stock as is needed. Most of the bottles are imported and are thus ordered by the containerful. Sometimes some bottles are left over after a bottling run but will be used within the following three weeks. This does require more accurate planning in advance compared with using the local bottle manufacturer, but the local bottles are on average R2,00 more expensive per bottle. So, for the over 500 000 bottles they use per year, that is a R1 million saving (this saving excludes the storage costs and the cost of financing the cash tied up).

The quality of the imported bottles is also superior according to the general manager. Another positive aspect is that it is a standard bottle throughout, which makes the packaging simpler. Generally, they attempt to drive costs of packaging down by ordering in higher quantities. They do not do a cost-benefit analysis of this ordering system. For example, compare the cost of saving versus, the money that could have been made by investing the money or using that money on other immediate expenses. The general manager does agree that such an exercise can be beneficial in the future, but they have not gone through the trouble of setting up such a calculation.

Although planning has been lacking at The Winery, they are now in the process of implementing some planning strategies toward a more market-driven approach. The Winery has also been very successful at being responsive to customer demand and aiming to deliver on time and in full. This gives them a competitive advantage in keeping and winning customers. They also value producing quality wines of high acclaim which is received well by their customers and the customers do not mind paying extra for the quality and status of the wines. The design of their product is also aimed at the customers that they are attracting. The Winery also aims to be as accessible as possible to most customers – to have a variety of wines spread to numerous locations, especially those markets that demand the most. They aim to be available in restaurants, supermarkets and boutique wine shops to attract various types of consumer. These strategies seem to be working well for them in selling their wines and keeping customers loyal.

6.7 Implementation of framework

After the introduction of the current situation at The Winery in the previous section, this section covers the implementation of the demand planning framework there. This is a step-by-step

implementation of the framework developed in Chapter 5, whereafter the results of effectiveness, ease of use and possible benefits will be established.

Step 1A: Identify wine industry generic value opportunities

The framework commences with the identification of value opportunities in the wine industry in general. This could be beneficial to consider for The Winery as some opportunities that exist in the broader industry are not exploited by them but could be valuable if recognised. These opportunities were researched through wine industry body websites, industry conferences and conversations with industry players as discussed in Chapter 3.

Generic value opportunities identified in the wine industry include the following (this is not an exhaustive list, but a list of the most common value opportunities):

1. Local growing middle class: A new group of clients – knowing how to target this market is crucial.
2. Packaging: Bottles and labels can have a big influence in ‘persuading’ a customer to buy a wine. How a wine is packaged can thus have an influence on sales. Aesthetics are a major deciding factor with the modern customer.
3. Small batch production: Specialised and unique wines are trending, along with custom-made wines. Consumers (buying in the premium range) like to be unique and buy distinctive and exclusive products. Therefore, smaller production of custom-made wines sell.
4. Organic/more health conscious: Consumers (buying in the premium range) are more concerned about their personal health and the health of the environment. Therefore, they prefer to buy wines made organically, using sustainable practices.
5. Fewer additives: This trend correlates with the one above where consumers are concerned about preservatives in food and even in wine.
6. Rosé movement: The biggest increase in sales across the globe belongs to Rosé, it has been trending for a couple of years. It could possibly be because of the usually lower price and fun, no fuss style of wine.
7. Interesting varietals: This opportunity ties in with ‘Small batch production’ in that it addresses the opportunity of uniqueness and exclusivity. The modern consumer is interested in buying a wine that has a story, is different and exclusive.

Step 1B: Identify winery-specific value opportunities

At this step, The Winery has the opportunity to evaluate which of the major industry opportunities would be easy for them to exploit, i.e. not having a big capital or effort expenditure. Such opportunity evaluations should at least be done yearly to stay up-to-date with trends and

movements. Creating the value that current customers want, will keep them loyal and possibly win new customers over.

Specific value opportunities that The Winery can consider (given the opportunities presented in Step 1A, the range of products the winery sells and their production philosophy) for exploitation are discussed below:

1. Growing middle class: The Winery has several easy-drinking white and red wines in their portfolio. These wines are also available at a reasonable price for the quality and can, therefore, be sold to new wine drinkers.
2. Small batch production/exclusive wines: The Winery produces some super-premium wines from their best batches.
3. Less additive/more health conscious: The Winery can market their wines as being healthier since they are produced without much intervention. They use the minimum amount of chemicals in the vineyards and in the cellar.
4. Rosé movement: The Winery produces a Rosé which automatically enables them to exploit this opportunity. Their biggest challenge will be to monitor the demand of this to keep the demand and supply balanced.
5. Interesting varietals: The Winery produces top quality wines of some interesting varietals (Grenache noir, Grenache blanc, Riesling) that are not seen much in South Africa.

Other value opportunities that need to be maintained by The Winery to keep current customers and possibly increase sales need to be evaluated as well. These form part of the already existing value proposition of The Winery, but they still need to be revised twice yearly, to ensure the standard is kept up. These opportunities are mentioned in section 6.5 and include the following:

1. Responsiveness: Being able to deliver wines on short notice and being available whenever and wherever wine is demanded.
2. Design: The bottle, label and packaging should be of high quality and endorse the type and quality of wine in the bottle.
3. Status and Quality: Wine awards should be promoted when they are won. The quality of wine produced should be kept at the same level and increased.
4. Accessibility: Having the wine available in a variety of stores countrywide. The wines should also be easy to access online and worldwide.

Now that the main opportunities are evaluated, management can decide on how to incorporate them into planning and how much influence they will have on sales.

Step 1C: Decide how to incorporate opportunities in planning

This step evaluates the effect that value opportunities will have on the demand for wines. This is estimated as a percentage. It would be advisable for The Winery to focus on the opportunities that would have the greatest influence and a high probability of success. The researcher, together with the general manager at The Winery plotted the opportunities on a graph according to the probability of success and the influence. The opportunities from Step 1A are also incorporated in the heat map as they might be valuable at some stage if The Winery keeps tracking them. This can be seen in Figure 6.2.

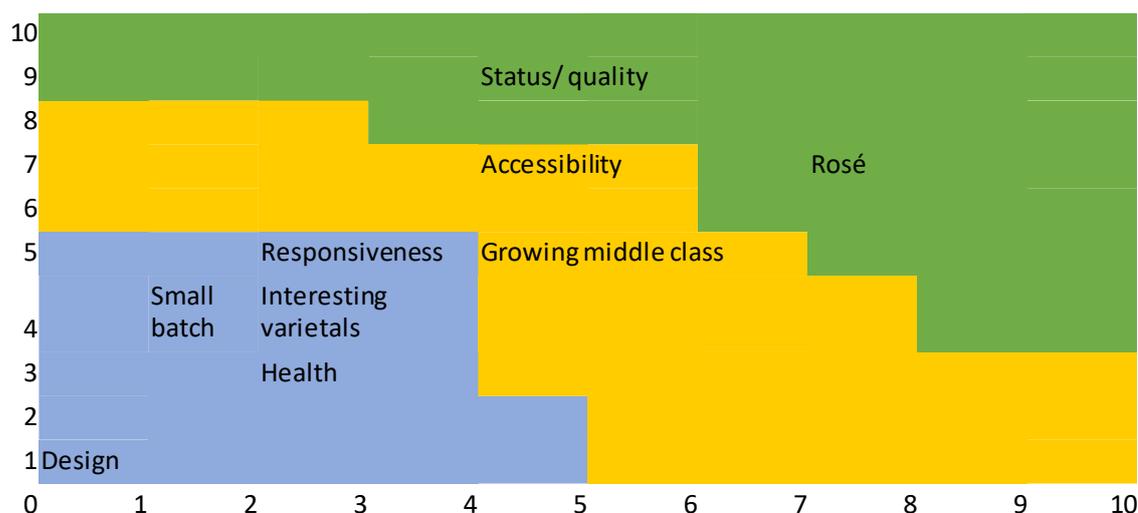


Figure 6.2: Value opportunities – size of influence and probability of success

This graph is, however, qualitative and cannot be measured, but a reasoned approach was followed to arrive at the result. The winery had a brainstorming session where everybody in the team's inputs were used as well as market trends to establish this number. As far as possible reports were considered, but as this exercise has never been done by The Winery, the first couple of years might be inaccurate. After building the database, it will become more accurate because historical data and their previous ability to predict in the past can be used to better predict the future. Opportunities in blue were assigned a 0–5% influence; opportunities in yellow were assigned a 5–10% influence and those in green were assigned a 10–15% influence. Table 6.2 summarises the effects of value opportunities.

Table 6.2: Value opportunities influence

Opportunity	Magnitude*	Reason
Growing middle class	5%	Strategy to sell more wine to the middle class; as people earn more, they might consider increasing expenditure on more expensive products like wine. This growth is focused on lower and medium-priced wines. A marketing strategy should also be considered to win new customers.
Small Batch	2%	A small market, but collectors and fine wine drinkers, prefer to buy exclusive wines of which only a few are made. This can be a marketing strategy of small batches of a fine wine that are produced. The Winery can promote their flagship and small production special wines in this way.
Organic/ Health / fewer additives	3% +	Difficult market to estimate, but since health and environmental consciousness has grown as a trend, some consumers are more likely to buy a product that has been ethically made and uses fewer preservatives. The Winery can use their minimum intervention winemaking as a strategy to tap this market.
Rosé Growth	10%	Rosé sales are growing throughout the world and domestically, it is a trend that could increase sales by 10% or more when marketed and priced correctly. These sales also tend to soar in Summer months.
Interesting varietals	3%	Not a big market, but consumers are interested in buying interesting products they cannot find elsewhere, especially if they are of good quality. As The Winery has some interesting varietals on the farm, some of these can be bottled separately to increase the sales.
Responsiveness	2%	The Winery already focuses on being responsive but improving in the areas where they are lacking whilst maintaining their current responsiveness, could increase sales.
Design of the product (mostly label and bottle)	0%	This is an opportunity that needs to be maintained and updated as the market modernises. If, however, they decide to change the design, careful considerations about market demand implications should be taken into account. Customers might not recognise the new design or not like it, so demand can go down or a new design might attract new consumers and demand increases.
Status / Quality	10% +	When a wine wins awards for the first time or is rated highly by wine critics, sales increase. Thus, marketing these awards and entering more competitions can increase demand.
Accessibility	5%	If a product is available in more locations, the probability of selling the wine is more likely. If the wine is always available and stock-outs are kept to a minimum demand is also likely to increase.

**The magnitude is a guessed percentage influence the specific opportunity will have on sales. This percentage will become clearer once The Winery tracks these numbers yearly. To start the process the magnitude can only be guessed since no data exists.*

The influences established in Table 6.2 will be incorporated in the demand plan by adjusting sales forecasting numbers by these influences.

Step 1D: Group SKUs into product families

This is an extremely important step in creating a bulk wine forecast, which is tactical planning. If wineries have any sales or demand data, it will be for the SKUs that they sell. So, to be able to forecast the bulk wine that they need to make for the next year, these SKUs need to be grouped into their product families.

The Bill of Materials (BOM) of every SKU will indicate which bulk wine is used for that specific product. These bulk wines are the product families and multiple SKUs are produced from the same product families. The product families with their corresponding SKUs are shown in Table 6.3. Contributing to the anonymity of The Winery, no names of wines can be mentioned. The codes for the wines given in Table 6.3 are according to 'R', for red wine; 'W', for white wine; 'P', for Rosé wine; 'S', for sweet wine; 'B', for sparkling wine. The numbers are given to separate the SKUs.

Table 6.3: Product family classification

Product Family	SKUs (R: Red; W: White; P: Rosé; S: Sweet; B: Sparkling)
Cabernet Sauvignon	R4, R5, R6, R7, R8, R9, R10, R11, R27, R40
Shiraz	R21, R22, R23, R24, R25, R26, R39
Flagship Red blend	R17, R18, R19, R20
Red blend	R1, R13, R14, R16, R29, R30, R31, R32, R33, R35, R36, R37, R38
Grenache Noir	R15
Pinot Noir	R34
SP* Red blend 1	R2, R3
SP* Red blend 2	R28
SP* Red blend 3	R12
Sauvignon blanc 1	W9, W12, W20
Sauvignon blanc 2	W7, W8, W13, W17
Sauvignon blanc 3	W1, W11, W16, W18, W22
Chenin blanc	W10, W15
Chardonnay	W3, W4, W5, W19
Riesling	W21
SP* White blend 1	W2, W23
SP* White blend 2	W6, W14, W25
SP* White blend 3	W24
Rosé	P1, P2
Sweet wine	S1
Sparkling wine	B1

*SP = Super Premium

The winery now has only 21 different product families (the bulk wine) to be concerned about, rather than the 69 SKUs that make up those product families. By assigning the SKUs to product families, the demand forecasting and planning is simpler and more accurate.

The operational, month-to-month plan of forecasting the SKUs is outside the scope of this study. After aggregating the sales data, product families can be classified based on volume in the next step.

Step 1E: Classify product families based on volume

To classify the product families of The Winery based on volume, historical sales data was retrieved. As mentioned previously, the database they use does not export the data to Microsoft Excel and the researcher had to manually enter the data into an Excel sheet – referred to as the Sales Master. The Sales Master was then used to easily identify and use the data required.

The product families are classified based on demand volume – this study uses the sales volume because it is required to know how much of a product to produce in the next year. According to the ABC approach, product families are then divided into the 20:30:50 ratio based on the number of product families. The ABC classes were defined by the following formulation.

Formulation for ABC classes (volume is always measured in 750 ml equivalents):

- Rank average (average sales across five years was used) sales per year from highest to lowest sales volume (aggregated units in product families).
- First 20 % of product families belong to the A-class.
- Second 30% of product families belong to the B-class.
- The last 50% of the product families belong to the C-class.

This formulation results in the Lorenz curve illustrated in Figure 6.3.

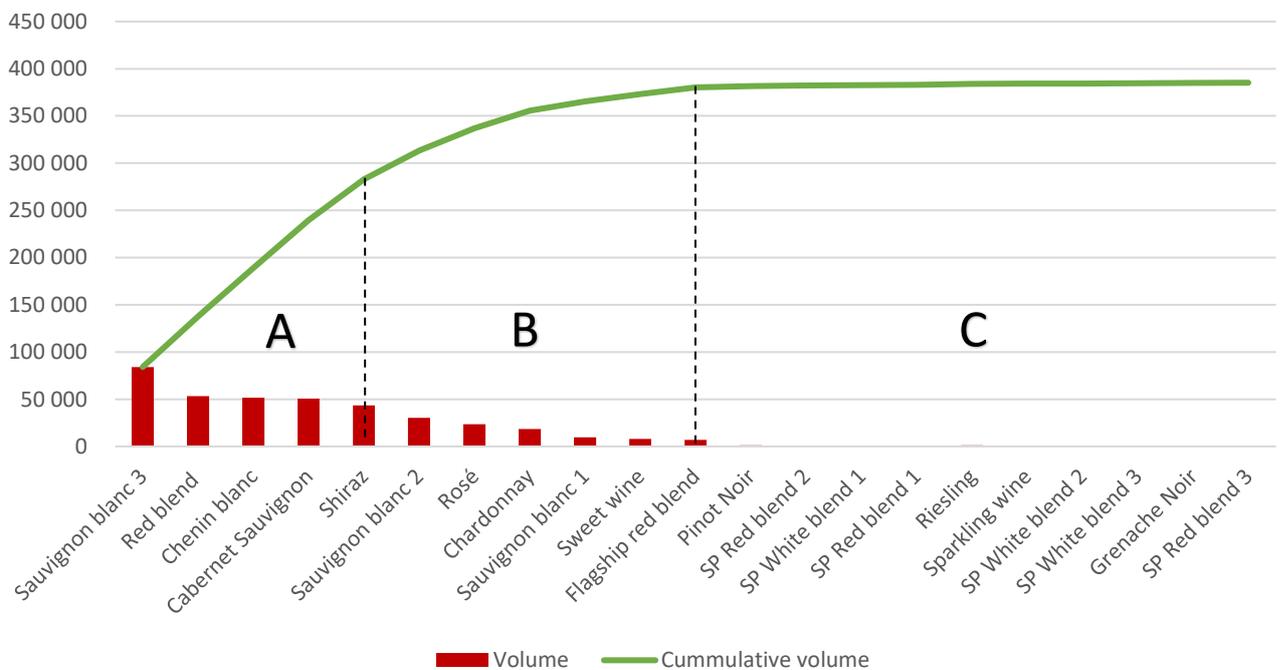


Figure 6.3: ABC product family distribution (Lorenz curve)

Figure 6.3 illustrates Pareto's principle in terms of the volume that A, B and C products represent. Another aspect that is clear from Figure 6.3 is that the most product families belong to the C-class, but that in terms of volume, the C-class is the smallest – as Pareto suggests.

Step 1E: Classify product families based on demand volatility

By classifying the product families based on their demand volatility in combination with demand volume classification, a more accurate forecasting method can be assigned to each category. The demand patterns or volatility can be derived from the Sales Master. Sales data from 2011–2015

were used to estimate demand volatility. The total of sales for every product family in every year was used to estimate demand volatility from year to year. A similar method can be used to estimate these numbers for month-to-month and this would be useful for inventory management. Inventory management is outside the scope of this study and considered a possible future research area. The following equation is used to determine the standard deviation (σ) from year to year of product families.

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \bar{x})^2}$$

The standard deviation is then used to determine the coefficient of variation (CV). The mean (\bar{x}) used is the mean of total sales of product families across five years.

$$CV = \sigma / \bar{x}$$

To estimate if the demand volatility is X (stable demand), Y (more volatile, can be due to seasonal factors) or Z (sporadic), the researcher used the following criteria, which are a good indicator of the stability of consumption according to field experts (Scholz-Reiter, et al., 2012).

- X classification: CV smaller than 0.5
- Y classification: CV between 0.5 and 1
- Z classification: CV larger than 1

In Table 6.4 the product family's classifications, volumes and CVs are summarised to give an indication of the volumes and variability that The Winery are dealing with. Volumes are given in units of 750 ml equivalents.

Table 6.4: Classification, volume and CV of product families

Product Family	Classification	Volume	CV
Sauvignon blanc 3	AX	84 205	0.217
Red Blend	AX	53 142	0.141
Chenin blanc	AX	51 479	0.252
Cabernet sauvignon	AX	50 720	0.036
Shiraz	AX	43 409	0.063
Sauvignon blanc 2	BX	30 322	0.258
Rosé	BX	23 624	0.309
Chardonnay	BX	18 574	0.179
Sauvignon blanc 1	BY	9 819	0.677
Sweet wine	BX	7 961	0.105
Flagship Red blend	BX	6 980	0.162
Pinot noir	CY	1 225	0.507
Riesling*	CZ	1041	2.000
SP Red blend 2	CY	749	0.682
SP White blend 1	CY	587	0.859
SP White blend 3*	CZ	416	2.000
Grenache noir*	CZ	378	2.000
SP Red blend 1	CX	223	0.381
Sparkling wine	CY	196	0.831
SP White blend 2	CY	96	0.572
SP Red blend 3	CZ	71	1.513

**New products*

The data in Table 6.4 is used to create the ABC/ XYZ classes shown in Table 6.5. Where X is stable demand, Y is more fluctuating, and Z is fluctuating a lot and A is high-volume, B is medium-volume and C is low-volume items. In this classification, the product families are relatively spread across the categories, except for no product families being in AY, AZ and BZ.

Table 6.5: ABC/XYZ classification

	A	B	C
X	Cabernet Sauvignon, Shiraz, Red blend, Chenin blanc, Sauvignon blanc 3	Sauvignon blanc 2, Chardonnay, Rosé, Flagship red blend, Sweet wine	SP Red blend 1,
Y		Sauvignon blanc 1	Pinot noir, SP Red blend 2, SP White blend 1, SP White blend 2, Sparkling wine
Z			Grenache noir, SP Red blend 3, Riesling, SP White blend 3

It is positive to see the majority of product families being X (stable demand) items and no products in the AZ and BZ categories. The AZ and BZ categories would be difficult to forecast, with large implications if the forecasts are inaccurate. The only Z items are CZ, which could adopt a make-to-order (MTO) strategy since the volumes are so low.

The distribution of product families across categories is illustrated in Figure 6.4. The pie chart gives an immediate indication of how the product families are spread across the categories.

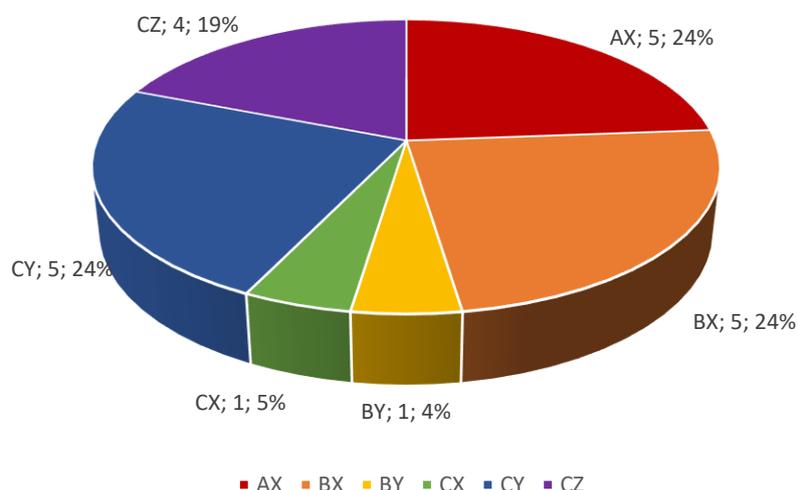


Figure 6.4: Number of product families per category (count; % of count)

In Figure 6.4 it is clear that the C items have the highest count with more than 50% of the product families. A and B items have almost equal counts, which is less than half of the product families but accounts for most of the volume of demand.

Step 2A: Determine appropriate forecasting techniques

Now that all the 'Inputs' are gathered, the forecasting of every category can be done. As seen in Table 6.5, in this case, The Winery only has six classes to forecast instead of the nine available classes. It is particularly positive to see that there are no high volume (A) products that have fluctuating (Y) or sporadic (Z) demand volatility. Which means that the bulk of the wine that is produced should be relatively easy to forecast, but the downside is that there are a lot of smaller volume product families that would be difficult to forecast accurately. Although there are many product families that have a sporadic demand pattern, they do not take up a large portion of the production and thus would not influence profitability that much (see Figure 6.5). Having said that, smaller volumes of production could be wines with higher profit margins due to a higher quality. A strategy for every class should thus be meticulously developed.

The researcher recommends that wineries critically assess the Z items, to understand why they are in this category. Reasons should be noted and compared yearly. Demand forecasting can be very complex to implement and understand, especially for sporadic demand. As mentioned before, it would be advisable for wineries to use a specialised management strategy for Z items. A make-to-order or postponement strategy could be considered. Alternatively, these items could be in the Z category, because it is at the beginning or end of its product life cycle and should be forecasted accordingly. These strategies will be discussed in Step 3B.

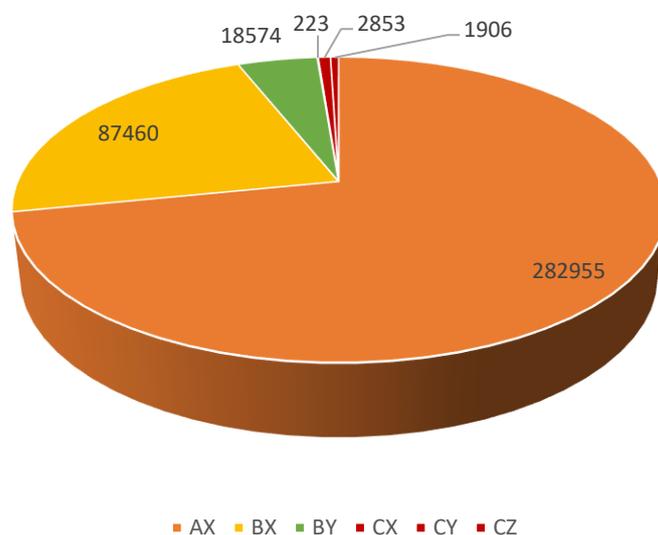


Figure 6.5: Volume of classes

Table 6.6 is used to evaluate the forecasting techniques that literature would suggest versus what would be implementable.

Table 6.6: Assignment of forecasting techniques to product family classes

	A	B	C
X	Time-series techniques*	Time-series techniques*	Time-series techniques*
Y	Croston /SMA	Time-series techniques*	Time-series techniques*/ Causal forecasting
Z	Croston /SMA	Croston /SMA /Causal forecasting	Causal forecasting

*Time-series techniques include Simple Exponential Smoothing (SES), Simple Moving Average (SMA) and Holt's Model.

After analysing The Winery's data and classifying product families accordingly, forecasting was done on the different classes to establish which is the most appropriate. At first, the graphs were constructed, to quickly establish any trend and the stability of items. Based on the outcome, forecasting was done, and forecasting errors calculated to evaluate which methods are most accurate. Mean Absolute Percentage Error (MAPE) was the deciding forecast error as described in section 4.4.1. Mean Squared Error (MSE) and Mean Absolute Deviation (MAD) were included as a secondary check for forecast errors.

The forecasting was done on the sales data of The Winery for the years 2010–2014. Forecasting was done using the three different chosen methodologies: a two-point simple moving average (SMA), Simple Exponential Smoothing (SES) and Holt's Model. These methods were implemented on one product per product family. By calculating the resulting forecasting errors an indication can be obtained of which method is best to use per product family. The specific forecasting method is then tested on a random product family to judge the accurateness of the methodology.

Table 6.7 to Table 6.13 summarise the forecasting errors obtained from implementing the various forecasting methods. From these tables, it is easier to see which forecasting methods would work best on the different classes. These outcomes are not a one-size-fits-all solution but should be implemented by every winery for their specific situation. These are basic methods and should be easily implementable by employees with numeracy and basic Microsoft Excel skills. These are the results of forecasts for The Winery.

Table 6.7 and Table 6.8 are given on two different AX items – Cabernet Sauvignon and Sauvignon blanc to illustrate the differences in how they need to plan for these items. Since both AX items have stable demand that has an increasing trend, Holt's model displays the best accuracy. Although the Cabernet Sauvignon displays very good accuracy, it also stays constant and is not increasing. That is because they produce the maximum every year. They are sold out of this wine

before the end of its life cycle. The winery could consider planting more Cabernet Sauvignon, buying in high-quality grapes or increasing the price of the wine to manipulate demand.

As for the Sauvignon blanc, they had an overproduction issue with this wine and should adopt the forecasting appropriately. There was wine left over after the product's life cycle, which caused them to sell the wine at discounted prices. The leftover wine did not influence the product's variability but rather gave an indication that the winery had produced too much of that specific wine. Although they could still sell the wine, the profit would have been much higher had they produced just enough and sold it at a higher price.

Table 6.7 Forecasting errors for one AX item (Cabernet Sauvignon)

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	5376532	2262	4,5
SES	2627884	3233791	3,2
Holt's Model	2556722	1595	3,2

Table 6.8 Forecasting errors for one AX item (Sauvignon blanc)

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	802564394	26177	15,9
SES	322614291	332352240	23,6
Holt's Model	68351997	7322	9,2

Table 6.9 indicates that Holt's model is an appropriate forecasting method for this BX item since the MAPE is by far the lowest of all the forecasting errors. It is not surprising since this item shows an increasing trend as displayed in Figure 6.6.

Table 6.9: Forecasting errors for one BX item (Rosé)

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	74676098	7739	29.0
SES	28996136	17518637	20.7
Holt's Model	8197158	2840	14.7

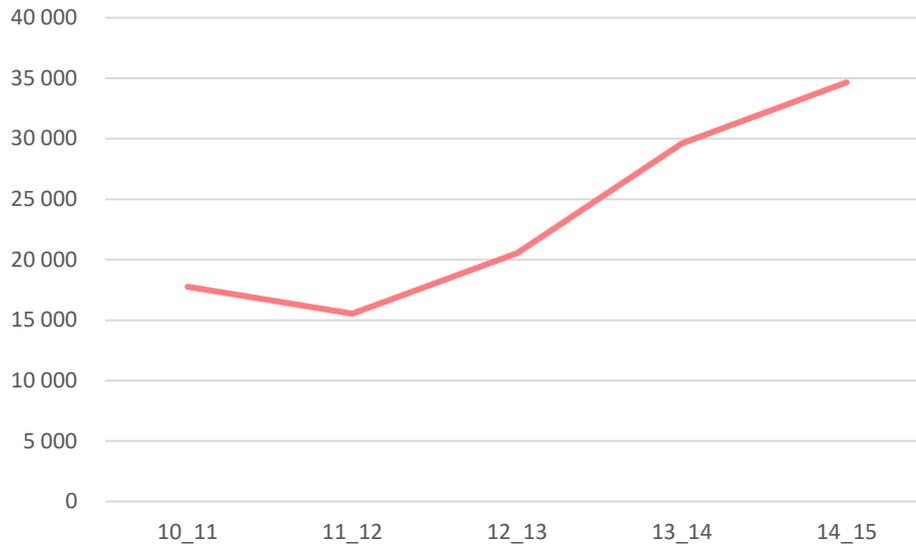


Figure 6.6: BX item sales patterns

Table 6.10 also indicates that Holt's model is best for the CX item with a MAPE of 15.5%. Although this is not as low as desired, Holt's model has been the best forecasting method for all the stable demand items (X items) of The Winery. This is a small volume wine, which would most likely benefit from a 'limited production' or 'make-to order' strategy.

Table 6.10: Forecasting errors for one CX item (SP Red blend 1)

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	9473	95	77.4
SES	3785	2621	34.4
Holt's Model	1385	31	15.5

In Table 6.11, the two-point Simple Moving Average (SMA) is the best forecasting method for a BY item, although not one of the three methods gave impressive results. This category might find a combination of SMA and causal forecasting beneficial. Human knowledge could have a positive influence on forecasting this more accurately. This can be explored in Step 2B.

Table 6.11: Forecasting errors for one BY item (Sauvignon blanc 1)

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	5528687	2336	25,1
SES	33263962	53967762	43,6
Holt's Model	15558613	3301	34,6

Table 6.12 suggests that Holt's model is the best for this particular CY item. This item does display a trend but is also somewhat volatile in demand pattern. Causal forecasting in combination with Holt's model might be a better solution. A make-to-order strategy might be a good consideration for this product. It is already a small batch production and multiple small bottling runs might not justify a postponement strategy.

Table 6.12: Forecasting errors for one CY item (Pinot Noir)

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	367602	564	41,8
SES	144258	126811	48,1
Holt's Model	63649	223	31,7

It is clear from Table 6.13 that no forecasting method is appropriate for the CZ item. This is also illustrated in Figure 6.7. A decision-making strategy should be in place to plan the CZ items because forecasting would result in too large errors. This, however, should not be too concerning for The Winery since it is a C-item, which means a low volume production which would not have a significant financial impact compared to an A-item in terms of production costs.

Table 6.13: Forecasting errors for one CZ item (SP Red blend 3)

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	44187	205	2685,9
SES	13102	8762	823,5
Holt's Model	12712	94	1014,0

Figure 6.7 also illustrates that there is only one forecastable CZ item, as all the other items are new items. This is also indicated in Table 6.4. Therefore, a separate strategy should be developed for new items and their demand tracked carefully.

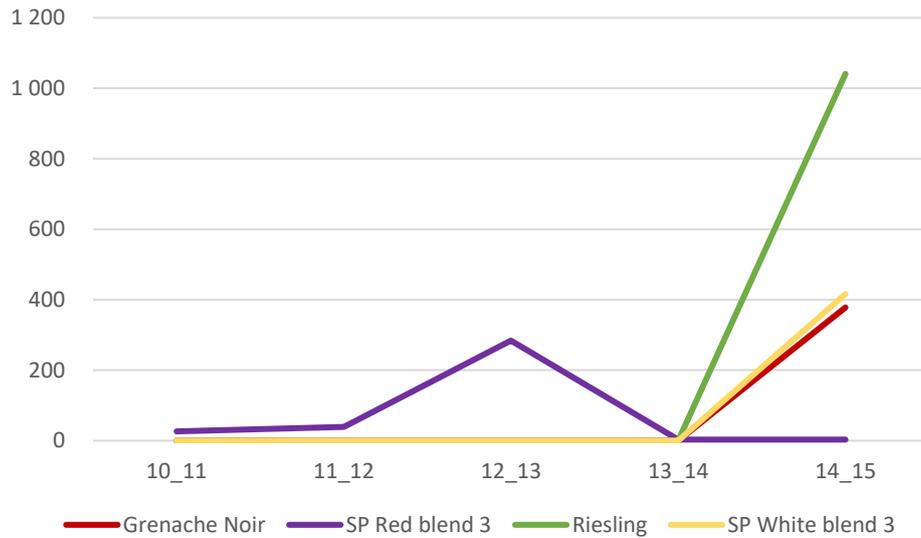


Figure 6.7: Sales patterns for CZ items

After an attempt to implement the framework as in Chapter 5, the researcher came to the following conclusions:

1. No one forecasting method is ideal. There are guidelines for forecasting methods given in the framework, but methods should be tested by The Winery before implementation. Someone with basic numerical and Excel skill would be able to do this.
2. Graphs for demand or sales data can be easily constructed in Microsoft Excel to give a clear indication of trend and stability. It is also valuable to see where the product is in its product life cycle. Forecasting methods should be based on this. An example of such a graph is depicted in Figure 6.8. This graph was drawn from data of an AX item, which has a stable and growing demand. Figure 6.9 illustrates a BY item on the decline in sales.
3. It is advisable to forecast sporadic demand based on human judgement. It might be more valuable to judge every product individually, rather than trying to forecast the demand with time-series techniques. These will only be difficult to implement and will not generate accurate results (see Table 6.13). Rather than forecasting, a specific strategy (like make-to-order, postponement or limited production) should be implemented. This will be discussed in Step 2B.

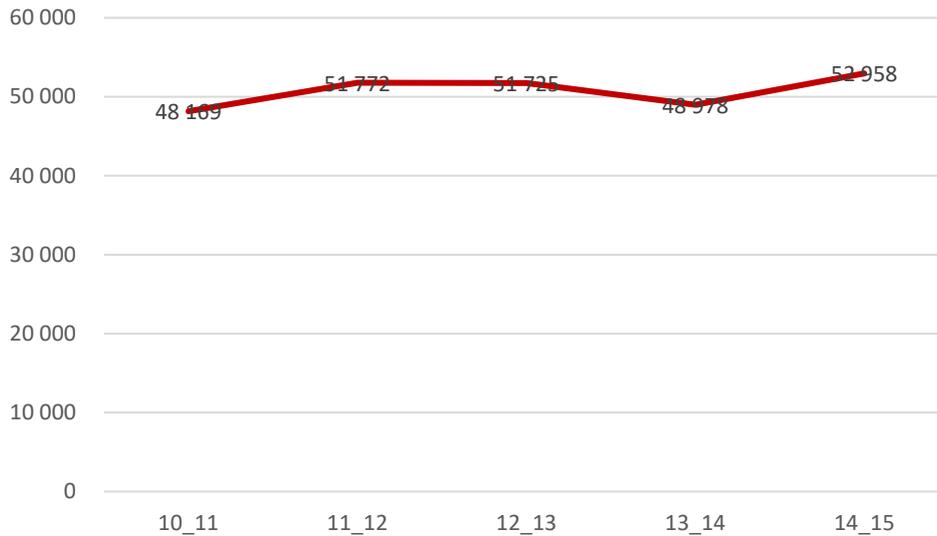


Figure 6.8: AX item sales per year

The item illustrated in Figure 6.9 is declining in demand every year. The winery should take note of these falling sales figures and plan to discontinue this product. The red dashed line represents a trend line of how sales are decreasing.

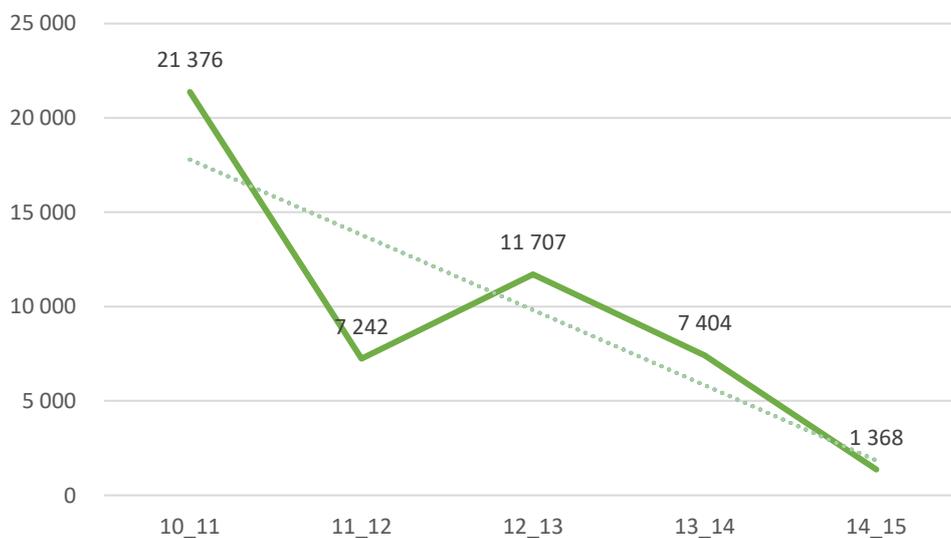


Figure 6.9: BY item sales per year

Now that all the best forecasting methods are established for the specific items, The Winery can consider with which strategies they want to implement the different forecasting methods and how they would promote and counter changes in demand.

Step 2B: Demand management strategy

The demand management strategy needs to be explicitly formulated and recorded. This is where The Winery management decides how they will forecast the demand, which value opportunities they will consider and what other factors will play a role in the demand for the following year.

Strategies to improve forecast accuracy and planning:

It was evident in 'Step 2A' that some product families cannot be forecasted (like the CZ items) and some product families could do with a combination of forecasting and strategy (like the CY and BY items). The researcher recommends the following strategies at this winery:

Make to order

Products like those belonging to the CZ category, do not have a large volume of demand and the demand is very volatile. Wines in this category should consider implementing a make-to-order strategy since volumes are low and they are usually super premium wines. These wines will not be as impactful to profitability but are rather produced as collector's items. They are not the main income source but are supplementary to The Winery's offering. Therefore, the winery might consider making these wines when customers pre-order them.

Postponement strategy

The postponement strategy will be worth considering on Y items – in this case BY and CY items. This can be used in combination with forecasting. When demand is forecasted yearly (the bulk wine forecasting, as described in this study), The Winery can postpone the bottling of these wines to ensure there is demand for the wines bottled. Since Y items have a fluctuating demand which is not completely unforecastable, an estimate of demand can be forecasted and managed monthly by monitoring demand (this forms a part of operational planning which is outside the scope of the study). This eliminates the risk of having an oversupply of bottled inventory, which is expensive, for which there might not be a demand. Inventory management is a definite area of future research identified in the wine industry.

Limited production

This strategy can be implemented on most C items, especially those that are difficult to forecast (CY and CZ) and any new products. By producing small batches of products to test the consumer demand, no big losses would be apparent, since the expenditure is not too much. The Winery should decide on a volume that would not be as impactful financially if the anticipated demand does not exist. Along with the financial implication, the volume also depends on the capacity available, i.e. do they have empty barrels or maybe a small 1 000 litre tank that can be used. It also does not make sense to make a wine in such a small format, if the appropriate vessels to make

a quality wine are unavailable. This strategy could also increase demand because only a limited number of bottles are made, which makes this an exclusive product. Consumers sometimes buy these products as soon as possible to avoid missing out. Demand for these products should be monitored and recorded accurately, to know when production should be increased or discontinued.

Table 6.14 summarises the influences that value opportunities will have on all the various product families. The decision of how to link the opportunity and product family lies with The Winery. They decide on which opportunities will be exploited with which product families. The product category is deducted from Table 6.4 and the influence from Table 6.2. The planner can easily discern where to increase demand according to what the opportunities in the industry and in future are according to what has happened in the past. The researcher suggests that, until a record of trend influences is established, The Winery should use the highest influencing factor if multiple influences are impacting the same wine.

Table 6.14: Influence of value opportunities on product families

Opportunity	Product category	Product family	Influence
Growing middle class	AX	Chenin blanc	5%
		Sauvignon blanc 3	
		Red blend	
	BX	Rosé	
Small Batch	CX	SP Red blend 1	2%
		Pinot Noir	
	SP Red blend 2		
	SP White blend 1		
	SP White blend 2		
	CZ	SP White blend 3	
Rosé	BX	Rosé	10%
Interesting varietals	CZ	Grenache noir	3%
		Riesling	
Status	AX	Cabernet Sauvignon	10%
	CX	Flagship Red blend	

There are two main ways that companies use to manipulate demand – whether it is to minimise an overproduction or underproduction. The winery can use promotions when they have a surplus of wine or increase prices when there is an underproduction.

The researcher suggests that aiming for an underproduction is a better strategy than producing too much. In this way, prices never have to be reduced and customers are interested to buy more

wine, should a wine sell out before the end of its product life cycle. But, when prices are reduced, it can be very difficult to increase prices the following year. This is also negative towards the image and status of the producer.

Step 3A: The demand plan

During this step, the information from Phase 1 and 2 are combined to create the demand plan. This is an 18-month plan that needs to be revised monthly. An illustration of a demand plan was given in Figure 5.7. The execution strategy of the plan will be discussed in Step 3B.

The demand forecasting done in Step 2A serves as the basis for the demand plan. The value opportunities are then incorporated in the forecasting to create a demand plan. The forecasting can thus be done according to classes, but the specific wines that are influenced by the opportunities must be singled out after forecasting to incorporate the value opportunity influences on specific wines. As mentioned before, in the first couple of years the influence of opportunities can be inaccurate, but as this data grows over some years, more accurate influences can be assigned.

During the forecasting, it was evident that forecasting methods can be used with success when forecasting product families, especially for the X items. The X items take up most of the volume and thus value in terms of production. This means that demand planning should be focused on more attentively, executed effectively and enjoy priority if a winery wants to increase revenues.

The demand plan for one BX item is done here, to illustrate how it can be implemented at The Winery.

Rosé is a BX item for The Winery. In Step 2A, Table 6.9 displayed the smallest forecasting error for Holt's Model to forecast a BX item. We thus use Holt's Model to forecast the demand for the 2014/2015 year.

Holt's Model forecasts the demand for Rosé in 2014/2015 to be 31 012 units. A summary of this forecasting and application can be seen in Table 6.15.

According to Table 6.14, Rosé should show a 10% increase in sales since the Rosé sales worldwide are increasing. This trend became apparent in 2012 and is still growing. Rosé is likely to also benefit from the growing middle-class opportunity, which could result in a 5% increase. Even though Rosé could be influenced by all these value opportunities, the researcher suggests only forecasting the highest factor, which in this case, would be the Rosé trend, with a 10% increase. As the planning and record-keeping of The Winery becomes more sophisticated in the next couple of years, they should attempt at refining this percentage. Since there is not a lot of data available,

The Winery does not want to overestimate the market demand and have too much inventory on hand, especially for a Rosé wine which is made to consume fresh.

Table 6.15: Rosé demand planning for 2014/2015

Rosé Forecast (Holt's Model)	Demand planning forecast (+10%)	Actual Sales	Accuracy
31 012	34 113	34 660	98%

The demand plan thus estimates a bulk wine forecast of 34 113 units for the 2014/2015 year. The researcher can test the accuracy of this forecast by comparing it to the actual sales of the 2014/2015 year. In 2014/2015 the winery sold 34 660 units of Rosé. The demand plan forecast is thus 98% accurate. This may be a rare case, but it still proves that demand planning can be near accurate, or better than a guess (see Appendix B for other BX product families).

The demand plan for The Winery is represented as in Figure 6.10.

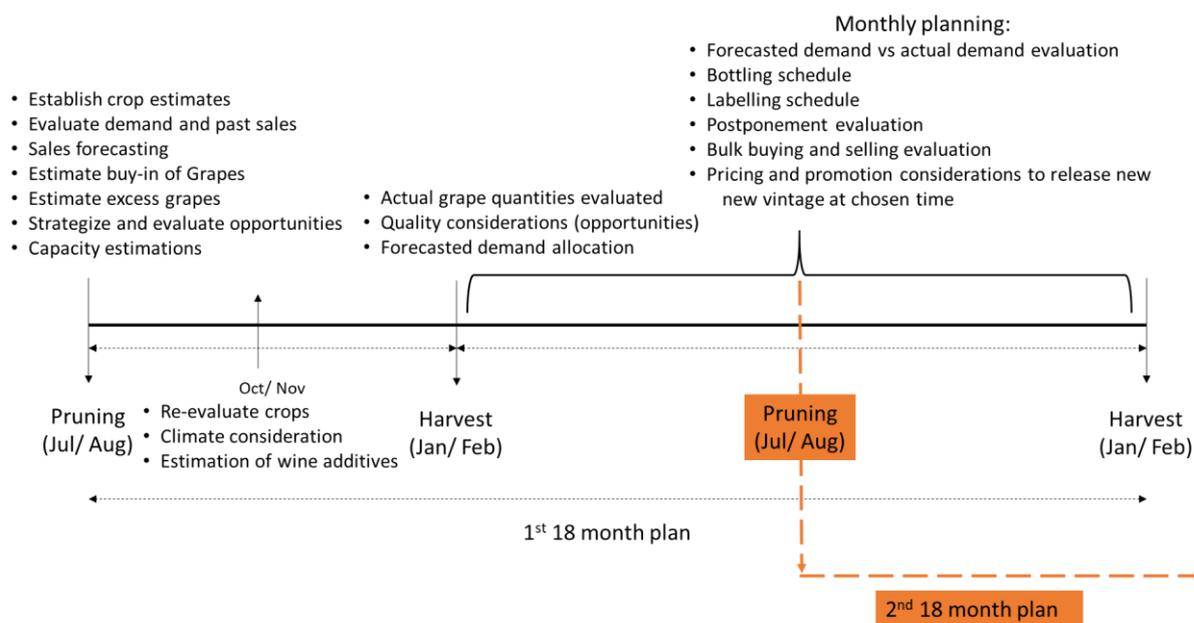


Figure 6.10: 18-month demand plan

During July/August of the first planning cycle, The Winery starts the planning for the next year's harvest which will be in January/February. Here they also form a strategy to manage demand and do monthly planning. The following action steps need to be taken (Person responsible is given in brackets):

- Brainstorm about opportunities in the industry and winery (General manager, Winemaker, Owners, Vineyard manager, Sales manager)
- Calculate crop estimates (Vineyard manager)
- Estimate volume of wine needed for the next 18 months after the next harvest (General manager, Sales manager)
- Make decisions about buy-in or selling of grapes (General manager, Winemaker, Owners, Vineyard manager)
- Ensure capacity is available for the desired production. All aggregated forecasts for the 21 product families can be added together to estimate the required capacity. Decisions about capacity requirements should be made well in advance (General manager, Winemaker)

In October/November of the first planning cycle, The Winery must re-evaluate the situation in the vineyard and the market to ensure that the original plan is still valid. If any deviations exist, the plan should be altered accordingly. During this time The Winery plans the following:

- Re-evaluate crops for more accurate estimation (Vineyard manager)
- Take climate situation into account – drought, rains, wind (Vineyard manager)
- Plan the amount of additives needed in the cellar (Winemaker)
- Establish performance measurements to evaluate the demand plan (General manager)

The grape harvest commences in January /February and the actual amount of wine can be determined accurately. The following planning decisions need to be made:

- The opportunities that arise from the quality of the grapes (Winemaker, General manager, Sales manager)
- Monthly planning can be done for the next 12 months (General manager, Sales manager)
- Demand management strategy to be established (General manager, Sales manager)

During the 12-month period between the current and following harvest, the demand plan established 6 months previously, must now be kept up-to-date monthly dependent on how demand varies. During the monthly planning the demand management strategy, inventory management and stock control policies are used to keep inventory costs low and demand fulfilled. This is where the demand management strategies come into play. The following monthly planning should be a function of the general manager, sales manager, winemaker and any appointed person assisting with stock control and order placements. Updated monthly planning should include:

- Monthly forecasted demand versus actual sales and possible reasons for variation;
- Evaluation of inventory;
- Bottling and labelling schedule update;
- Pricing and promotion considerations; and
- Evaluation of bulk wine sales when demand is low.

Along with these recommendations for planning demand, the researcher also suggests keeping record of all decisions made during planning to be incorporated into the feedback, thus improving on the decisions and processes. The immediate or long-term effects should also be noted when it happens. In this way, The Winery has more factual data about influences of decisions and actions and can therefore keep guessing to a minimum.

Step 3B: Strategy and execution

To have a successful implementation of the demand plan, the researcher suggests that The Winery start by incorporating at least two simple mechanisms to ensure the strategy is implemented more effectively.

1. **Accountability:** The parties involved in the planning of demand should know exactly what is expected of them and when deliverables are needed. This assists in having information on time and ensures better performance by employees.
2. **Information availability:** When The Winery's strategic, tactical and operational strategies are available to all employees and they understand the part they play in being more successful, their performance will increase, and better execution will be achieved (Lee, 2012).

If The Winery improves strategy execution by implementing these mechanisms, they should evaluate if there are any other factors that are hindering strategy execution and find ways to break those barriers.

Table 6.16 can also be used as a tool to implement the framework successfully and keep the tactical planning and decision-making up-to-date. This table should be updated quarterly to ensure accurate execution.

Table 6.16: Successful framework execution checklist

Step	Skills	Responsible person	Frequency
1A - 1C	Researching opportunities/ trends/wine industry movements	Sales/Winemaking team	Monthly
1D - 1F	Knowledge of products and classification/ simple calculations	General manager/ Winemaker	One-off/new product development/changing of product
2A - 2B	Forecasting and Management	Sales/General manager	Yearly
3A	Demand planning	Sales/General manager	Yearly
3B	Strategy/ Communication	General manager	Yearly/plan executed continuously

This table is not prescriptive but should be modelled to suit every winery individually. The Winery can decide who should be responsible for each of the phases of the planning process and when they want to review all decisions. This is thus a recommendation as to how to keep track of decisions and record-keeping in the process.

6.8 Feedback

The feedback step is extremely important in learning from past mistakes and repeating successes. This is where the record-keeping of decisions and actions play a big part in ensuring the winery learn from what they have decided and done, how it played out and finding possible reasons for the outcomes.

When the next planning cycle arrives, the winery can use the outcomes of their previous planning cycle to improve on forecasts, decisions and strategy. As this data builds up, trends will become apparent and the winery can make improved decisions with more accuracy and confidence. It will be beneficial for the winery to have a meeting with all the role-players in the process present and giving inputs regarding the outcomes of the plan, decisions and actions. By reiterating this process the planning becomes more useful and accurate.

6.9 Interpretation of results

By implementing the steps of the demand planning framework at The Winery, the researcher and winery management came to the following conclusions:

1. The framework serves to be very valuable in terms of decision-making and record-keeping. It provides a systematic way of structuring strategy, planning and decision-making and keeping track of all these processes to assist in making better decisions in future. It thus provides The Winery with data to base decisions on, rather than making decisions intuitively.
2. By actively researching opportunities and trends in the industry, The Winery continuously assesses their product offerings and can update, remove or alter these offerings as the market changes. In this way, they change to be more market-driven, as they assess what the market is interested in.
3. The Winery is kept aware of how demand grows or declines for different products and can accurately adjust the production according to the forecasts. As they continuously track and evaluate sales, they will have a better idea of where the market and product are heading.
4. Although forecasting and planning can never be 100% accurate, the framework reduces repetitive guessing over years and prevents repetition of the same mistakes. They can base decisions on a number, which gives management and owners more peace of mind about decisions. It can also be used as an argument as to why certain decisions are made and not merely grabbing answers from thin air.

6.10 Reflection on case study choice

This section aims to evaluate the appropriateness of the case study choice and the limitations the case study provided. The researcher then aims to give recommendations as to future case study choices to improve results.

A medium-sized winery (processing 500 tons of grapes) in the region of Stellenbosch, South Africa was chosen as the case study participant. The Winery's management was willing to share information and sensitive data through interviews, sales data and financial statements. This particular winery is currently in good financial standing, which makes them one of few wineries in South Africa to be profitable. Even though they are doing well financially, the researcher identified, with the assistance of the framework, where business practices are lacking.

The Winery was a good choice for the case study since it produces a variety of wines to serve a wide customer base. It was established early on that The Winery did not have much planning structure in place and that most decisions were made intuitively, so the framework especially proved to assist in those areas.

The limitations of the study are the amount and accuracy of the data available and the time limit to complete the study. Although the limitations are clear, the positive effects of the framework as is, were found and perceived to be valuable.

It would have made more sense to work with demand data of The Winery, had it been available. With demand data it would be easier to track when there is an over- or under production of wines. The effect of the implementation of the framework would be more apparent if it could be tracked in the long term. Therefore, studies to validate the framework in future would serve as valuable to the outcomes and benefits of the framework.

6.11 Validation of framework

The framework was validated after it was implemented, and the case study and results have been finalised. The validation serves as a credibility check for the framework and evaluates if the framework has achieved its objectives. Although an implementation validation at numerous wineries would be the ideal, this would be too time consuming and is outside the scope of study. An implementation validation with real-time data is suggested for future research.

Validation of the framework was done through semi-structured interviews with participants from the South African wine industry (see Table 6.17 for summary). Participants were chosen to take part in the validation process based on their involvement with small and medium sized wineries similar to 'The Winery'. The researcher gained insights regarding the framework from six participants. Four out of the six participants are in a management or ownership position at the respective wineries. These wineries are all of a small and medium size and produce premium to ultra-premium wines. A description of the participants follows:

- Validation 1 (V1): Nine years in total experience in the wine industry, specifically in sales, logistics and financial fields. Currently in a managerial role, overseeing two wineries.
- Validation 2 (V2): Eight years' experience in the wine industry, in a business management role at winery. Previous experience in accounting.
- Validation 3 (V3): Three years' experience in the wine industry in a managerial role, especially focussing on logistics and operations.
- Validation 4 (V4): 20 years' experience in the wine industry as winemaker and owner of two wineries. Currently more involved in the management and business side of the wineries.

Another two participants were selected to validate the need and feasibility of the framework. They were chosen based on their involvement with multiple wineries, the strategy of the South African wine industry and winery systems. These participants are described below:

- Validation 5 (V5): 11 years' experience in the wine industry in strategic and managerial roles. Currently in a managerial role dealing directly with wineries on behalf of a wine industry representative body.
- Validation 6 (V6): Six years' experience in the wine industry, with specific focus on wine management systems and software, in a development and managerial role. With previous experience as an IT consultant.

Table 6.17: Participant summary

Participant	Winery size	Years in wine industry	Education	Description
Validation 1	500 ton	8	BAcc, MBA	General manager at well-known winery in Stellenbosch, overseeing all business and financial operations.
Validation 2	300 ton	4.5	MEng (Industrial)	Farm manager, supply chain manager at historic Stellenbosch winery.
Validation 3	70 ton	9	BComm Marketing Management	General manager/sales manager at very successful small boutique winery in Stellenbosch.
Validation 4	200 ton	20	Marketing and Graphic design	Owner and winemaker of two successful wineries in Stellenbosch.
Validation 5	N/A	11	BScAgric (Economy)(Hons)	Wine industry representative for wineries.
Validation 6	N/A	6	BEng (E&E). BSc (Physics/Computer science)	Winery management software and systems developer and manager.

This is an evaluative validation to explore the immediate benefits or shortcomings of the framework and to validate the objectives of the framework, as seen through the eyes and experience of industry role-players.

As the validation serves as a tool to measure if the framework has reached its objectives, the objectives of the framework are revisited here as described in section 5.2.3. It should be:

- Feasible: The framework should achieve the desired outcomes, which in this case will be to improve decision-making, demand planning and record-keeping.
- Practical: The framework should be easy to use and understand.

- Holistic: The framework should consider as many aspects as possible of decision-making within demand planning of small to medium-sized wineries.
- Adaptable: The framework should be easily adaptable to multiple situations. The framework thus serves as a guideline.
- Structured: The steps in the framework should be logically arranged and easy to follow.

6.11.1 The planning maturity in wineries

None of the participants currently use a very structured approach to demand planning. Wineries mostly make decisions based on intuition, as a function of the grapes and capacity that are available (as with The Winery) V4 mentioned that wineries need to follow a more structured approach to planning and need to gather data to base decisions on. He has misjudged the market before and made a loss due to an overproduction on white wine. Although in terms of industry amounts of wine, this was a small amount, but for the business, they suffered a loss due to unnecessary production and packaging costs. Although, V4 is trying to track sales from year to year in different markets, no formalised planning and forecasting is done. This is the same for all the other wineries. V3 and V2 agreed that structured planning can be very beneficial in their wineries, but that they mostly rely on intuition and repeating the same process yearly.

As V6 is dealing with numerous wineries and especially focussed on management software, he is not aware of any wineries that implement such a demand planning framework. He does however see it as a necessary process for all wineries.

6.11.2 Feasibility of the framework

Most wineries agreed that the framework can be beneficial to their winery, even if it is just a starting point for improved record keeping and decision-making. V3 specifically mentioned that they do not use any planning structure, but that they have recently started keeping record of agreements made with clients in terms of volumes and prices promised and that this has resulted in an improvement in managing clients and resources. V2, V3 and V4 agreed that this framework can be beneficial in implementing a structured plan to improved demand planning. Specifically, in reducing unnecessary costs of overproduction.

One of the wineries where V1 works is in the fortunate position to operate at maximum capacity (and they do not intend to expand) and sell out all their wines at high prices. They therefore use a system where wine is allocated to customers and then monitored in terms of how fast or slow it sells. They therefore do not see a need for such a framework. The other winery, however, has a stock issue, where a large amount of wine is kept as finished stock (bottled and labelled). They

did not anticipate the demand for the wine correctly but are still producing in the same amounts. V1 also concluded that it will be more beneficial for the image of the brand to rather 'put the wine to the drain' than sell at discounted prices.

According to V6, who knows the systems and processes of many wineries, such processes are currently not being implemented by wineries. He feels that it is needed and can potentially benefit a large number of wineries if they are willing to follow a process. He is also of the opinion that if planning can be improved, and be done more structured, that wineries will improve on many levels.

6.11.3 Practicality and structure of the framework

All the participants felt that the framework was easy to understand and provided a logically structured process. The step-by-step manner in which the framework is presented is also considered an asset of the framework. This helps the understandability of the framework and would assist in being implemented by the wineries' current employees as mentioned by V2 and V3. Furthermore, V3 commented that the framework is high-level enough to be understood and implemented, whilst still giving concrete instructions on how to implement it.

6.11.4 Adaptability and holism of the framework

Regarding the way the framework can be applied to multiple situations and serve as a guideline, ties in with the fact that the wineries could see the benefit and applicability to their wineries. Since three out of four participants agreed that they could implement this in their winery, indicated that the framework is somewhat adaptable. V4 even agreed that it could be implemented at both his wineries, the one a small winery and the other a large operation. V6 agreed with this in saying that the framework would be beneficial for all wineries and not just small and medium sized wineries. He is of the opinion that large and cooperative wineries are particularly production-driven and that they ought to benefit from a framework such as this.

In terms of the inclusion of all aspects into the framework for improved demand planning and decision-making, the participants did not have any additional aspects to add or any suggestions. They agreed that this is a good starting point for improved planning. V5 especially considered the inclusion of identifying value opportunities and including them into planning as valuable and necessary. This is a part of the wine industry representative's mission to provide wineries with insights into the market, customer segments and trends and equip wineries to exploit these opportunities. He also feels that wineries are repeating the same mistakes year after year and that this could be a good starting point to record these past failures and learn from them.

The only concern from V3 was incorporating the value opportunities into planning by a certain percentage. He reckons that it would be difficult to connect a percentage to opportunities in the beginning, but that this would improve as the record-keeping data grows over the years.

In conclusion the framework proved to be well-accepted by other wine industry role-players. The framework achieved its objectives as being feasible, practical, holistic, structured and adaptable. There is also a definite need for the framework according to the participants, the exception being small ultra-premium wineries that sell out their wines yearly. Although their need might not be as great for such a framework, it would probably benefit them to implement the practices. This would have to be validated in another study.

6.12 Chapter conclusion

This chapter followed the implementation of the framework developed in Chapter 5 at a winery in Stellenbosch, South Africa. The chapter started out by defining the contextual background and business problem and then doing the case study preparation. The case study winery's current state was defined as well as their product and information flow processes. Thereafter the framework was implemented step by step, as explained in Chapter 5. The researcher interpreted the results, reflected on the case study choice and concluded by validating the feasibility and need for the framework.

Chapter 7

Conclusion

7.1 Chapter introduction

The final chapter gives an overview of the research and summarises the findings of the study. It highlights the contributions of the framework at a winery. The limitations of the research are discussed as well as the need for future research. Recommendations on what future research needs to be done are explored. The chapter concludes with final remarks.

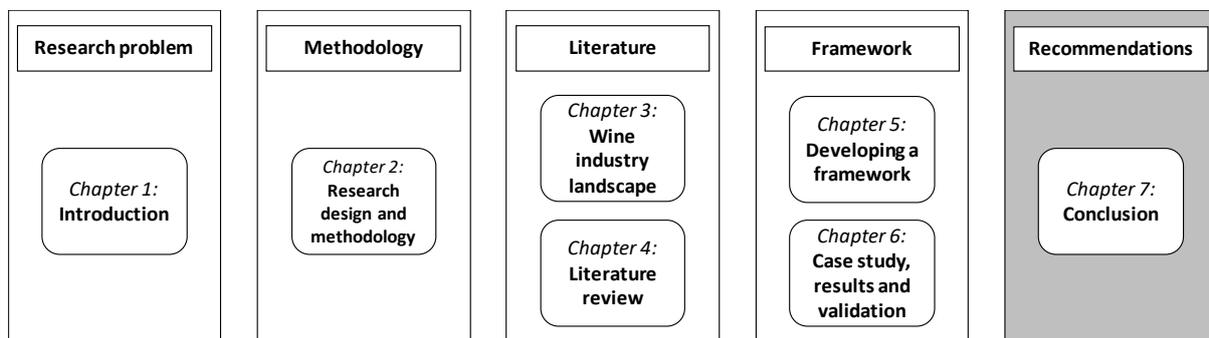


Figure 7.1: Thesis outline

7.2 Overview of the study

The wine market has become more and more competitive, locally and globally. In South Africa most wine producers are struggling financially. Although increasing quality and marketing might enable growth in sales, there are numerous other ways in which to improve a company's bottom line. The research investigated the feasibility and use of demand planning in small to medium-sized wineries.

This study started off in **Chapter 1** with an introduction to the wine industry of South Africa. The problem was introduced as well as the set research objectives, scope of the study and a strategy for conducting the research. A brief overview of the research design and methodology was also discussed.

Chapter 2 provided an in-depth explanation and reasoning for the chosen research design and methodology. A mixed methods approach was followed where quantitative and qualitative data was used to address the research problem. The research process, data gathering and analysis was also accounted for.

The wine industry landscape was explored in **Chapter 3** as a part of the literature review. This chapter explored the wine supply chain and the planning phases in wine production. It also gives background to the Wine Strategic Exercise (WISE) aims and the current opportunities in the wine industry. The wine-specific attributes that need to be considered in planning and the demand planning methods used in industries with similar attributes to the wine industry are also covered.

In **Chapter 4** the literature review is continued by exploring all the elements used in developing the framework, especially elements of tactical and strategic planning. Value propositions, SKU aggregation and classification, demand forecasting, management and planning, strategy execution and decision-making were all part of the reviewed literature.

From the literature in Chapters 3 and 4, a framework was proposed in **Chapter 5** for incorporating value opportunities in demand planning in small to medium-sized wineries. The scope, purposes and objectives of the framework are stated and then the framework is built in a step-by-step manner.

The proposed framework was implemented at a case study winery in **Chapter 6** to evaluate the outcomes. By obtaining qualitative data from the case study winery in the form of structured and semi-structured interviews and quantitative data in the form of sales data and financial statements, the proposed framework was implemented step-by-step. The feasibility and ease of use of the framework was then validated by means of structured interviews with validation wineries.

7.3 Contributions

In Chapter 1 the researcher set out to answer a research question by achieving set research objectives. The main research question asked is revisited here:

What should a generic demand planning framework for small to medium-sized wineries look like?

After developing a framework in Chapter 5 and implementing the demand planning framework in Chapter 6, the main research question was answered. Even though the researcher believes that there are multiple frameworks possible for successful demand planning, the set research objective, revisited here, was reached.

The research aims to develop a practical decision-making framework to implement at small to medium-sized wineries, especially aimed at improving demand planning.

Through developing the demand planning framework, the researcher uncovered that wineries do not plan demand accurately, nor do they consider the value opportunities present in the industry. But what the framework firstly provides is a guideline for wineries to improve their record-keeping and decision-making in a more structured way. This can be done by the winery's current employees and does not require expensive software, nor does it require new advanced skills. In addition to providing this platform on which to make more informed decisions, the framework then provides guidelines and formulas to organize SKUs and finally forecast the demand and create the demand plan for an 18-month period.

This demand planning framework, when implemented successfully, can provide wineries with a demand plan by which they will not overproduce or under produce wine extensively, thus being able to supply the market fully, without having any stock left over (which contributes to major cost savings). This would enable wineries to push prices up, because they do not have an oversupply of wine. In the long run, the researcher can see this contributing to a greater and more promising market share abroad as Brand South Africa. Table 7.1 summarises the objectives set out at the beginning of the study and the contributions made.

Table 7.1: Research objectives against the contributions made

Objectives:	Contributions:
1. Establish the fundamentals of:	
a.) SKU grouping and family classification	These topics were covered in the literature study in Chapter 4 and the elements were then incorporated accordingly into the framework in Chapter 5.
b.) Demand forecasting and planning	
c.) Strategic and tactical planning and decision-making	
d.) Determine value opportunities in the wine industry	
e.) Wine and wine industry specific characteristics	
2. Consider appropriate forecasting model to implement in the wine industry	In Chapter 3 time-series forecasting is suggested as a part of apparel forecasting and is explored in the literature further. It is then incorporated into the framework and tested to work well in the case study.
3. Choose an appropriate research design and shape a constructive methodology to develop a model	In Chapter 2 thought is given to how the thesis and research should be structured. With help from the literature on research design and methodology, the researcher found an appropriate fit to guide the research.
4. Define the strategic decision-making process and planning maturity of wineries	The maturity of these processes was established at the case study winery as being very low. This is then further validated in further validation interviews with similar wineries and wine industry role-players as being very low.
5. Evaluate the impact of the implemented demand planning framework on wineries	The framework was implemented successfully at the case study winery showing good results and providing valuable steering guidelines to implement the strategies. Through validation it was then concluded that such a framework is needed in wineries – not just in small and medium-sized wineries and that it ought to reap numerous benefits.

7.4 Limitations of the study

The main limitation of this study and in the wine industry in general, is the lack of data and literature. In the literature there is a wealth of knowledge in the wine and vineyard production fields, but very limited literature on business and supply chain in the wine industry. This is something that needs to be addressed. As soon as more research is done on the wine business and wine supply chain, more concrete strategies for wineries and the wine industry can be formulated.

During this study, none of the wineries (the case study winery, validation wineries and wineries contacted for additional information) could supply the researcher with any records kept when decisions were made, or the tracking of sales under the influence of certain trends or opportunities. Therefore, the researcher concluded that it would be largely beneficial for wineries to start by tracking all and any decisions made within the winery, from procurement to the consumer. Data can be very powerful, especially in the wine industry where understanding markets and customers is crucial. Data can ultimately help wineries in making more informed and thus, better decisions. This framework is also then a first step in the direction of record-keeping and improved decision-making. And this is no high technology system, but it starts with simply writing down every decision and change and then keeping it updated and reviewing former decisions versus outcome in subsequent decision cycles.

7.5 Future research recommendations

There are numerous studies to be done in the wine supply chain, but some definite areas of future research on the back of this study include the following:

- An industry-wide validation by the implementation of the framework. The feasibility and comprehensibility of the framework were validated at other wineries, but a complete implementation of the framework at other wineries needs to be done to validate the functioning of the framework.
- Inventory management strategies. Inventory management plays a big part in keeping a winery's cash flow positive. Wineries have a lot of cash tied up in inventory as the production and packaging of wine is capital intensive. By implementing effective inventory management strategies, the wine will be ready on demand, but without keeping too much finished wine in stock.
- Evaluate the impact of this framework on winery profitability after implementation for a couple of years.

- The maturity of winery strategic plans needs to be evaluated and aligned with the strategy of 'Brand South Africa'. Wineries can achieve a great deal more if they stay focused and have a clear vision of what they want to achieve and who they want to target.
- Take a look into how to consolidate value opportunities and predict their influence more accurately. Also, an investigation into the ability to predict future trends.

7.6 Final remarks

As the wine industry of South Africa is struggling financially, there are numerous supply chain and business issues to be addressed within the industry. This study is concerned with the consumer or market that any specific winery wants to serve, and how to fulfil these markets' needs. In doing so, the framework built in this study proved to be market-driven, starting out with identifying the market opportunities and building a strategy, along with the correct amount of supply, to address these markets. Through supplying what the market wants and in the correct quantities, wineries will be able to cut unnecessary overproduction costs and increase profits by pushing prices up (since value is created). These benefits will have to be validated by implementing the framework at numerous wineries over a few years, but it is a starting point to drive the record-keeping, decision-making and planning functions of wineries in the right direction.

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Appendix A

Appendix A consist of the structured interview questions (A1) and semi-structured interview questions (A2) of interviews that were conducted at the case study winery. The semi-structured interview questions asked in interviews of the external validation can be found in A3.

A1 Questions in structured interview

Structured interview conducted with General Manager on 10/10/2016

The purpose of the structured interview is to determine which strategic and planning processes The Winery is implementing and the maturity thereof. Questions are allowed at any stage during the interview.

1. Do you have a strategic business plan in place?
2. Do you think that such a plan would be beneficial?
3. Do you have a system according to which you make decisions?
4. If you do not have a formal business plan, are the employees aware of any structured strategy when making decisions?
5. Is it clear to the employees of the goal towards which you as a company are working?
6. What do you base decisions on?
7. Do you have a Sales and Operations plan? Per definition it is then where you look at demand and make forecasts according to demand. And then structure the operations plan to supply the demand.
8. Did you plan how much wine will be available during pruning?
9. Can you please explain the planning in detail?
10. So, you do have a planning system in place?
11. Does it look like system has proven valuable thus far?
12. Do you have yearly, monthly or weekly meetings about this plan?
13. What do you attempt to do with the production plan? How will this look?
14. This is now based on the actual data that you have received?
15. Do you base your production then on the previous years' demand?
16. Since when are you doing this?
17. How did you realise that you need a demand plan?
18. Do you take any other factors into consideration when doing a demand forecast? Except for historic sales.
19. How much, percentage wise, of the wine that you planned to sell in this year, was left over?
20. How much, percentage wise, of your packaging materials was left over after you used it?

21. Say you want to bottle your Shiraz, how much of those bottles do you over of under estimate?
22. Do you have any empty bottles standing around?
23. The bottles that you import, is there not an alternative that you can have it made locally?
24. How much additives, chemicals that is used in the cellar is left over after vintage?
25. Do you do a cost benefit analysis when you order packaging in bigger quantities than required?

A2 Questions in semi-structured interview

Semi-structured interview conducted on 10/10/2016

The purpose of the semi-structured interview is to map the product and information flow to, from and within the company. This is necessary to understand the processes and timeline within The Winery operates. The three main areas of focus will be, the suppliers, the company as the manufacturer and the customers.

1. What process do you follow when placing an order from the supplier and who does this?
2. And you suppliers are reliable?
3. In terms of manufacturing/ production, who is involved in doing the forecasts determining how much wine is needed, how much do you have in stock? What is the situation in the cellar and in the office?
4. In terms of customers, how do you receive an order and what is the process that that order follows to be delivered to the customer?

A3 Validation Interview Questions

Semi-structured interviews conducted with multiple similar wineries to validate the feasibility, comprehensibility and need for the framework (July-August 2018)

The framework was explained by the researcher and the interviewee was encouraged to ask questions and make comments. After the framework was explained, the semi-structured interview revolved around these questions:

1. Do you use such a planning process in your winery?
2. If yes, discuss what is different and what is the same?
3. Is the framework easy to understand?
4. Do you think such a framework can benefit your winery?
5. Do you think there are any aspects missing in the framework? What are they?
6. Do you think this framework can be easily implemented in your winery by your current employees? If not, why?
7. If you think that this framework will not work, please share your thoughts.

Appendix B

Appendix B serves as an additional guide to the forecasting done on all the product families as explained in Chapter 6, section 6.7. B2 shows the additional demand planning for the other BX product families, not shown in Chapter 6.

B1 Forecasting errors for product families

AX Product families

Shiraz

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	9142439	1869	8.5
SES	9259522	11274562	6.1
Holt's Model	9181761	2499	6.0

Reb blend

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	154382041	11768	19.8
SES	60868783	57157870	15.4
Holt's Model	16602759	3630	7.3

Chenin

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	390836166	19316	32.2
SES	156293222	110940247	25.5
Holt's Model	40266344	5349	13.5

BX Product families

Sauvignon blanc 2

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	100829884	9886	27.4
SES	74751200	102099528	30.9
Holt's Model	3618209	1743	7.0

Chardonnay

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	17284292	4081	19.6
SES	11674654	13210742	16.1
Holt's Model	410827	571	3.2

Flagship red blend

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	2027295	1410	19.0
SES	819330	596346	12.7
Holt's Model	296444	447	7.5

Sweet wine

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	1241412	1106	12.8
SES	863368	1022043	9.8
Holt's Model	24638	138	1.8

CY Product families

SP Red blend 2

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	690241	749	57.1
SES	304087	217552	73.0
Holt's Model	44003	204	33.6

SP White blend 1

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	627162	583	58.8
SES	237610	115652	136.3
Holt's Model	100558	281	127.5

SP White blend 2

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	1811	34	21.7
SES	889	647	20.0
Holt's Model	186	11	9.4

Sparkling wine

Forecasting Method	MSE	MAD	MAPE (%)
2-point SMA	64003	200	1488.8
SES	21275	20116	507.4
Holt's Model	13830	98	423.7

B2 Demand planning for BX product families

Sauvignon blanc 2 (no increase expected, other than what the forecasting trends incorporates)

SB 2 Forecast (Holt's Model)	Demand planning forecast (0%)	Actual Sales	Accuracy
48 390	48 390	33 113	68%

Chardonnay (no increase expected, other than what the forecasting trends incorporates)

Chardonnay forecast (Holt's Model)	Demand planning forecast (3%)	Actual Sales	Accuracy
25 377	25 377	21 232	84%

Flagship red blend (a 10% increase is expected as this wine won awards)

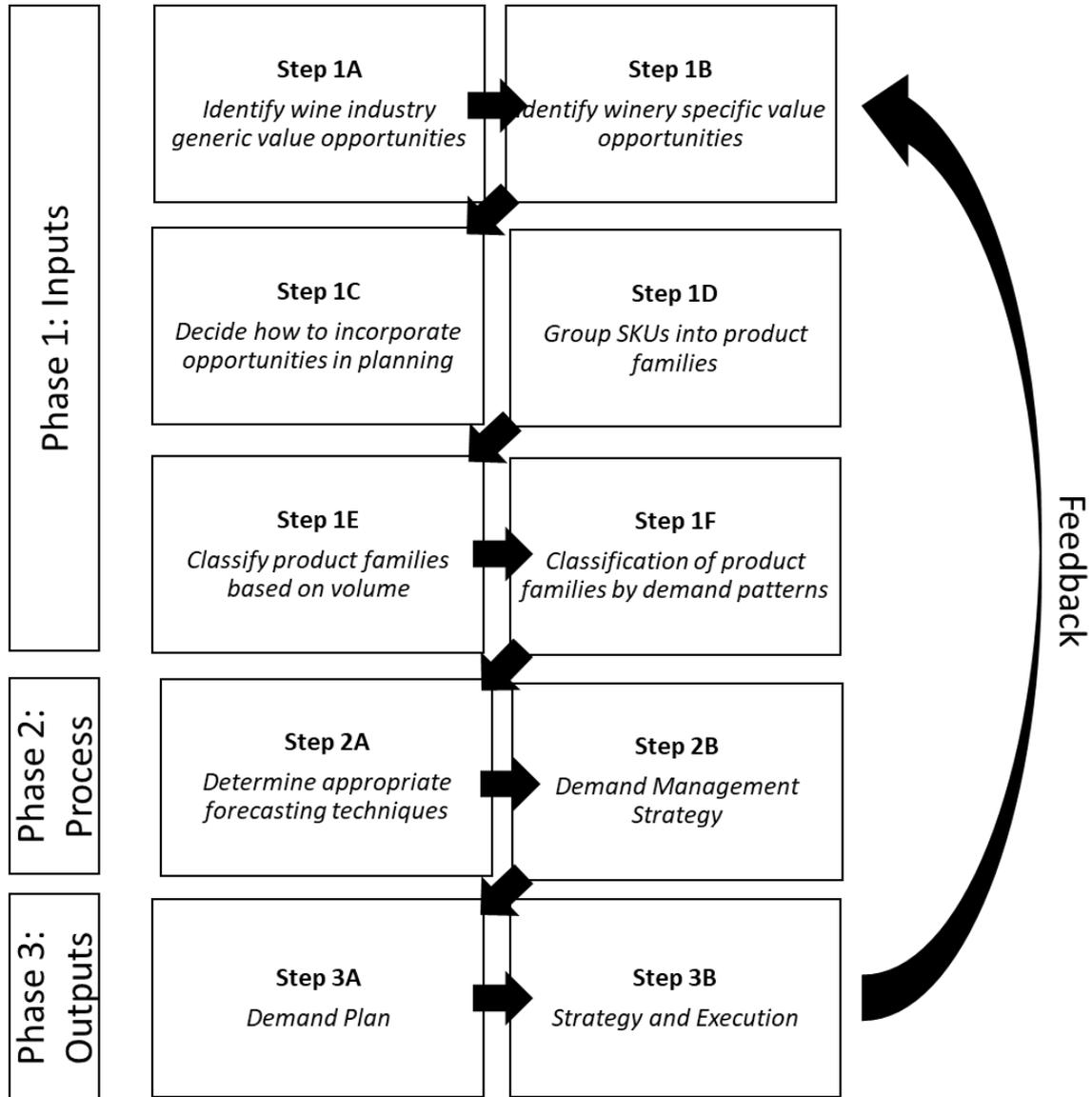
Flagship red blend forecast (Holt's Model)	Demand planning forecast (10%)	Actual Sales	Accuracy
8 190	9 009	8 575	95%

Sweet wine (no increase expected, other than what the forecasting trends incorporates)

Sweet wine Forecast (Holt's Model)	Demand planning forecast (0%)	Actual Sales	Accuracy
9 926	9 926	8249	83%

Appendix C

Appendix C provides a record-keeping structure to be used by wineries. This will assist in making improved decisions by recording and revisiting decisions and actions. The framework outline is given here to remind the reader that record keeping is important throughout every step.



The structure provided for improved record-keeping, looks very basic, but none of this is formally recorded at wineries currently. For this to be successful, it is recommended that the document is readily available to all employees and that updates and changes are made and shared on this same document. Furthermore, this document should be revisited monthly as well as when any decisions are made

Example of a basic record-keeping structure:

Date	Decision	Action	Timeframe	Reasoning	Responsible	Outcome	Revised?
12/06/2016	Increase production of Chenin blanc.	Find a suitable quality supplier of grapes. If reoccurring and estate label a consideration – plant vineyards.	Two months for sourcing grapes for production in 2017.	Chenin blanc is sold out before the end of product life-cycle, despite increasing price.	Viticulturist, winemaker, general manager.	Production was increased with 5% and this was suitable for demand at a price increase.	Yes on 01/06/2018. Demand is being fulfilled optimally at increased price levels. Any more production increase would result in capacity constraints.