

DEVELOPMENT OF A COLLABORATIVE FRAMEWORK FOR WINE BOTTLING FACILITIES AND THEIR SUPPLY CHAIN PARTNERS

by

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Declaration

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Abstract

In recent years, both local and international demand for South African wine have seen significant growth. This includes demand for packaged exports as well as bulk exports. However, the South African wine industry has placed emphasis on increasing packaged export and decreasing bulk exports to create a larger market share for brand SA in international countries. This correlates to the Wine Industry Strategic Exercise (WISE), which aims to increase the packaged-bulk ratio from the current 40:60 to 60:40 by 2025.

This increase will require stakeholders of the industry to work closely together to produce more packaged wine at the lowest possible price while utilising the available bottling capacity to the best of their ability. Communication and information sharing, i.e. collaboration between wine bottling facilities, wineries and dry goods suppliers are of the essence to ensure that bottling delays and missed production opportunities are avoided and that demand requirements are met in a timely manner. The coordination of ordering activities, delivery as well as the availability of dry goods and wine for a given production period are essential for bottling facilities and their various supply chain partners, as these factors all influence the ability of the stakeholders to deliver packaged orders on time and in full.

Previous studies highlighted a lack of integrated decision-making capabilities within the wine supply chain, resulting in a decrease in responsiveness and reliability. This study identifies the key dimensions and aspects that must be included in a collaborative framework to enable stakeholders in this supply chain environment to work together, looking to enhance decision-making capabilities, ultimately increasing responsiveness and reliability. The Wine Industry Collaboration (WIC) framework proposed, is developed using literature, primarily relying on the concept of Collaborative Planning, Forecasting and Replenishment (CPFR) as primary input. In addition, the researcher conducted several interviews with a variety of industry stakeholders to gain further understanding of the industry and the challenges. This, along with the implementation guidelines, serves to guide stakeholders towards the successful implementation of a collaborative effort.

Several subject-matter experts (SMEs) validated the WIC framework, focusing on its practicality, feasibility and structure. The researcher used semi-structured interviews

to perform the validation. This assisted the researcher to make appropriate amendments where needed and to incorporate improvements. Finally, the implementation guidelines, derived from the validated WIC framework are validated using a theoretical case study at a wine bottling facility. It was found that a need exists for such a structured collaborative approach and that the implementation of such a framework would enable the sharing of demand information, improve order planning and fulfilment and finally help stakeholders with performance measurement.

In conclusion, the South African wine industry can benefit from a collaborative effort such as the one proposed by the WIC framework and implementation guidelines presented in this document, as it will assist stakeholders to improve decision-making, aiming to improve the reliability and responsiveness of the entire industry. This study is a starting point to introduce collaboration and the benefits thereof to stakeholders in the South African wine industry.

Opsomming

In die afgelope paar jare het die plaaslike en internasionale vraag na Suid-Afrikaanse wyn gegroei. Dit sluit die vraag na verpakte uitvoere en grootmaatuitvoere in. Die Suid-Afrikaanse wynbedryf het egter die klem gelê op die verhoging van verpakte uitvoere en afname in grootmaatuitvoere om 'n groter marktaandeel vir die SA handelsmerk in internasionale lande te skep. Dit stem ooreen met die wynbedryf se strategiese oefening (WISE), wat daarop gemik is om die verpakking tot grootmaatverhouding te verhoog vanaf die huidige 40:60 na 60:40 teen 2025.

Om hierdie verhoging te bewerkstellig, sal die belanghebbendes in die bedryf moet saamwerk om meer verpakte wyn teen die laagste moontlike prys te produseer, terwyl die beskikbare botteleringsvermoë so goed as moontlik benut moet word. Kommunikasie en die deel van inligting, dit wil sê samewerking tussen wynbotteleringsaanlegte, wynmakerye en verskaffers van droë voorrade is van die uiterste belang om te verseker dat verdragings in die bottelering en gemiste produksiegeleenthede vermy word en dat daar vroegtydig aan die vraagvereistes voldoen word. Die koördinering van bestelaktiwiteite, aflewering, sowel as die beskikbaarheid van droë voorraad en wyn vir 'n gegewe produksietydperk, is noodsaaklik vir botteleringsfasiliteite en hul verskillende verskaffingskettingvennote, aangesien hierdie faktore alles beïnvloed deur die belanghebbendes se vermoë om verpakte bestellings betyds en ten volle te lewer.

Die huidige probleem bestaan in die industrie is 'n gebrek aan geïntegreerde besluitnemingsvermoëns wat lei tot 'n afname in die reaksie en betroubaarheid van die wynverskaffingsketting. Die raamwerk wat ontwikkel is, identifiseer die sleuteldimensies en -aspekte wat in 'n samewerkingsraamwerk ingesluit moet word om belanghebbendes in hierdie voorsieningskettingomgewing in staat te stel om saam te werk, met die oog op die verbetering van besluitnemingsvermoëns, wat uiteindelik die responsiwiteit en betroubaarheid van die voorsieningsketting as 'n geheel verhoog. Die voorgestelde wynbedryf-samewerking (WIC) raamwerk word ontwikkel met behulp van literatuur, hoofsaaklik gebaseer op die konsep van samewerkende beplanning, voorspelling en aanvulling (CPFR) as primêre inset. Die navorser het ook verskeie onderhoude met 'n verskeidenheid belanghebbendes in die bedryf gevoer om 'n verdere begrip van die bedryf en die uitdagings te kry. Dit, tesame met die implementeringsriglyne wat geformuleer is in hierdie studie, dien om belanghebbendes

te lei tot die suksesvolle implementering van 'n samewerkingspoging.

Verskeie vakkundiges het die WIC-raamwerk bekragtig, met die fokus op die praktiese, uitvoerbaarheid en struktuur daarvan. Die navorser het semi-gestruktureerde onderhoude gebruik om die validering uit te voer. Dit het die navorser gehelp om toepaslike wysigings aan te bring waar nodig en om verbeterings op te neem. Laastens word die implementeringsriglyne, afgelei van die gevalideerde WIC-raamwerk, gevalideer aan die hand van 'n teoretiese gevallestudie by 'n wynbotteleringsaanleg. Daar is gevind dat daar 'n behoefte bestaan aan so 'n gestruktureerde samewerkingsbenadering en dat die implementering van so 'n raamwerk die deel van aanvraaginligting moontlik maak, bestelbeplanning en die vervulling van bestellings kan verbeter en die belanghebbendes uiteindelik met die meting van prestasies kan help.

Ten slotte kan die Suid-Afrikaanse wynbedryf baat vind by 'n samewerkingspoging soos dié wat voorgestel is deur die WIC-raamwerk en implementeringsriglyne wat in hierdie dokument aangebied word, aangesien dit belanghebbendes sal help om besluitneming te verbeter, met die doel om die betroubaarheid en responsiwiteit van die hele bedryf. Hierdie studie is 'n beginpunt om samewerking en die voordele daarvan vir belanghebbendes in die Suid-Afrikaanse wynbedryf bekend te stel.

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List of Acronyms

BOM	Bill of Material
BSc	Bachelor of Science
CEO	Chief Executive Officer
COO	Chief Operating Officer
CPFR	Collaborative Planning, Forecasting and Replenishment
CPS	Collaborative Performance System
CR	Continuous Replenishment
CRM	Customer Relationship Management
ECR	Efficient Consumer Response
EDI	Electronic Data Interchange
FIVS	International Federation of Wine and Spirits
GDP	Gross Domestic Profit
IBP	Integrated Business Planning
ICT	Information Communication Technology
IoT	Internet of Things
IT	Information Technology
JIT	Just In Time
LT	Lead Time
KPI	Key Performance Indicator
MEng	Master of Engineering
MPS	Master Production Schedule
MRP	Material Requirement Planning
NDA	Non-disclosure Agreement

OIV	Organisation of Vine and Wine
POS	Point of Sales
RFID	Radio Frequency Identification
RO	Research Objective
S&OP	Sales and Operations Planning
SA	South Africa
SAWIS	SA Wine Industry Information and Systems
SCC	Supply Chain Collaboration
SCOR	Supply Chain Operations Reference
SKU	Stock Keeping Units
SME	Subject-matter expert
T&C	Terms and Conditions
VICS	Voluntary Inter-industry Commence Standards
VMI	Vendor Managed Inventory
WIC	Wine Industry Collaboration
WISE	Wine Industry Strategic Exercise
WO	Wine of Origin

Glossary

Collaboration	The extent of information sharing, communication, joint planning and decision-making amongst stakeholders.
Bulk wine	Large quantities of wine that has not been packaged.
Packaged wine	Still wine packaged in glass containers.
Wine bottling facility	A third party wine bottler rendering a service to wine producing clients.
Winery	A wine producer, including wine cellars, wine estates and all other wine producers, that bottles wine at a third-party service provider.

Chapter 1

Introduction

The focus of this chapter is to introduce the research undertaken. It provides a brief theoretical background explaining the research problem, as well as clearly defining the project problem statement, the objectives and the approach followed. The chapter concludes with the outline of the study.

The content of this chapter includes the following:

- Background information about the research.
- A clear problem statement addressed throughout the project.
- A broad framework of the research design containing the main research questions and sub-question that will be answered, along with the methodology used in the project.
- The scope of the research and ethical considerations.

1.1 Background and rationale of the research

South African wine cellars and their supply chain partners are placing more emphasis on efficient supply chain practices in order to keep up with the growing demand, both locally and internationally. A more synchronised supply chain can potentially lead to increased profitability and a competitive edge (Knoblauch, van Eeden & Edwards, 2016).

In essence, a supply chain is the efforts involved in the production and transformation of raw material into a finished product delivered to the customer. "Supply chains are composed of components: people, organisations, technological structure, information flows, flows of physical good, and flows of intangible services" (Caddy & Helou, 2007). In a wine supply chain, all of these components are involved in delivering a bottle of wine from the farm to the table. The South African wine industry has seen significant consolidation in the last two decades, with many collaborative partnerships established in loosely defined geographical borders around several bottling facilities.

A survey conducted by Stellenbosch University in 2014 highlighted the occurrence of underachieving service levels, estimated at 90%, at a number of South African wine producers (Kruger & van Eeden, 2016). The perceptions of the reliability of cellars towards their customers are directly influenced by the performance of the entire wine supply chain. Upstream delays and issues cause downstream delays resulting in decreased service levels and responsiveness.

The study conducted by Kruger and van Eeden (2016) aimed to identify the root causes of reliability problems and provide feedback to the industry. Several root causes traced back to internal and external planning and information sharing deficiencies specifically related to the bottling stage of the supply chain.

1.1.1 The wine bottling process

Bottling is a key process within the wine supply chain as South Africa (SA) exports packaged wine to 26 countries including the UK, Germany, China, the USA and Canada (SAWIS, 2017, 2018). A total of 169 million litres of bottled wine was exported from SA to these and numerous other countries and a total of 380 million litres of bottled wine was sold to the local market, consisting of still, sparkling and fortified wines (SAWIS, 2018).

Most major vineyards and production centres are located around Cape Town within districts such as Paarl, Stellenbosch, Worcester and Constantia. The majority of the wine producers bottling and packing activities. Breede River Valley Bottling, Koelenhof and Paarl Valley bottling company are some of the main wine bottling facilities¹ in the industry, bottling most of wine for local and export purposes. Alternatively, some wine cellars make use of mobile bottling companies, rendering on-site bottling services. There are also a few larger wineries such as Distell, KWV and DGB bottling their own wine.

Bottling facilities in SA mostly deliver a service to their respective clients, with the focus of this study being wine cellars making their own wine. The bottling facilities operate using various business models. Smaller scale bottling companies bottle wine according to order, subject to availability of the wine cultivars during the season, and the client is responsible for providing all the raw material required to deliver the

¹ In this document, the term bottling facility refers to a wine bottling facility that bottles still wine packaged in glass containers.

product. This includes the wine itself and the dry goods such as labels, bottles, corks, caps, boxes, etc. The bottling facility then schedules bottling for their clients according to the demand triggered by either customer demand or wine readiness, based on available capacity. The client in return is responsible for ordering all the necessary dry goods and arranging delivery in accordance with the production schedule of the bottling facility. Larger scale bottling companies provide their clients with the option of customising their products out of a selection of dry goods bought by the bottling company from suppliers as requested by the clients.

Garcia *et al.* (2012) constructed a basic representation of the wine supply chain (refer to Figure 1.1), highlighting the complexity of the wine supply chain. This configuration illustrates the functioning between raw material suppliers, wine producers and bottling facilities (indicated as filler/packer on the diagram), as well as the extended supply chain. Using this supply chain configuration, the direct supply chain partners of a bottling facility includes raw material suppliers, wine producers and the party responsible for distribution of wine. The different organisations that form part of this group directly influence the planning, forecasting and replenishment procedures of a bottling facility. Communication in such a supply chain environment is extremely important to ensure that various stakeholders communicate clearly about demand that is needed and the demand that is available. Establishing a multitier collaborative partnership between these customers and suppliers will be beneficial to both ends in several ways (Palm & van Eeden, 2018).

The current lack of integration and collaboration between bottling facilities and their respective supply chain partners influences several performance metrics, including reliability and responsiveness. Based on findings by Palm and van Eeden (2018), long order cycle times are attributed to bottling facilities' scheduling constraints and dry goods sourcing delays. The responsibility of placing the orders for dry goods varies between bottling facilities and wine cellars. The lack of communication and information sharing is often a root cause of bottling delays and missed production opportunities.

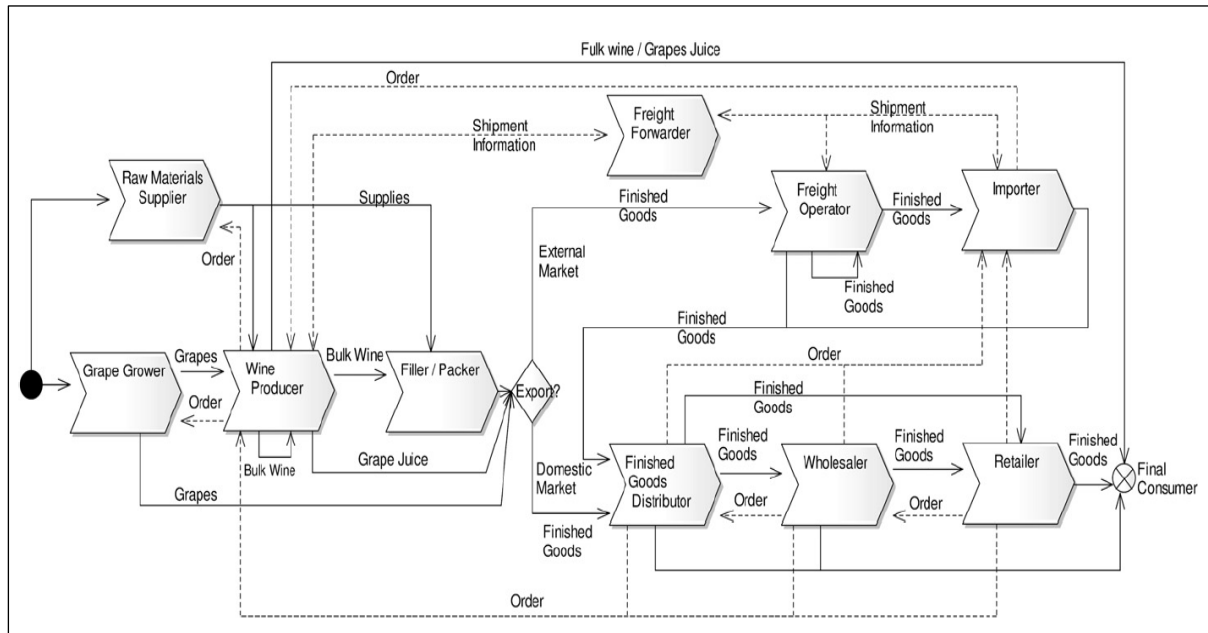


Figure 1.1: Wine supply chain (Garcia et al., 2012)

1.1.2 The wine supply chain improvement initiative: Wine Industry Strategic Exercise

The Wine Industry Strategic Exercise (WISE), is an initiative that was launched in 2014 in the South African wine and brandy industry, which focuses on creating an adaptable and competitive industry with a sustainable future (Augustyn & Heyns, 2016). This strategy aims to ensure that the entire wine and brandy value chain adopts a comprehensive, industry-wide strategy by 2025. WISE determined a set of goals for 2025 (see Table 1.1). According to Farmers Weekly, a key focus of the WISE initiative is to shift the South African focus from bulk wine exports to branded packaged products (du Preez, 2017). Rico Basson, managing director of Vinpro, emphasises that the collective relationships within the industry as well as with other stakeholders such as labour and government are determining factors that will contribute to the success of this project (Vinpro, 2015).

Table 1.1: WISE goals for 2025 (Adapted from Vinpro, Salba, Sawis, Wosa & Winetech, 2016)

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%
1%:2%:5%	Export markets USA: China: Africa	7%:7%:10%
2 Free trade agreements	Market focus	Agreement for key markets
R6 billion	Wine tourism	R15 billion
R80 million: R11 million	Industry: Government levies	Matched funding
275 000	Employment levels	375 000

According to SAWIS 2018 statistics, total still wine bulk exports for the year amounted to approximately **251 million** litres, which is considerably more than the total still wine packaged export, which amounted to only **164 million** litres in the same year (all package types included). The initiative aims to improve this packaged:bulk export ratio from its current ratio, **39:61**, to the desired ratio of 60:40 by 2025 (PWC, 2015). This works out to an increased bottling capacity requirement of approximately 90 million litres. This will directly increase the need for responsiveness (in terms of both delivery time and flexibility of product delivery) of the wine supply chain and places pressure on bottling facilities to improve the utilisation of their bottling capacity. In order to increase the amount of packaged exports, utilising current bottling capacity, will call for improved cooperation between supply chain partners to enable reliable supply and responsive decision-making.

The WISE initiative consists of six deliverables (summarised in Table 1.2) that will provide information to individuals in the wine industry to operate more efficiently, focus on priorities and work towards a common goal (Augustyn & Heyns, 2016). These all form part of the six work streams: (1) Socio-economic development and upliftment, (2) Economic empowerment and development, (3) Market development and promotion, (4) Knowledge and information development, (5) Technology innovation and transfer

and (6) HR development and training as mentioned in an article by PWC (2015) reporting on insights of the WISE initiative.

Table 1.2: WISE Project Deliverables (Augustyn and Heyns, 2016)

Deliverables	What does it entail?
1. Formalising a global trade agenda	Build a customised model to identify market opportunities for SA wine, explore these markets and distribute insight to relevant stakeholders.
2. Technological innovation	Develop a strategic framework to enable technological innovation, creating a platform that enables re-engineering of the wine industry.
3. Promoting “Brand SA”	Growing the domestic wine market by 100 million litres by 2025.
4. Improving tourism	Understand current industry and make projections about future state.
5. Establishing a transformation plan for the industry	Establish intent, quantify timelines and set targets for the wine value chain.
6. Sealing the WISE envelope	Developing a social compact between, government, labour and the industry.

As the WISE initiative specifically focuses on technological innovation and re-engineering of the wine industry, this will require the implementation of a collaborative initiative between industry stakeholders. The intent is to transform the SA wine industry and to gain a bigger market share with packaged exports rather than bulk export, while simultaneously reducing unnecessary costs and increasing profits.

1.1.3 Supply chain collaboration challenges in the wine industry

The most recent research in the wine supply chain industry has focused on establishing appropriate performance measures in order to improve supply chain logistics and promote supply chain maturity, ultimately increasing profitability and competitiveness (Jooste, van Eeden & van Dyk, 2015; Smit, van Eeden & van Dyk, 2017). The research suggests that having an appropriate performance measurement framework will guide the wine industry towards reaching these goals. The two main performance factors the wine supply chain industry is currently concentrating on, specifically related to packaged exports and packaged local products, are reliability and

responsiveness (van Eeden *et al.*, 2014).

Reliability requires an organisation to deliver a product or service that is consistently predictable, often measured using perfect order fulfilment (Jooste *et al.*, 2015). As wineries have the responsibility to deliver the correct quantity and top quality wine to their customers on time, reliability of order commit date is highly important to ensure that customer demand is fulfilled (Smit *et al.*, 2017).

Responsiveness directly relates to reliability as order fulfilment cycle time is one of its main metrics. Responsiveness is the speed of execution and delivery of orders. Responsiveness in the case of dry goods supply is very important, as the lack of dry goods can easily cause order delays. If supply of dry goods and wine in this case are not reliable (delivering orders on-time, in full, with all the documentation) bottling facilities have decreased responsive capabilities. Responsiveness is especially important in the case of packaged exports, as there is an order fulfilment cycle time of only 28 days (Palm & van Eeden, 2018). Should this order fulfilment cycle time be exceeded, it can potentially lead to lost sales opportunities, decreasing packaged exports volumes.

Having improved collaboration amongst supply chain partners involves sharing information and data that can be utilised to enhance decision-making, positively influencing these performance factors. This creates the opportunity for improved supply chain collaboration to accomplish these goals. The coordination of ordering activities, delivery and availability of raw materials for the given production period is of essence for bottling facilities and their various supply chain partners, as a delay in availability of raw materials (including dry goods and wine), causes delays in the production of packaged wine.

A study by Palm and van Eeden (2018) found that scheduling constraints at bottling facilities and dry goods sourcing delays were very frequently root causes of responsiveness issues. This suggests that reliability of dry goods supply is essential to ensure efficient execution of bottling schedules, to avoid responsiveness issues. Jooste *et al.* (2015) argues that reliability in terms of perfect orders is very important and creates the opportunity for close collaboration, directly relating to the responsiveness of the supply chain. Entering a collaborative relationship with dry goods suppliers will enable sharing sourcing knowledge related to inventory availability and delivery, as well as knowledge sharing about production planning (Palm & van Eeden, 2018).

The current level of collaboration has however been limited to some wine cellars obtaining a shareholding in a bottling facility, consequently sharing the investment in new equipment. Through this they obtain some preferential treatment due to ownership and the technological benefits of having a shared facility. Bottling facilities have limited visibility of their clients' orders, supplier production orders, tracking these orders and ensuring that the necessary raw materials are available when production is scheduled. Through enhanced supply chain integration, the level of collaboration could be expanded to include information sharing, order prioritisation, bulk discount for joint purchasing efforts, etc. Improved supply chain integration could lead to improved performance for all the players in the supply chain involved in the collaborating initiative (Kamau, 2015).

Supply chain collaboration (SCC) has been widely discussed in recent years (Barratt, 2004; Ireland & Crum, 2005; Simatupang & Sridharan, 2005; Attaran & Attaran, 2007; Ramanathan & Gunasekaran, 2014; Singh, Garg & Sachdeva, 2018) and SCC solutions have been improving. What started at electronic data interchange, followed by vendor managed inventory, continuous replenishment programmes and later efficient consumer response, have now developed into a best practice known as Collaborative, Planning, Forecasting and Replenishment (CPFR) (Attaran & Attaran, 2007).

Kamau (2015) conducted a study to determine the effect of implementing different planning processes on the performance of water bottling companies in Nairobi. The study found that increased supply chain integration leads to improved supply chain performance in the case of water bottling facilities. SCC was noted to be one of the key supply chain planning practices to implement in order to improve supply chain integration, directly leading to improved supply chain performance. This study is based on a supply chain that is very similar to the supply chain of a wine bottling facility, although the product is very simple with a limited number of stock keeping units (SKUs) compared to packaged wine, providing a possible indication that integrating the supply chain using collaborative initiatives could yield positive outcomes. This thesis will venture into defining and configuring a collaboration framework and testing it to confirm the potential outcomes.

Having a more collaborative relationship between the various stakeholders in the wine supply chain, which improves the reliability and responsiveness of the supply chain as a whole, could enable transformation of the industry and be a driver of success for such an initiative (Palm & van Eeden, 2018). Developing a framework that assists

stakeholders (bottling facilities, dry goods suppliers, wine producers etc.) with the facilitation of collaborative strategies such as CPFR and evolving technological capabilities will contribute to the realisation of the deliverables mentioned in Table 1.2 and the success of this industry platform.

1.1.4 Potential improvements of implementing collaborative initiatives

In the case of the configuration of the supply chain in the wine industry, the players that could benefit from this collaboration are wine cellars, bottling facilities, dry goods suppliers, wine distributors, export agents and transport service providers. By means of a best practice such as CPFR, firms can develop, update and correct forecasts, share information with their customers and suppliers, and enhance operational planning and product replenishment processes by leveraging the sharing of information (Hill, Zhang & Miller, 2018). Having visibility throughout the supply chain would enable bottling facilities to schedule bottling more effectively, or make changes to the schedule if need be, to ensure supply chain efficiency for both bottling facilities and their suppliers (Palm & van Eeden, 2018).

Basic CPFR is often the starting point for any planning initiative and roots back to other planning initiatives such Efficient Consumer Response (ECR) and VMI (Vendor Managed Inventory). However, Sheffi (2002) argues that CPFR has evolved to be far more comprehensive than these initiatives. It enables the communication of all forecasts and exceptions to all parties involved and allows the solving of these exceptions using a planned collaborative process, increasing the amount of potential benefits. This concept will be used as the basis for the development of a collaborative framework that can be implemented by a South African wine bottling facility in order to promote collaborative planning and execution of supply chain activities.

There are various dimensions related to a CPFR framework as proposed in literature that can potentially assist bottling facilities and their supply chain partners to enhance their level of collaboration in order to achieve satisfactory results. These dimensions should be evaluated to understand which ones would be the most beneficial to the specific industry, depending on the business model and supply chain operations of a specific bottling facility. The steps included in a CPFR framework could address the following factors (Cao & Zhang, 2011):

- Cost efficiency without compromising service level

- Combined planning
- Movement of raw materials and finished goods
- Reactivity to demand changes (responsiveness)
- Improved production scheduling, resulting in better asset utilisation
- Distribution efficiency

These are just a few of the factors that one can incorporate into the processes, steps, activities and tasks related to a CPFR framework, resulting in numerous benefits for all the supply chain partners. CPFR can significantly reduce supply chain inventory, improve inventory management, increase product sales, speed up order-response times, improve production processes, reduce forecasting errors and ensure better product availability (Hill *et al.*, 2018). Ultimately, cost savings and financial gains are some of the most important drivers of collaborations (Corsten & Felde, 2005; Chen & Chen 2005).

The processes, steps, activities and tasks involved in CPFR and synchronising the process requires a tremendous amount of data and information sharing, along with the appropriate technological input (Barratt & Oliveira, 2001). Utilising the technologies associated with the 4th industrial revolution offers great room for improvement in various supply chain aspects such as information visibility, data availability, connection and transfer of data/information, data storage centralisation, increased logistic transparency, real-time supply chain management as well as improved inventory and warehouse management. The Internet of Things (IoT) is connected to the newly evolving 4th industrial revolution that addresses the trends of atomisation, digitalisation, collaboration and socialising of processes and products (Szozda, 2017).

Information sharing between involved parties could lead to automatic rescheduling of orders according to prioritisation rules, knowledge about availability of dry goods, approval of wine by the agricultural board and shipping export schedules. These are just a few of the advantages that the use of IoT offers the different stakeholders involved in the process. From a supply chain perspective, IoT will ensure richer data and deeper intelligence for all the stakeholders in the supply network. Jooste (2016) emphasised that the availability of information and data for supply chain metrics is also a prerequisite to enable performance measurement to advance supply chain maturity, which is a field recommended for further research.

Depending on the nature of the supply chain and the aim of collaboration, there are three levels of collaborative partnership (Skjoett-Larsen, Thernøe & Andresen, 2003). The first of these is basic collaboration (level one), which focuses on increased information sharing to improve planning. More developed collaboration (level two) entails joint planning and decision-making, while advanced collaborative efforts (level three) are extended to coordinate processes within forecasting, replenishment and planning. These levels of collaboration all focus on information sharing; however, the purpose of information sharing differs.

Ultimately, supply chain management can utilise IoT data and information exchanged through collaboration between supply chain partners to advance the maturity of the South African wine supply chain. Technology can be used to improve workflow in factories, increase material tracking and optimise distribution to maximise revenue (Machado & Shah, 2016). Improved visibility of data and information will assist with developing a more accurate representation of future demand and promised shipment dates, help to track progress and improve the overall supply chain process (Palm & van Eeden, 2018).

Despite the various limitations and barriers related to the realisation of collaboration amongst the various supply chain stakeholders involved in wine bottling, the implementation of a collaborative initiative in any industry can lead to market leading innovation if altered according to the various dimensions related to the specific industry (i.e. reliability and responsiveness in the case of the wine industry). The key is to establish which level of collaboration is appropriate for individual supply chain scenarios and to understand the role of digital technologies as an enabler.

1.2 Research problem statement

The reliability and responsiveness of wine bottling facilities are influenced by various other supply chain activities, including planning, forecasting and replenishment of materials and bulk wine needed during this step in the wine production supply chain. Pre-planned production schedules of bottling facilities also suffer significantly from the lack of collaboration and effective information sharing and visibility throughout the various supply chain channels. Notification of dry goods ordering, tracking and delivery between bottling facilities and their direct supply chain partners, suppliers and wine cellars, is a central aspect of the bottling scheduling process. Collaboration among parallel players in competing supply chains in upstream activities can assist

these players to be more competitive collectively and separately. Implementing collaborative planning and customer and supplier collaboration will allow wine cellars to forecast demand, set inventory more accurately and increase upstream collaboration with suppliers (Palm & van Eeden, 2018).

To improve collaboration between the various parties involved, a tremendous amount of information sharing and its visibility are required. Furthermore, it requires the necessary technological input such as an appropriate platform that can visibly display the required information. The current lack of management aspects, the relevant channels and technologies for sufficient information and data sharing, inhibits collaboration between bottling companies and their respective supply chain partners and the development of an adequate framework is required.

The main problem at hand is *a lack of guidelines that will enable wine bottling facilities and their supply chain partners to establish a collaborative partnership and improve information sharing, to improve planning, decision-making and co-ordination of supply chain processes aiming to increase reliability and responsiveness.*

The main research question addressed in this research project is: *“How can wine bottling facilities and their supply chain partners improve their decision-making capabilities to increase the reliability and responsiveness of the wine supply chain, whilst keeping supply chain agility, costs and asset management to acceptable levels?”*

1.3 Research aim and objectives

The aim of this research is to develop a framework that will guide the establishment of a collaborative partnership, aid collaborative planning and allow responsive decision-making through improved information sharing and communication between wine bottling facilities and their direct supply chain partners. Additionally, the aim includes the formulation of generic guidelines towards the implementation of a collaborative partnership.

The framework will enable the stakeholders within the context described to collaborate in new ways and means to improve their individual and collective supply chain efficiency and effectiveness, increasing reliability and responsiveness. This aims to address the main problem stated above and to answer the main research question. The Research Objectives (RO) that will support the realisation of this aim are divided into four key Research Objectives (RO 1 – RO 4), each with a number of sub-objectives.

The research objectives are:

RO 1. Understand supply chain collaboration initiatives, more specifically CPFR, and the **influence of industry 4.0** on collaborative planning initiatives.

RO 1a. Investigate the dimensions, benefits and challenges related to CPFR.

RO 1b. Provide an overview of the evolution of Industry 4.0 and digital technologies in order to understand how digitalisation concepts and technologies can enhance collaborative practices at bottling facilities.

RO 2. Investigate the supply chain operations of wine bottling facilities and their direct supply chain partners to:

RO 2a. Develop a detailed understanding of the current configuration of the wine supply chain and the information/communication flow between a wine bottling facility, wine cellars and dry goods suppliers.

RO 2b. Understand the existing implementation of industry practices, the challenges and the opportunities.

RO 2c. Use the literature studied to achieve RO 1 and information regarding current supply chain operations investigated to achieve RO 2, to formulate design requirements for a framework that will enable collaborative planning, forecasting and replenishment between the supply chain partners.

RO 3. Develop a collaborative framework and implementation guidelines that overlaps with the dimensions, challenges and benefits from RO 1 and the identified opportunities from RO 2.

RO 3a. Develop a collaborative framework for wine bottling facilities in South Africa, their wine-producing clients and dry goods suppliers that will enhance collaborative planning, forecasting and execution of processes in this supply chain environment.

RO 3b. Formulate implementation guidelines and five-step implementation approach for implementing the collaborative framework.

RO 4. Verify and validate the proposed collaborative framework by conducting subject matter expert (SME) interviews, followed by a theoretical case study to validate developed implementation guidelines.

- RO 4a. Plan and host validation interviews with SMEs.
- RO 4b. Validate the proposed collaborative framework based on feedback obtained from SMEs in order to ensure the inputs and processes contributing towards the development of the framework are satisfactory.
- RO 4c. Adjust the proposed collaborative framework to develop the final collaborative framework that is implementable by South African wine bottling facilities and their supply chain partners.
- RO 4d. Develop implementation guidelines based on final collaborative framework.
- RO 4e. Conduct a theoretical case study to determine how improved collaboration can aid planning and execution at South African wine bottling facilities based on the formulated implementation guidelines.

By achieving these objectives, the ultimate aim of more collaborative and integrated decision making, supply and replenishment will be possible for the stakeholders involved. It will ensure that the information flow between the various stakeholders in the supply chain is efficient and effective using the correct technology as well as having the necessary information visible to the relevant parties to ensure collaborative planning, forecasting and replenishment. This will help the industry to eliminate current inefficiencies and manage the 50% capacity increase required to change the packaged to bulk ratio to 60:40.

1.4 Research questions

The problem statement highlighted in section 1.2 is addressed by investigating the current supply chain operations of various stakeholders involved in the wine packaging process. This serves to identify the possible opportunities for collaboration to determine the appropriate dimensions to include in a collaborative framework developed for these stakeholders, which can be similar to the CPFR framework developed by VICS. Based on these dimensions, the appropriate implementation guidelines are formulated to assist stakeholders with understanding the information sharing requirements, and to guide joint planning and decision-making to ultimately improve their tactical and operational planning.

Furthermore, the relevance of digitalisation and the applicability of appropriate digital technologies to enable collaboration is investigated. Ultimately, this aims to improve reliability and responsiveness. This leads to the formulation of several research questions and research sub-questions addressed by this research to develop the appropriate theory that will answer the main research question and help the researcher to achieve the desired ROs. Table 1.3 gives an overview of the primary research questions paired with the related research sub-questions.

Table 1.3: Alignment of research questions and research sub-questions

Research Questions	Research Sub-Questions
1) What are the general benefits, challenges, inhibitors and enablers of CPFR relevant to the supply chain environment?	i. How can the implementation of CPFR benefit the South African wine supply chain, specifically the wine bottling process? ii. How can supply chain digitalisation and Industry 4.0 concepts potentially enhance CPFR?
2) How are South African wine bottling facilities and their direct supply chain partners currently doing the planning, forecasting and replenishment of raw material required to produce packaged wine?	iii. What is the current basic supply chain process and what channels of communication are involved in the bottling of wine at a South African medium-sized wine bottling facility? iv. What technologies are used by wine bottling facilities and other supply chain stakeholders for daily business-related communication and operations? v. What forms of collaboration currently exist in the South African wine bottling process and what are the existing challenges and opportunities?
3) What are the key success factors for improved collaboration between wine bottling facilities and their direct supply chain partners?	vi. What level of collaboration is required for different supply chain processes involved in the planning, forecasting and replenishment operations related to wine bottling?
4) How can a collaborative planning framework be developed for a wine-bottling facility and their direct supply chain partners?	vii. Which Industry 4.0 concepts and technologies can be utilised by wine bottling facilities and their supply chain partners to enable the desired level of collaboration? viii. How can such a collaborative planning initiative be implemented by wine bottling facilities and their supply chain partners?

Research Questions	Research Sub-Questions
5) Is the developed framework implementable within the intended supply chain environment and does it fulfil its intended purpose?	ix. Is the framework feasible, practical, adaptable and structured? x. Will this framework contribute towards enhanced information sharing, availability and visibility, leading to more responsive decision-making? xi. Will the implementation of such a collaborative initiative be beneficial in terms of improving the overall supply chain reliability and responsiveness of the South African wine industry?

These research questions and sub-questions are sequenced according to the planned order of completion of the different phases of the project, using the research approach described in Section 1.5 that follows.

1.5 Research methodology and approach

The research methodology followed to complete this study is a triangulation approach. Following this approach more than one method of data collection is used to corroborate qualitative research findings (Bryman & Bell, 2017). This consists of following an inductive qualitative method to develop theory based on previous literature, experience and observations, in this case the collaborative planning framework. Using an inductive approach involves reviewing research that focuses particularly on context-related literature that will be used to build the theory (Saunders, Gray, Tosey & Sadler-Smith, 2015). A thorough literature review is conducted to achieve this.

There are several sources that are used for the completion of the literature review, namely: journal articles, conference papers and proceedings and books, as well as some grey literature (i.e. online articles). The literature study is completed using a narrative review. According to (Sylvester, Tate & Johnstone, 2013), a narrative review synthesises or summarises existing literature written about a specific topic, providing a broad overview. This approach is particularly useful as research and literature forms the basis of this study.

The conclusion of an inductive approach may be probable based on the information provided by the theory formulated, in this case the framework developed. The development of the collaborative framework relies primarily on this data as input, as

well as data collected during semi-structured interviews with various industry stakeholders. The data serves to provide insight into the daily operations of stakeholders involved in the planning and execution of wine bottling in order to ensure the developed framework suits the operating environment and culture manifested in this industry, while also addressing relevant problem areas and needs identified. The verification and validation of the framework relies on feedback from a group of Subject Matter Experts (SMEs) covering a wide range of industry expertise to ensure that the framework is feasible, practical and structured in the correct manner.

The development of corresponding implementation guidelines follows and it is validated by conducting a theoretical case study. For the development of the appropriate framework and implementation guidelines, this research study is methodically divided into three phases, each aiming to achieve one or more of the objectives described in Section 1.5. Figure 1.2 provides an overview of the methodology followed to progress from problem formulation, to synthesis of the theory required for formulating the framework, followed by the development phase that is required to deliver the desired outputs. A short detailed description of the methodology of each chapter completed in this research project follows as an introduction to the relevant chapter.

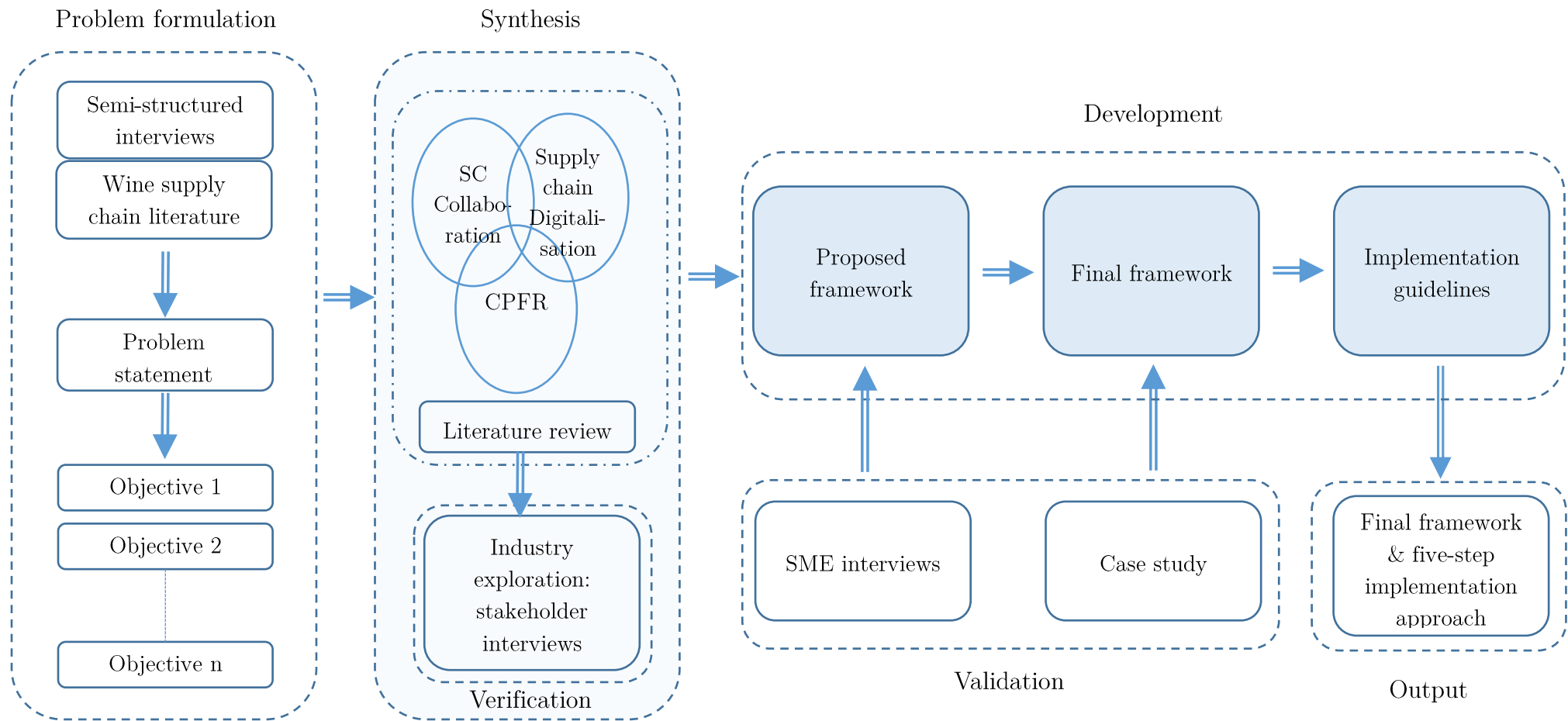


Figure 1.2: Overview of research project methodology

1.6 Research scope

The focus of this research is the South African wine industry and more specifically the interaction between wine bottling facilities, wineries and dry goods suppliers. This includes the various supply chain activities involved in the planning and execution of wine bottling that involves these stakeholders. The scope of this research study includes the suppliers, wineries and bottling facilities, thus excluding direct collaboration with distribution centres and demand points. For the scope of this study the planning and execution of bottling operations at small- medium-sized contract wine bottling facilities (bottling between 3 million and 5 million bottles annually) and the flow of information and goods between them and their supply chain partners are of interest.

Figure 1.3 illustrates the typical stakeholders involved in the production of packaged wine, clearly indicating which stakeholders are of importance for the scope of this study. It excludes mobile bottling operations as well as bottling operations performed by large-scale bottlers such as Distell and KWV. But it should be noted that the framework developed could be expanded to include stakeholders such as mobile bottlers. The collaborative framework and implementation guidelines are developed under the assumption that all the required information that is required from the involved industry stakeholders is readily available and will be shared within the boundaries of the appropriate ethical considerations.

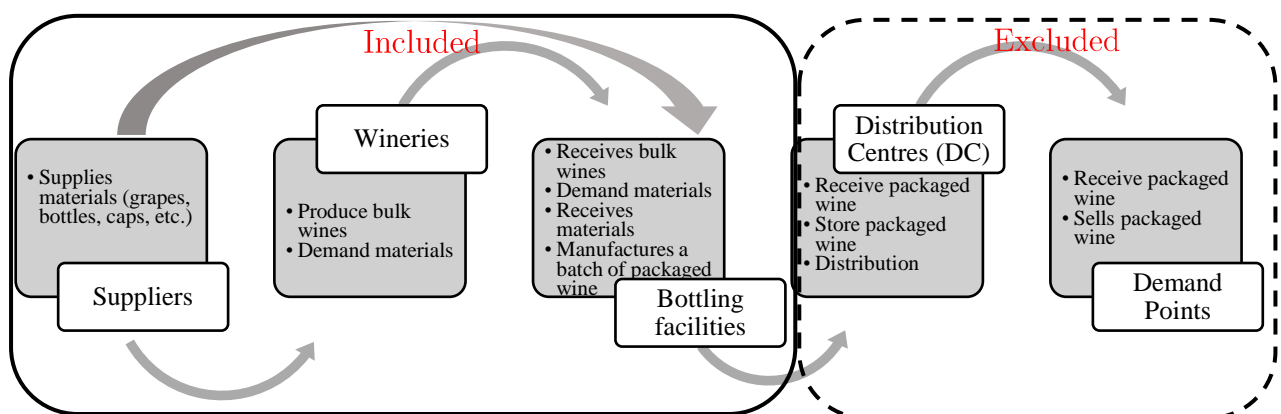


Figure 1.3: Basic scope of the wine supply chain (Source: Adjusted from Varsei and Polyakovskiy (2017))

1.7 Ethical considerations

Due to the nature of this project, the information that will be shared in order to develop the appropriate framework is bound to several ethical considerations. It is imperative that the following ethical issues are considered during the completion of this project: informed consent, voluntary participation, confidentiality and anonymity.

Informed consent implies that the participants interviewed for research purposes will be fully informed about the evaluation conducted and participants will be able to decide whether they want to take part in the evaluation or not. Participants interviewed will do so out of free will and may withdraw from the research at any time, as participation is voluntary. Confidentiality ensures that the sharing of information obtained from the relevant industry stakeholders will be used in accordance with the agreed upon NDA and anonymity enables all participants interviewed for the purpose of this project to remain anonymous, if preferred. As this research involves conducting several semi-structured interviews with industry stakeholders, these ethical considerations were adhered to by obtaining the necessary ethical clearance. The ethical clearance was approved in line with the specifications of Stellenbosch University.

1.8 Thesis outline

The thesis is structured according to the objectives set to be achieved, as highlighted in Section 1.5. Figure 1.4 provides an overview of respective chapters that are included in this thesis, as well as the objectives to be achieved by the content of each chapter.

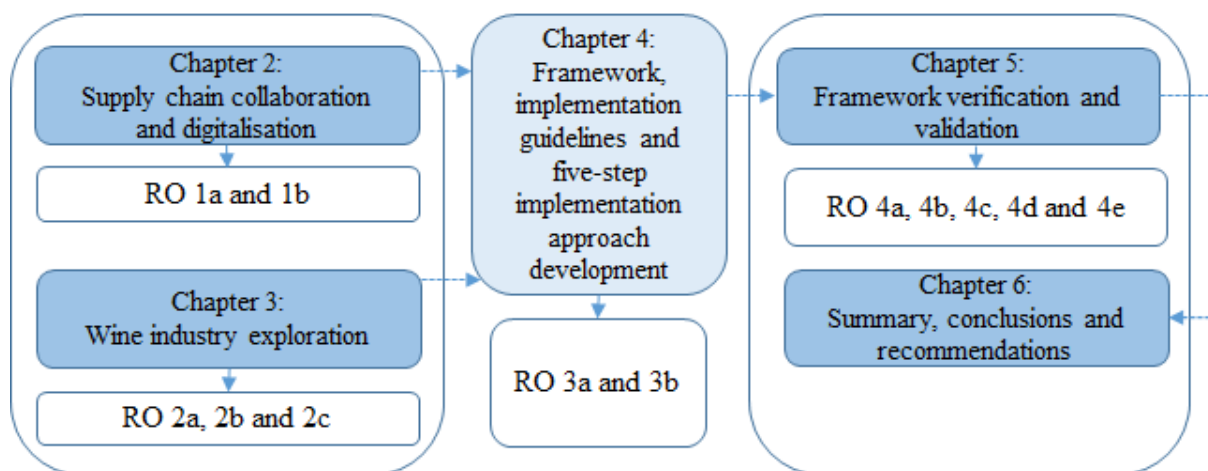


Figure 1.4: Thesis outline

Chapter 2

Literature Review

The previous chapter introduced the research project, providing some industry background, along with a description of the problem, the main research question and the primary objectives set to be achieved with this research. This chapter provides a review of aspects in the literature that are relevant to the research. This specifically serves to explain supply chain collaboration initiatives, more specifically CPFR, and the influence of Industry 4.0 on collaborative planning initiatives to achieve RO 1 as well as its sub-objectives, RO 1a and RO 1b.

The content of this chapter answers the following research question (RQ) and the related research sub-questions highlighted in Table 1.3 (Section 1.2):

- RQ1: What are the general benefits, challenges, inhibitors and enablers of CPFR relevant to the supply chain environment?

By answering this research question, one will be able to identify how the implementation of CPFR benefits the South African wine supply chain, specifically the wine bottling process. It will highlight the importance of technology and the impact of supply chain digitalisation on collaborative partnerships.

2.1 Verification of literature sources

The purpose of this literature review is to produce a set of theories that are relevant to the research topic (Ramdhani & Ramdhani, 2014). This provides a frame of reference for the formulation of a research framework relevant to the research problem. When literature forms the basis of research in making a framework, one has to ensure that the literature reviewed is compatible with the aim of the research and that it comes from reliable sources. This verifies that the framework has been ‘built correctly’ to ensure accuracy of the developed theory, model, framework or method (Ramdhani & Ramdhani, 2014).

For the purpose of this research study, the literature review serves as input for the formulation of an appropriate collaborative framework that addresses the research

problem, therefore it is important to ensure that the 54 sources studied are relevant and reliable. The sources used for the completion of the literature review (refer to Figure 2.1) include journal articles, conference proceedings, books and limited grey literature (i.e. online articles and reports).

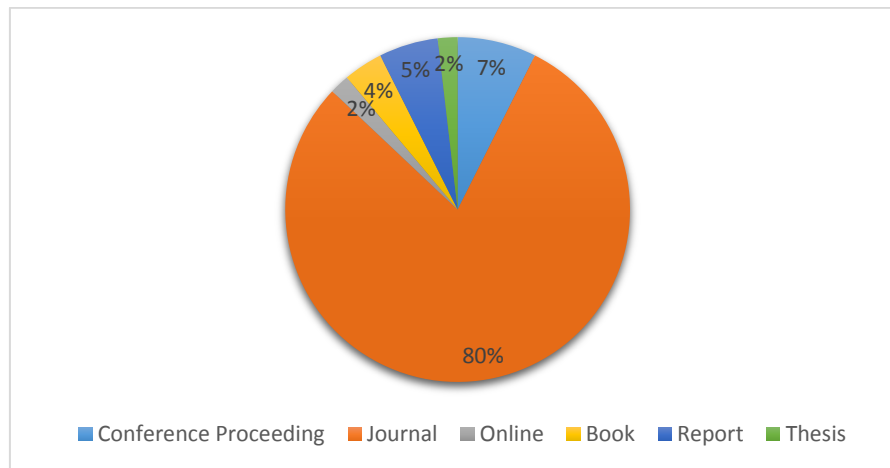


Figure 2.1: Composition of literature review source types

Looking at the distribution of source types, journal articles are most prevalent and several other source types are also included. Journal articles are trustworthy sources as they are peer-reviewed and published in accredited academic publications. Almost 60% of the sources were published within a timeframe of the past 10 years (refer to Figure 2.2). This ensures relevancy to fit current conditions, while older research relates to well-established industry definitions and concepts. The search engines used to find sources included Google Scholar, Scopus and the Stellenbosch University Online Library. Key terms related to the results of the searches included collaboration, CPFRR, collaborative framework, supply chain, digitalisation and Industry 4.0.

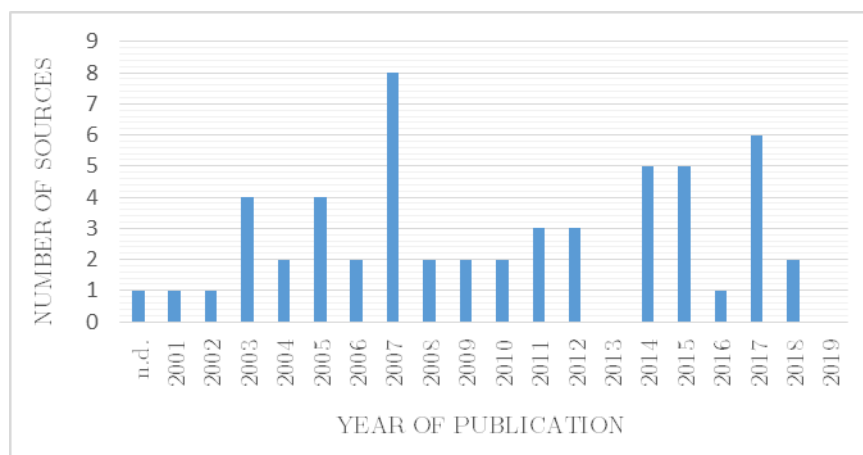


Figure 2.2: Distribution of yearly publication of literature review sources

2.2 Evolution of collaborative planning initiatives

Several collaborative planning initiatives have evolved over the years (Barratt *et al.*, 2001; Ireland & Crum, 2005; Danese, 2011; Singh *et al.*, 2018). The evolution started in the mid-1980s when Vendor Managed Inventory (VMI) was developed (Danese, 2011). Under this practice, it is the responsibility of the supplier to manage the replenishment process of their customers' inventory. Following this practice, Continuous Replenishment (CR) emerged (Singh *et al.*, 2018). This policy is very similar to VMI as the vendor uses the point of sale data of a customer in order to regulate the replenishment process to manage the inventory levels. Efficient Consumer Response (ECR) was later developed and this initiative is seen as the building block used to develop CPFR as displayed in Figure 2.3 (Whipple & Russel, 2007). The concept of CPFR first evolved in the mid-1990s and this technological innovation tool was first registered as a trademark in 1998 by the Voluntary Inter-industry Commerce Standards (VICS) (Panahifar, Heavey, Byrne & Fazlollahtabar, 2015).

The concept can be defined as a web-based platform coordinating a diverse range of supply chain activities, including purchasing and production planning, demand forecasting and inventory replenishment (Fliedner, 2003). Another definition states that CPFR is an interrelated set of processes whereby the various supply chain trading partners share information, risks, synchronised forecasts, costs and benefits with the goal of improving supply chain performance by means of joint planning and decision-making (Hollmann, Scavarda & Thomé, 2014).

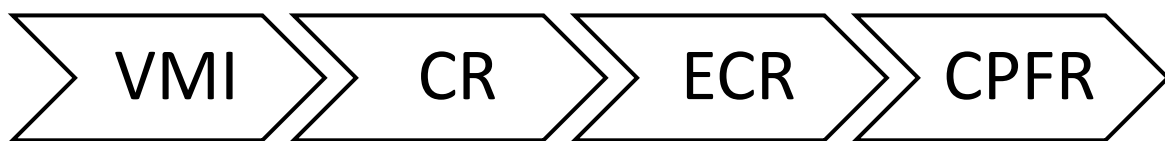


Figure 2.3: Evolution of supply chain collaborative initiatives (Adjusted from Singh *et al.* (2018))

CPFR was developed by VICS in 1998, aspiring to cover the gaps left by the previous collaborative planning initiatives mentioned (Barratt & Oliveira, 2001; Sheffi, 2002; Danese, 2011). This collaborative planning tool has a broader focus than the rest as it aligns plans across organisational boundaries through joint decision-making and exceptions management (Danese, 2011). The model developed by VICS in 2004 is a comprehensive model that allows companies the flexibility to choose where to focus their efforts at collaboration, as well as adjusting the sequence of tasks according to their preference (VICS, 2004). Barratt and Oliveira (2001) argue that the

comprehensiveness and flexibility that CPFR has to offer, addresses more issues previous collaborative tools did. These include:

- Incorporating promotional activities when forecasting and taking their influence on inventory management into consideration.
- Decreasing the lack of coordination between suppliers, manufacturers and customers.
- Increasing synchronisation of general functionality of a manufacturers' functionality in terms of production planning, sales and distribution.
- Considering the influence of changing demand patterns.

The major advantage associated with CPFR is thus joint business planning as demand and supply planning are coordinated. It is recognised as one of the most efficient practices in the value chain (Singh *et al.*, 2018) and implementation is often triggered by responsiveness issues (Danese, 2011). Due to the nature of CPFR and the current reliability and responsiveness issues experienced by the wine industry in South Africa, this collaborative planning initiative poses a possible solution to address these issues.

2.3 Supply chain collaboration

A supply chain is defined as a set of activities that consists of a wide variety of enterprise functions that range from ordering and receipt of raw materials, manufacturing and assembly of products, through to the distribution and delivery to the customer (Xu, 2011). The goal of supply chain collaboration (SCC) has been a topic of interest in various supply chain industries in recent years, involving the promotion of interorganisational information sharing, decision-making and knowledge transformation in order to establish a cooperative relationship between customers and suppliers (Danese, 2011) because the nature of the activities involved in a typical supply chain is primarily the flow of materials and information.

Collaboration within a supply chain network requires supply chain integration, which involves the design of a well-coordinated flow of information and materials, creating a smooth process throughout the entire supply chain. Integrating the information and material flow of different supply chain channels in the greater wine supply chain, can possibly allow for improved supply chain operations. In order to facilitate SCC along the various channels in the supply chain, the concept of CPFR has developed in recent

years, having several industry applications. It is a technique that enables information sharing and joint planning along the different supply chain channels, reducing supply chain inventories, while improving customer service (Danese, 2011). Its adoption rate has been slow, but the concept is gaining more acceptance as web-based communication technologies and technological expertise are advancing, as technology is one of the biggest enablers of the CPFR (Fliedner, 2003). Existing literature has proposed various CPFR models, modified over time and tailored according to application in different industries. This can also be done for the wine industry.

As each organisation in a supply chain has its strategy for its own planning, replenishment, forecasting, production schedules, etc., collaboration starts with defining common goals for the entire supply chain (Barratt, 2004). This can be achieved by building mutual trust between the various supply chain stakeholders involved through relationship management. Integration between the stakeholders becomes stronger as the level of information sharing and data exchange increases, leading to increased joint decision-making and coordination meetings becoming more frequent (Skjoett-Larsen *et al.*, 2003). The integration involved in collaborative planning depends on different factors such as the number of participating supply chain partners, the number of business processes involved and the degree of involvement of the actors in the collaborative effort (Danese, 2011). This calls for all stakeholders involved in such an initiative in the wine supply chain to commit to and actively participate in the development and implementation phases.

The success of collaboration depends on various different factors. This includes the following (Barratt, 2004):

- Why do we need supply chain collaboration?
- Which supply chain processes will benefit from collaborative efforts?
- Who will be the various stakeholders involved in different supply chain processes collaborations and what are the activities involved?
- What are the elements needed in order to facilitate collaboration successfully?

Thus, there are various enablers identified in existing literature that will allow supply chain partners to reap the various benefits related to a collaborative partnership. As with the implementation of any new process or concept, it is accompanied by several barriers and some disadvantages. This will be touched on later in this chapter.

Matopoulos, Vlachopoulou, Manthou and Manos (2007) developed a general research framework for SCC (refer to Figure 2.4). This framework provides a guide to some of the important elements to address when researching a collaborative initiative such as CPFR. It will guide the formulation of the literature review, as it highlights key concepts to consider.

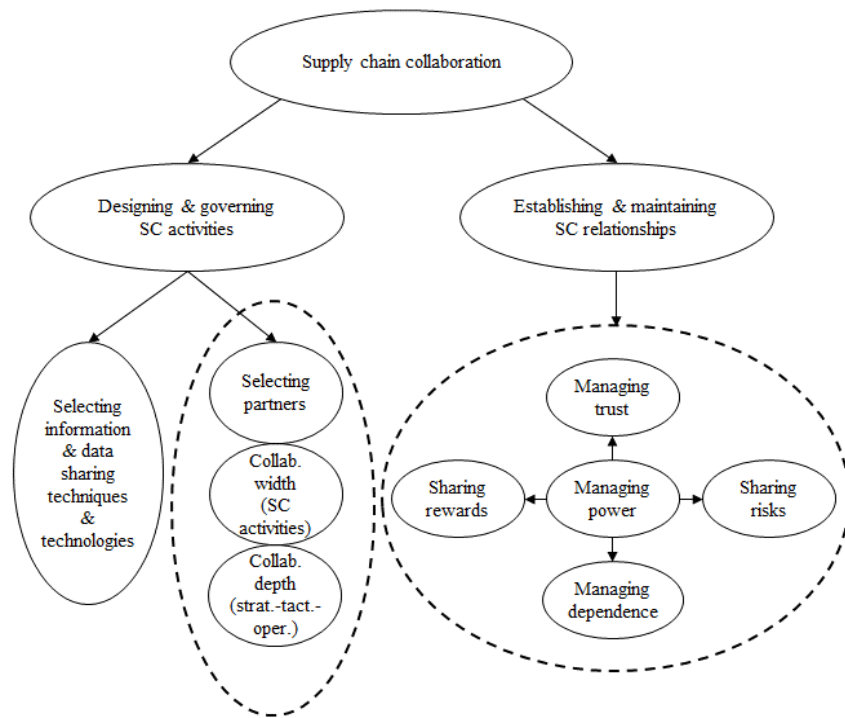


Figure 2.4: Research framework for supply chain collaboration (Matopoulos et al., 2007)

Collaboration involves the synchronisation of planning, forecasting, replenishment and extensive information sharing. With the evolvement of the use of the internet in recent years, new channels of information sharing have become available to supply chain players that ease the task of collaboration (Ramanathan & Gunasekaran, 2014). The complexity of information in supply chains is increasing, while at the same time the sophistication of information communications technology (ICTs) is increasing as well. The role of technology and ICTs (with reference to information sharing along the various channels of an entire supply chain) is not to be neglected and the importance of this factor as part of the success of collaboration follows later in this chapter.

Depending on the different factors to be taken into account when collaborating, the level of integration and the level of information sharing involved in a collaborative partnership, the level of maturity associated with a concept such as CPFR can be

defined, measured and characterised (Danese, 2011). This will ultimately serve as a roadmap for the development of collaborating partnerships in supply chains and guide the stakeholders to advance their level of collaboration in order to reap more benefits of such a relationship. Conducting some explorative industry interviews with members relevant to this study can assist with clarifying the current collaboration efforts and help to understand the requirements for a customised CPFR framework.

Literature proposes various other supply chain management initiatives such as Efficient Consumer Response (ECR), Vendor Managed Inventory (VMI) and Continuous Replenishment (CR) to support collaborative effort amongst supply chain partners (Danese, 2011). However, CPFR is the most promising and comprehensive to date. One of the main differences between CPFR and other initiatives is that both parties are notified of exceptions, allowing collaboration between the parties aimed at solving these exceptions (Du, Leung, Zhang & Lai, 2009, Sheffi, 2002), which will be of great benefit for wine bottling facilities and their supply chain partners.

CPFR allows extensive information sharing between suppliers and their customers, enabling them to jointly develop, update and correct forecasts and utilise shared information to drive planning and replenishment processes (Hill *et al.*, 2018). This makes it predominantly different from other collaborative planning initiatives and more beneficial for the parties involved. It can be successfully implemented when linked to other supply chain management best practices such as Sales and Operations Planning (S&OP) (Du *et al.*, 2009; VICS, 2010).

2.4 Collaborative Planning, Forecasting and Replenishment

Collaboration and integration within supply chain networks has been a common topic of discussions in recent years (Panahifar *et al.*, 2015). Supply chain integration consists of various activities related to the coordination of product flows between supply chain partners, including the movement of materials, procedures, and the optimisation processes, considering the flow of information (Vanpoucke, Vereecke & Muylle, 2017). The concept of CPFR was developed twenty years ago and aims to integrate the business plans of various supply chain stakeholders, managing the extended supply chain and ultimately creating competitive advantage for all the trading partners.

2.4.1 History of CPFR

CPFR was developed by experts in the mid-1990s, and originated from the concept of Collaborative Forecasting and Replenishment (CFAR), defined as an interorganisational system that allowed manufacturers and retailers to do joint demand forecasting and production scheduling (Hollmann *et al.*, 2014). As planning is an important component of collaboration, the concept CFAR was adjusted and renamed to CPFR. The first CPFR model was published in 1998 and the ECR in conjunction with the VICS committee revised this model in 2001, incorporating global requirements that were sanctioned by the Global Commerce Initiative (GCI) (VICS, 2004). This model was adjusted again in 2004, when the VICS CPFR committee did a major revision of the model to address the shortcomings of the original model and integrated several innovations, reducing the original nine-step model to a set of eight collaborative steps that was easier to understand, while also being more comprehensive (VICS, 2004).

It is a concept centred around extended information sharing between manufacturers, suppliers and retailers which often includes point-of-sales (POS) data, forecasts and promotion plans (Pramatari, 2007). Wall-Mart, SAP, Manugistics, Warner-Lambert and Benchmarking Partners were the first companies that conducted a CPFR pilot project that was initiated in 1995 involving Listerine products (Fliedner, 2003; Attaran & Attaran, 2007). By the beginning of 2000, the CPFR approach was considered a 'best practice' (Panahifar *et al.*, 2015).

The abbreviation is associated with a step-based approach which provides protocols, voluntary standards and guidelines needed to exchange sales and order forecasts between trading partners who belong to the same supply chain by using a web-based platform (Caridi, Cigolini & De Marcoz, 2005). It not only has to include sales and order forecasts, but can be extended to include collaboration to ensure that material demand is fulfilled by suppliers in order to maintain predetermined production schedules, an important element in the daily operations at wine bottling facilities. Using a CPFR approach to coordinate supply chain activities, both the seller and the buyer can correct, adjust and agree on quantity, price and delivery, so that both parties are able to reconcile their respective purchase and sales forecasts (Caridi *et al.*, 2005). The supplier is often responsible for replenishment based on actual usage of sales (Huo & Jiang, 2007).

2.4.2 Defining CPFR

VICS (2004) defines CPFR as the combination of collaborative intelligence of various trading partners used to plan and fulfil customer demand or a coordinated external collaborative process used as a strategic business management process to align the common capabilities of trading partners (VICS, 2010). Other definitions of CPFR describe it as “Collaboration where two or more parties in the supply chain jointly plan a number of promotional activities and work out synchronised forecasts, on the basis of which the production and replenishment processes are determined” (Skjoett-Larsen *et al.*, 2003). Yet another research group describe it as a set of cohesive business processes that allow supply chain trading partners to share information, synchronise forecast, cost, risk and benefits looking to improve the performance of the entire supply chain through joint planning and decision-making (Hollmann *et al.*, 2014). Fliedner (2003) defines CPFR as a web-based approach that can coordinate the diverse process of supply chain management including demand forecasting, production and purchasing planning and inventory replenishment. Other collaborative solutions models, such as Efficient Consumer Response (ECR) require a large number of participants to be involved and committed before any benefits are realised, whereas CPFR can be mutually beneficial if there exists a collaborative relationship between a buyer and only one supplier (Attaran & Attaran, 2007).

Although there are several different definitions and models in literature associated with CPFR, the primary goal of CPFR is to reduce non-value-added activities throughout the entire supply chain (Sattar, 2012). The central theme of the guidelines provided remains the alignment of business process and standardisation of information technologies to share forecasted requirements, schedules and other planning information simultaneously, globally and in real time, while still being secure (DeMin, no date). Having standardised information availability amongst different stakeholders in the wine supply chain will allow enhanced business process alignment, which in this case can be improved scheduling, production planning, exception notification and the management thereof, in order to improve responsiveness and reliability.

This corroborates the statement by Hollmann *et al.* (2014), stating that the purpose of CPFR is to improve the overall performance of a supply chain by using standardised information to create objective plans that allow the efficient flow of goods based on demand. Thus, a supply chain that is demand-driven throughout and plans production accordingly recognises the success of CPFR. Using a collaborative approach presents

multiple opportunities for vertical supply chain integration as displayed in Figure 2.5 below. This includes upstream supply chain elements being supplier relationships, supplier planning, production scheduling, collaborative design and collaborative transportation as well as downstream elements customer relationship management (CRM), collaborative demand planning, demand replenishment and shared distribution (Barratt, 2004).

The collaborative opportunities all depend on the nature of the supply chain. These are just some of the key elements to consider when developing a framework that facilitates CPFR. Whether your firm is a raw material supplier, a finished goods manufacturer, a seller or a retailer, implementing a best practice such as CPFR will reap significant benefits (VICS, 2010). These elements are of importance for wine bottling facilities, suppliers and wine cellars, as they contribute to the process of delivering grapes from farm to table as a packaged bottle of wine.

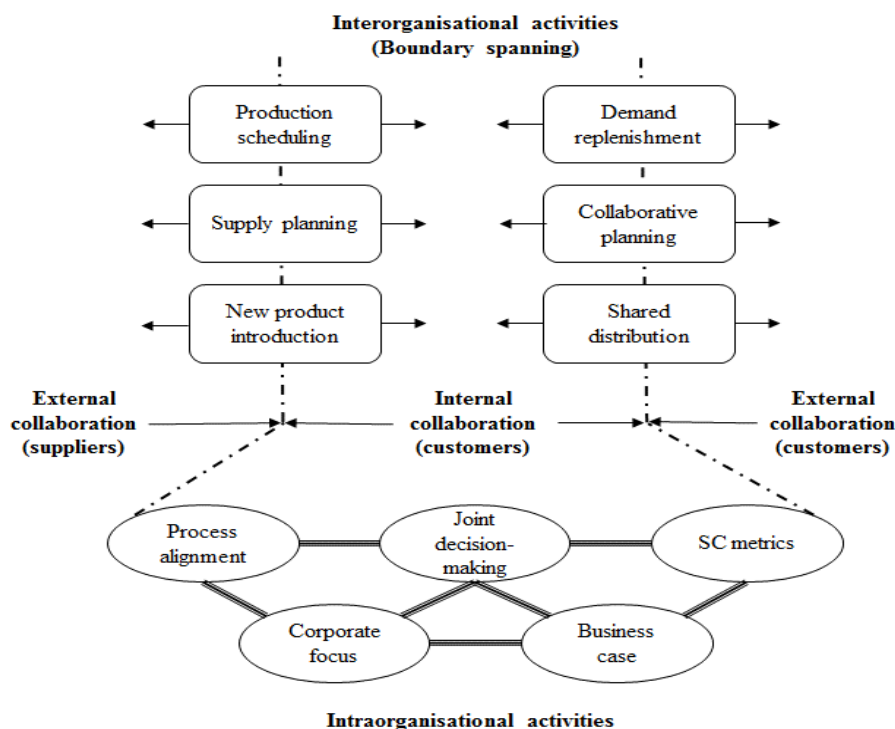


Figure 2.5: Scope for vertical integration and collaboration (Barratt, 2004)

A study conducted by Petersen, Ragatz & Monczka (2005) found the implementation of a collaborative planning initiative such as CPFR can significantly enhance the functioning and performance of a supply chain. Surveys were distributed to purchasing executives of companies located in the USA, Western Europe, Canada and the Pacific Rim. It investigated the effect of collaborative planning efforts on the performance of

the supply chain. This clearly indicated the importance of collaborative planning on performance measures and highlighted the importance of key planning processes, including:

1. Supplier scheduling – communicating and controlling needs and quantities for successful operation of the production system.
2. Inventory positioning and forecasting – ensuring that the correct quantities of materials/items are at the correct location when needed.
3. Inventory visibility – track locations of materials/items as well as usage thereof.
4. Capacity planning – ensure adequate capacity availability to manufacture/produce the correct requirements.
5. Supplier performance evaluation – ensure joint agreement and understanding between relevant parties.
6. Sourcing and supply proposal assessment – setting the terms and conditions related to purchasing, often including price, quantity discount, quality, etc.
7. Joint goal setting – alignment of performance targets and related metrics.
8. Material standardisation – reduce the number of unique materials.

These are all processes that are very relevant to any wine bottling facility, driving joint production scheduling, delivery of material and distribution, while managing exceptions with more ease. CPFR will allow bottling facilities to realign changes deviating from the original forecasted plans and generate collaborative actions to ensure the least amount of disruptions to the bottling schedule, as it will enable visibility of relevant information needed along all the channels of the supply chain. This in return will enhance reliability and responsiveness of the wine supply chain in its entirety.

Since the development of the original nine-step approach, several other CPFR models have evolved in literature, having a varying amount of steps, tailored for different industry applications and supply chain orientations. The configuration of CPFR is context-dependent and formats vary, as a given supply chain network can implement several formats altogether, limit the collaboration to some of the steps of the basic VICS model or customise the steps according to their specific network (Hollmann *et al.*, 2014).

2.4.3 Current CPFR models

As mentioned previously, the first CPFR model was developed by VICS in 1998.

Danese (2006) discussed the CPFR VICS model released in 1998. This model consisted of nine steps (displayed in Figure 2.6)

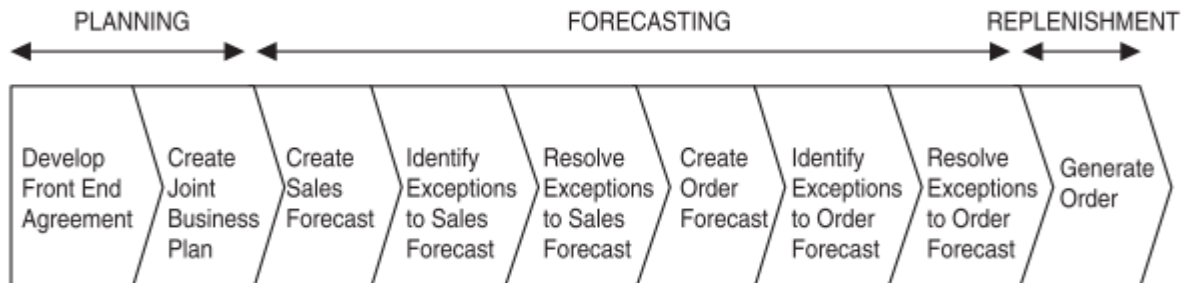


Figure 2.6 Activities of the original nine-step CPFR process

A revised model released in 2004 followed the original model created. The revised model consisted of only eight tasks, addressing shortcomings of the previous model and integrates innovation (VICS, 2004). This process model involves an interactive cycle consisting of four collaborative phases shown in Figure 2.7. Each phase consists of a set of collaborative tasks for both retailers and manufacturers, as well as specific tasks for each member respectively. It ultimately aims to link the planning and operations of the manufacturer with the planning and operations of the supplier through the collaborative tasks forming part of the four phases. CPFR enhances and is compatible with conventional ordering processes and VMI. This model is the most recognised model in CPFR literature and is often used as the starting point for the development of new CPFR models.

The four collaborative phases each consist of two tasks (VICS, 2004; Sattar, 2012):

- 1) Strategy and Planning: The *Collaboration Agreement* aims to establish the boundaries for collaborative relationship, by setting the collective goals, describing the scope of collaboration and allocating the necessary roles and responsibilities. Developing a *Joint Business Plan* for the agreed upon period helps to determine product mix and placement, as well as identify events that influence supply and demand for the planning horizon.
- 2) Demand and Supply Management: For the given planning horizon, project the demand, order requirements as part of *Sales Forecasting*. *Order Planning/Forecasting* determines future product requirements, using sales forecast, position of inventory, lead times (LT), etc., allowing production

scheduling and planning of shipment requirements.

- 3) Execution: This phase includes *Order Generation*, followed by placement of orders, production, shipping and delivery of orders. The orders are received and products are stocked, sales/usage transactions recorded and payments are made.
- 4) Analysis: *Manage Exceptions* by monitoring planning and execution of activities. Combine the results of the given planning horizon, calculate key performance metrics, and conduct a *Performance Assessment*. Evaluate business goals achieved and use the insight gained to adjust the future planning in order to ensure continuous improvement.

This can be expanded into Enterprise Tasks, specifically based on the roles of the suppliers and manufacturers as displayed in Figure 2.7 below. This depends on the nature of the supply chain, the scope, depth and width (see Section 2.4.5) of collaboration, which influences the execution of these tasks by the respective supply chain partners.



Figure 2.7 CPFR Model-Manufacturer and retailer Tasks (VICS, 2004)

There are several other models that also exist in literature. These models are often just a slight deviation from the original VICS 1998 model, consisting of less or more steps

and some alterations to some of the tasks performed. Looking at the basic steps and tasks in these models one can customise a similar framework suited for the needs, challenges and opportunities present at wine bottling facilities. The most predominant steps are *agreement formulation*, followed by *planning and forecasting*, then *implementation* and *performance measurement*, while each of these consist of several sub-steps recommended by different authors as depicted in Figure 2.8.

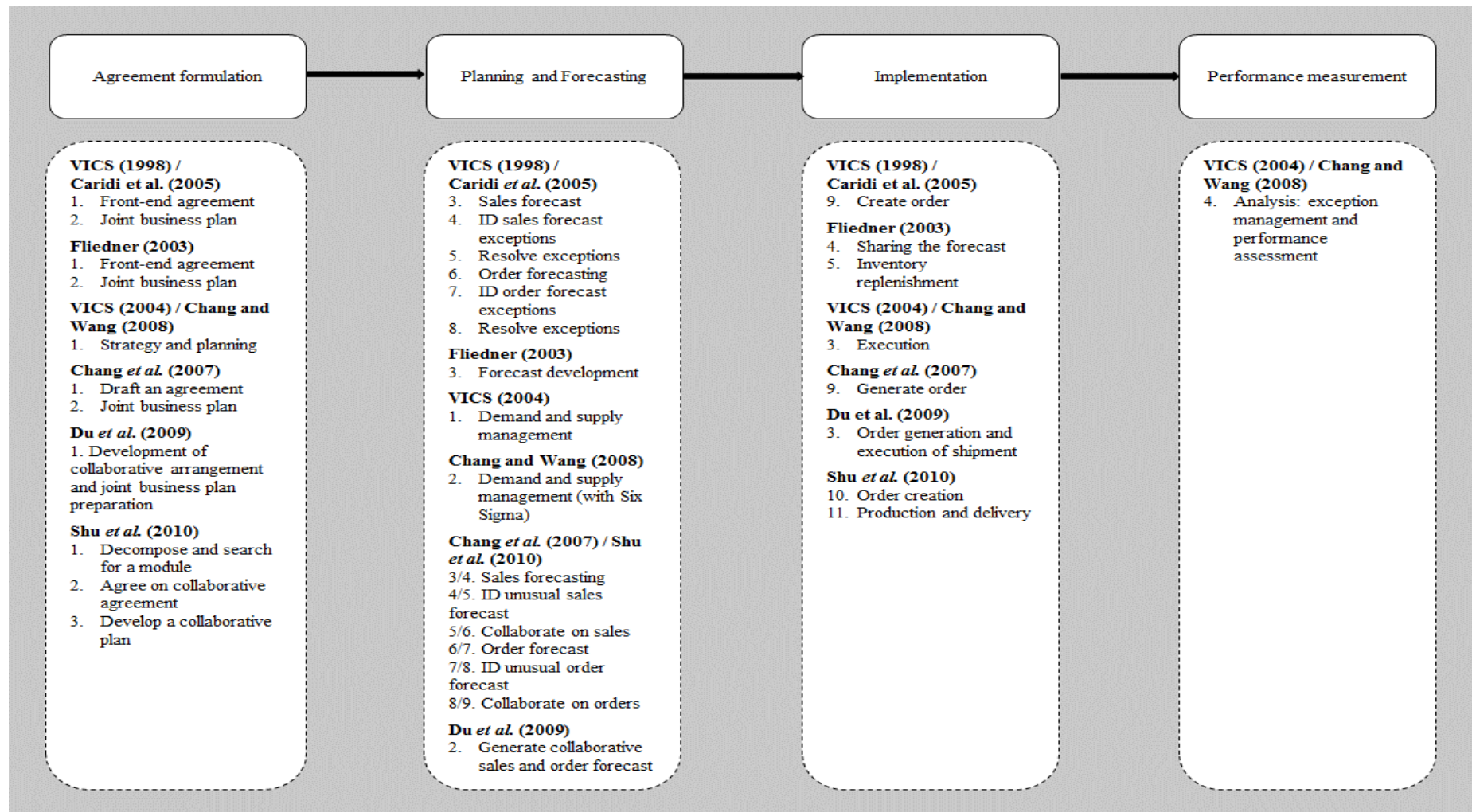


Figure 2.8: CPFR models (Adjusted from Hollmann et al. (2014))

According to Cao and Zhang (2011), implementing supply chain collaborative initiatives will only be beneficial when all the members in the supply chain cooperate. They mentioned seven dimensions of collaboration as goal alignment, information sharing, communication, decision synchronisation, resource sharing incentive alignment and joint knowledge creation. The VICS 2004 model can be utilised to incorporate multiple business partners, resulting in an n-tiered collaborative model as displayed in Figure 2.9. Depending on the scope of implementation, having the ability to expand collaborative initiatives to multiple tiers, creates an opportunity for expansion amongst more stakeholders further upstream and downstream in the wine supply chain.

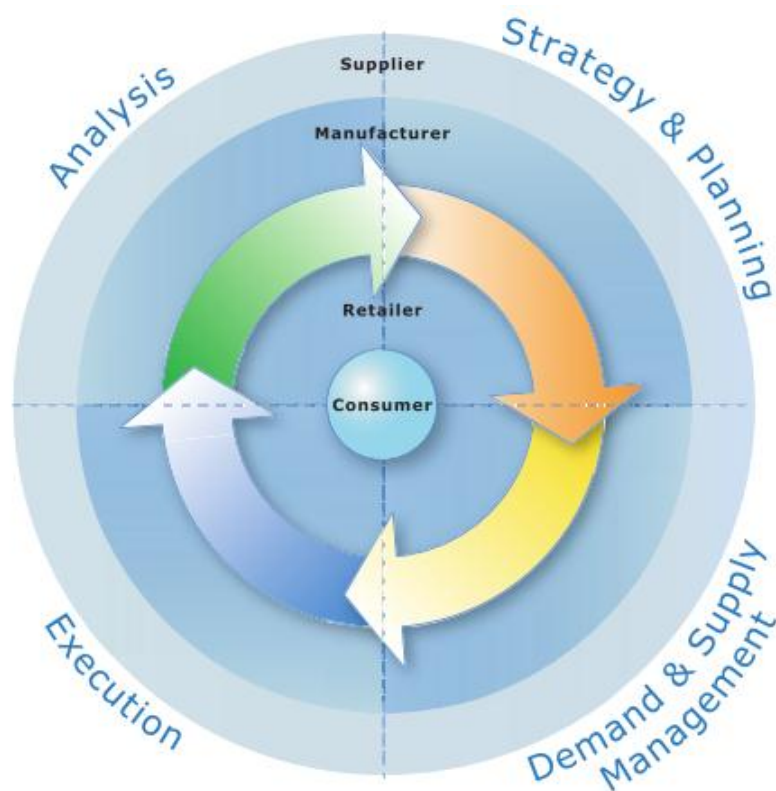


Figure 2.9: n-tier collaboration (VICS, 2004)

This can be described as the relationship between the retailer, manufacturers or distributors and multiple suppliers, placing the suppliers in the enclosing ring of the model (VICS, 2004). A simple example is the involvement that starts at the supplier, collaborating with the manufacturer, who in succession collaborate with the retailer and potentially the distributor, followed by the consumer. This CPFR model is designed to be able to fit different scenarios involving a different combination of business partners (Sattar, 2012). It is important to integrate the seven dimensions mentioned by Cao and Zhang (2011) when performing the various tasks of CPFR as it

enables integrated collaboration between the various business partners in different scenarios.

Adapting the model to suit the needs of the trading partners involved in a specific supply chain environment is inevitable. Any individual CPFR programme must adapt the model to the particular needs of the trading relationship. Of the alternative approaches that have been documented, four specific scenarios have dominated large-scale CPFR deployments. Table 2.1 summarises the four scenarios by their applicability to product categories, distribution methods and the industry segments in which they are mostly applied.

Table 2.1: Collaborative scenarios (VICS, 2004)

Scenario	Applicability	Industry
Retail event collaboration	Highly promoted channel	All industries
DC replenishment collaboration	Retail DC distribution	Grocery, hardware and drug chain
Store replenishment collaboration	Direct store delivery or retail DC-to-store distribution	Direct store delivery grocery, club store and mass merchant
Collaborative assortment planning	Seasonal goods and apparel	Department stores and specialty

Retail event collaboration is prevalent in the retail environment as there are several retail events (e.g. promotions) that influence demand and which result in problems such as product stock-outs, excess inventory or additional logistical costs. This CPFR scenario provides a standard approach that helps retailers and their supply chain partners to focus on these events to prevent problems from arising or minimising the effect.

A joint business plan and collaborative strategy is developed based on promotional planning, typically done on a quarterly or annual basis. The main strategy is to determine the impact of a specific event, predicting consumer demand. The necessary orders are placed within the related ordering window before the promotional events occur, delivery takes place and the event is executed in the stores. As part of the CPFR phase, exceptions are identified and resolved, whereafter the analysis of the

performance of the event concludes the process.

DC replenishment collaboration allows joint ordering at multiple horizons beyond a single lead time (LT). This collaborative process enables the adoption of a make-to-demand policy, while minimising inventory levels and stock-outs. Furthermore, it allows trading partners to align production capacity with customer demand and to optimise the flow of products between the different trading partners. DC withdrawal forecast, manufacturer-to-DC forecast or both are used to plan orders for a given time horizon, collectively demanding the buyer and seller to plan production and supply accordingly.

Store replenishment collaboration is similar to conventional DC replenishment, as one trading partner executes it over a single LT horizon. The collaboration uses POS forecasts, store clustering, assortment clustering replenishment parameters and presentation stock, generating an order or orders for the given time horizon. The benefits attributed to store replenishment collaboration include improved consumer demand visibility, improved operational execution, improved replenishment accuracy, decreased stock-outs, inventory level reduction and improved promotional execution.

Collaboration assortment planning is most applicable for industries having seasonal demand patterns, e.g. the textile and fashion industry. The collaborative planning horizon typically includes a single season and is performed in seasonal intervals. Due to seasonality, there is minimal historical data available that can be utilised to generate forecasts used during the planning phase. Thus, the interpretation of consumer tastes, industry trends and macroeconomic conditions is very important. These interpretations are used to create a jointly developed assortment plan, including both product designs and financial models.

Having different supply chain scenarios requires there to be different levels of collaboration roles with a CPFR process and business partners have different levels of responsibility. The modification of existing demand and replenishment processes is required in order to integrate CPFR successfully along all the channels of the supply chain. It is thus important to identify the correct collaborative scenario to a specific supply chain setup, developing the CPFR model accordingly and ensure its successful implementation. Once the operation of a wine bottling facility has been classified given the four collaborative scenarios in Table 2.1, the VICS model can be used as base and adjusted to include the collaborative planning activities required to drive

responsiveness and reliability.

The wine industry relates closely to the apparel industry, as there are several similarities between them. Both of these industries have volatile demand, seasonal sales, lack of historical data (for new wines launched), long lead times, relatively short product life cycles and highly competitive markets (Knoblauch, 2018). Thus, the wine industry can benefit most from a collaborative assortment planning orientated CPFR model.

2.4.4 Industry applications

CPFR is an initiative that can basically be applied to any industry, but research has largely focused on industries such as apparel, food and general retail (Fliedner, 2003). Panahifar *et al.* (2015) show that the majority of reported CPFR implementations have been in the retailing, groceries and high-tech sectors, but it has the potential for wider applicability beyond the traditional domain. Research shows that the majority of studies regarding the successful implementation of CPFR focuses on these industries (refer to Figure 2.10). There exists a need to develop guidelines that will streamline the successful implementation of CPFR in other industries which can also benefit from collaborative partnerships throughout the supply chain (Panahifar *et al.*, 2015). This opens the door for research to guide the successful implementation of CPFR in a fast-moving consumer good industry for a product such as a bottle of wine, which also forms part of the greater agricultural supply chain.

Both high-tech and the apparel industries are examples of industries with similar characteristics to the wine industry in which CPFR has proven to be of value. Characteristics correlating between the wine industry and high-tech industry include short product life cycles with some components having long lead times, a limited number of suppliers to supply components and individuals as end consumers (Knoblauch, 2018). Typical similarities between the apparel industry and the wine industry include volatile demand, seasonality of sales, long lead times, short product life cycle and a competitive market (Knoblauch, 2018). A study conducted by Jaramillo and Teng (2006), investigating small to medium-sized apparel companies, indicated that typical planning and forecasting can be enhanced by online visibility. Suggested improvements for similar supply chains include strategic partnerships with supply chain members and improved transparency along the channels of the supply chain.

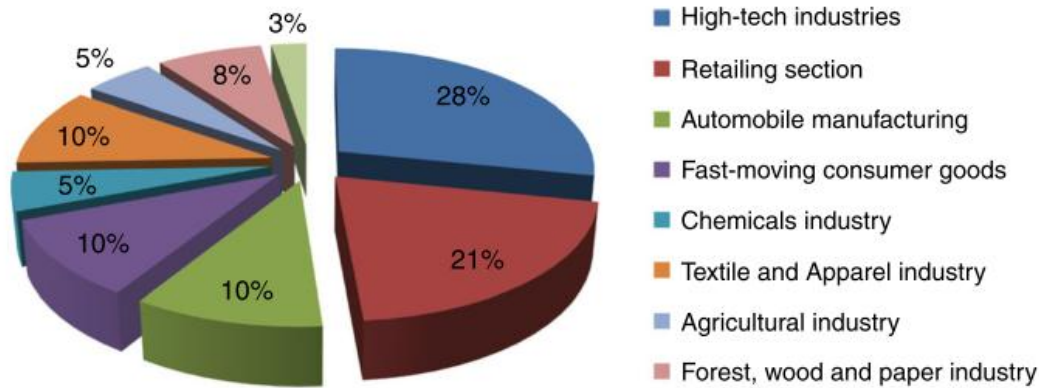


Figure 2.10: Percentage of CPFR studies in different industries (Panahifar *et al.*, 2015)

By 2013, more than 300 companies have already implemented CPFR (Hollmann *et al.*, 2014). As the fundamental activities of CPFR can be customised according to the variation of supply chain scenarios as described in Section 2.4.3, the extent of collaboration and flow of information differ. In a supply chain having seasonal demand such as the textile and fashion industry, product designs change quickly based on customer demand. In this case, information provided by downstream members of the supply chain help upstream members to adjust their plans such as product specification and production scheduling (Ramanathan & Gunasekaran, 2014). Other supply chain configurations may involve collaboration with logistical providers to ensure replenishment of orders is on time.

One industry that has specifically been paid attention to with regards to the implementation of CPFR is the grocery retail sector. As Walmart and Procter & Gamble were the first to launch a pilot project to implement CPFR, the groundwork was first established in this sector. To date, the retailing sector contributes towards a large percentage of CPFR studies, amounting to approximately 21% (Panahifar *et al.*, 2015).

Other CPFR pilot projects include Walmart and Sara Lee's Hanes brand involving 50 stock keeping units (SKUs) of underwear delivered to approximately 2500 Walmart stores, Heineken USA using CPFR to reduce order-cycle time and Levi Strauss & Co. who incorporate CPFR into their retail replenishment service (Danese, 2006). Dell computers leverages the internet in dealing with both suppliers and customers. The company utilises the advantages of CPFR to manage their worldwide supply chain, by sharing demand data to avoid unnecessary fluctuations and share current inventory position of components and products with their supply chain partners (Attaran &

Attaran, 2007).

The wine industry can utilise this specific attribute of CPFR to improve supply chain transparency and increase efficiency. Other industries whose trading relationships have also been significantly influenced, include chemical, automotive and high technology industries (VICS, 2004). A study done by Hill *et al.* (2018) that investigates the influence of CPFR on company performance identified 102 companies that have already implemented CPFR. These companies come from a broad range of supply chain industries and provide a good indication of the applicability of CPFR in varying industries. Table 2.2 provides an overview of the industries with frequent CPFR implementations.

Table 2.2 Industry examples of CPFR implementation (Adapted from Hill et al. 2018)

Industry	Frequency
Food and kindred products	13
Chemical and allied products	13
General merchandise stores	9
Food stores	8
Miscellaneous retail	8
Electronic and other electric equipment	8
Industrial machinery and equipment	6
Apparel and other textile products	5
Automotive dealers and gasoline service stations	4
Transportation equipment	4
Paper and allied products	3
Business services	3
Building materials, hardware, garden supply, & mobile	3
Furniture, home furnishing and equipment stores	3
Conglomerates	2
Rubber and miscellaneous plastics products	2
Instruments and related products	2
Leather and leather products	1
Apparel and accessory stores	1

Industry	Frequency
Fabricated metal products	1
Wholesale trade-nondurable goods	1
Lumber and wood products	1
Textile and mill products	1

A case study conducted by Audy, Lehoux, D'Amours and Rönnqvist (2012) focused on developing a framework for the implementation of efficient logistics collaboration. One of the case studies performed focused on a pulp and paper producer and the establishment of a collaborative partnership with one of its clients. In this context, the producer was responsible for planning operations in order to minimise production, inventory and distribution cost, while the client was responsible for ordering products with the aim of minimising buying, ordering and inventory cost. Changes in client orders generally had a big impact on the production system of the producer and the producer aimed to establish a collaborative relationship with the client. This led to the identification of four possible collaborative approaches namely the traditional non-collaborative system, CR, VMI and CPFR. The four collaborative approaches was tested using various decision models and the results showed that CPFR proved to be the best for efficient optimisation in terms of greatest total system profit. If managed correctly, this can also be the case for relevant stakeholders in this research study.

The functioning of a small- medium-sized wine bottling facility functions on the same principle, as the facility has various clients that are responsible for ordering dry goods from wholesalers. These dry goods in return have to be delivered on time to ensure that production and distribution can take place as scheduled. Implementing CPFR can optimise planning, ordering and replenishment for this specific industry, while yielding maximum system profit and improved order fulfilment. Not much research related to CPFR and its implementation has previously been done in the agricultural sector and more specifically the wine industry. The implementation of CPFR can help this industry to improve its supply chain performance, as collaboration in the agricultural industry has previously proven to be beneficial (Du *et al.*, 2009).

2.4.5 Implementation of CPFR

The implementation of a best practice such as CPFR and its effect on the performance of a supply chain is dependent on several variables related to the scope of the initiative (Danese, 2011). This includes the complexity of the supply chain (number of partners involved and the diversity of products); the specific goals of the CPFR process (efficiency vs responsiveness) and market dynamics (demand uncertainty). Having collaborative partnership within a supply chain environment will help the trading partners to gain advantages in planning, forecasting and replenishment areas.

Academic writing reports that countries having implemented CPFR varies, with most studies conducted in the USA and Europe, but the Philippines, Taiwan, Mexico, India, Canada and the Middle East are also well represented. The industries covered in these studies include apparel, food, agriculture, healthcare, general merchandise retail, transportation, computers, mechanical equipment, pharmaceutical, automotive and packaging, relating back to the industry applications covered in Section 2.4.4.

In a study done by Skjoett-Larsen *et al.* (2003), questionnaires were sent to 218 Danish companies to establish the areas that would benefit most from collaborative partnerships. The results of the study indicated that product development collaboration would gain most, followed by replenishment collaboration, then forecasting collaboration, production collaboration, transport collaboration and lastly promotion collaboration. Replenishment collaboration, forecasting collaboration, production collaboration and transport collaboration are all aspects that can be beneficial for wine bottling facilities and their supply chain partners. These aspects are some of the main areas to address when developing CPFR framework for this industry and are areas for further investigation.

Thomé, Hollmann and Scavarda do Carmo (2014) identified five features that can assist trading partners when planning and discussing the implementation of CPFR. These features include:

1. Developing a collaborative performance system: metrics that will help members of the supply chain to improve overall performance.
2. Synchronised decision-making: optimise profitability by managing critical decision at both planning and executional levels. Decisions may include sales and order forecasts, order placement, replenishment, order delivery, inventory, customer service level, and pricing (Simatupang & Sridharan, 2005).

3. Information sharing: monitoring the flow of goods in the supply chain by having access to the necessary data.
4. Incentive alignment: motivate partners to achieve the overall performance targets as per the collaborative performance system by sharing benefits, risks and costs.
5. Supply chain process integration: ensure supply chain efficiency in order to deliver a product of good quality to the customer on time and at a lower cost.

The VICS model is often used as the foundation for the implementation of CPFR, but this guideline is rarely followed completely. Research by Skjoett-Larsen *et al.* (2003) suggests that there is a gap between this guideline model and its implementation. The type of collaboration between supply chain partners can vary significantly. The research proposed that the level of collaboration is directly influenced by the scope and depth of collaboration, thus influencing the implementation of a collaborative practice such as CPFR. Collaborative partnerships can be divided into three levels: basic CPFR, developing CPFR and advanced CPFR (refer to Figure 2.11).

Basic CPFR only involves a few business processes and the integration between trading partners is limited. This entails identifying a few key processes between supply chain actors and exchanging information related to a single area such as order planning. A simple example will be the exchange of stock level data between a supplier and a client. In this case, information is shared but the process of order planning is not coordinated or synchronised. Such a collaborative relationship only utilises the advantage of information shared to minimise the costs of transactions, described as a transactional theoretical approach to collaboration.

Increasing the number of collaborative areas, advances the level of collaboration to *developed CPFR*. This can be achieved when collaborative partners agree about the type of information that they exchange and the appropriate response to the data exchanges, encompassing the process to be more coordinated. An example of developed CPFR could be the exchange of stock level data and the forecasted demand, increasing the collaboration by trusting the supplier with the responsibility of replenishment. In contrast with the motive of basic CPFR to minimise cost, developed CPFR focuses on increasing trade by improving customer services. Trading partners who enter developed CPFR focus on generating trust in their relationships and frequent information exchange.

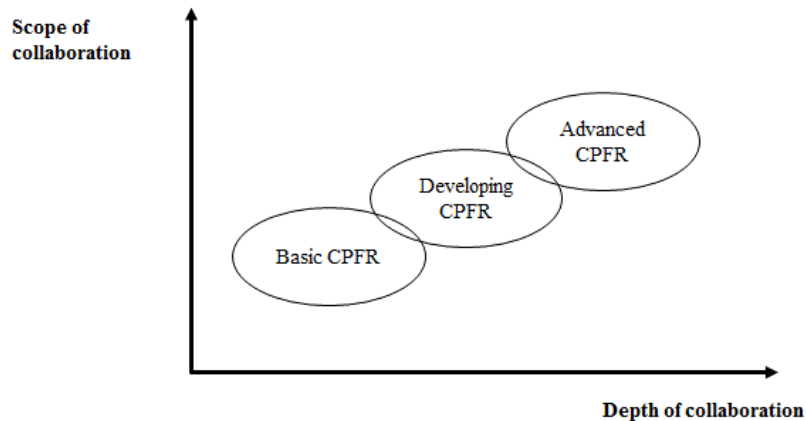


Figure 2.11: Levels of collaboration (Skjoett-Larsen et al., 2003)

When expanding coordinated processes to include planning, forecasting and replenishment, supply chain trading partners enter an advanced collaborative relationship, known as *advanced CPFR*. Planning can be decomposed to include collaboration on product development, production planning and scheduling, transportation planning and marketing activities. Advanced collaboration focuses on having joint objectives, even though goals may differ. In a basic supplier-retailer relationship, the supplier will most likely focus on collaborative forecasting and replenishment to improve production and reduce stock levels, while the retailer will aim to fulfil customer demand by having stock at the right time and the right place. Entering advanced CPFR collaboration leads to a more agile and flexible supply chain, increasing competitiveness as supply chain partners will have transparent information sharing.

A realistic approach towards the successful implementation of CPFR will be to focus on relationships and processes first, then expand the concept over time to include an increasing amount of processes, depending on the nature of the current collaborative capabilities of wine bottling facilities and the level needed. Advancing the relations from basic to advanced, based on these three levels of collaboration, the main differences between the nature of the three CPFR relationships are illustrated in Table 2.3. Looking at these dimensions, an industry analysis can assist with clarifying the current level of collaboration, if present, and identify the level of CPFR implementation required in this supply chain setup.

Table 2.3 Dimensions of different CPFR levels (Skjoett-Larsen et al., 2003)

Dimensions	Basic CPFR	Developed CPFR	Advanced CPFR
Shared information	Sales and order confirmation Inventory data	Demand data Order planning data Promotion data Production data	Demand data Order planning data Promotion data Production data
Degree of discussion	No	Some	Frequently
Coordination/synchronisation	No	Some	All activities
Competence development	No	No	Knowledge
Evaluation	No	No	Experiences
Type of relationship	Transactional	Information sharing	Mutual learning
Theoretical explanation	TCA	Network	Resource- and competence-based

The influence of cultural elements is not to be ignored when considering the implementation of CPFR. Most corporate cultures are not capable of supporting internal and external collaboration (Barratt, 2004). Collaborative culture is supported by several elements, consisting of strategic-, collaborative- and cultural elements (refer to Figure 2.12). Establishing a collaborative culture requires several initiators that enhance these elements.

Some initiators include: commitment, common goals, collaboration fluency, coordination, performance measures, decision synchronisation, information quality, information technology, management commitment, role definition and willingness to innovate (Ralston, Richey & Grawe, 2017). A set comprised of seven elements has been identified in research by Cao and Zhang (2011), that makes effective SCC possible: goal congruence, incentive alignment, decision synchronisation, information sharing, resource sharing, joint knowledge creation and collaborative communication.

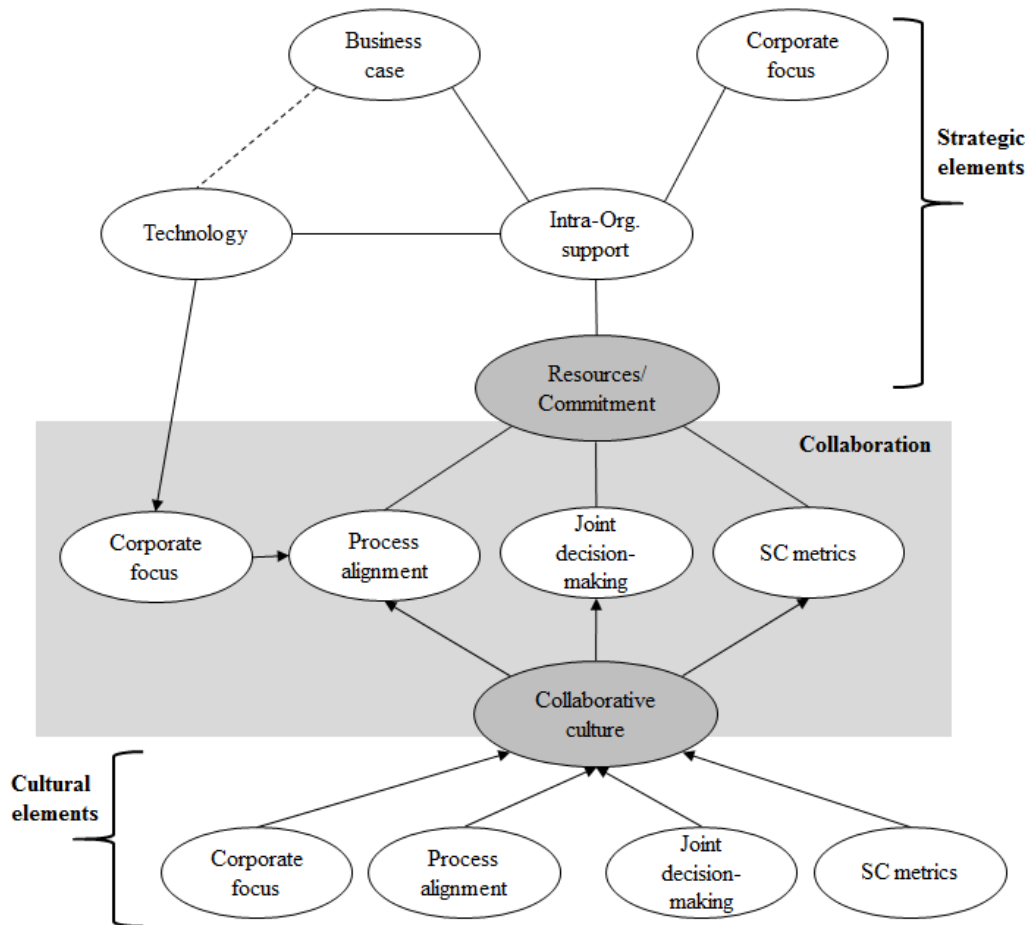


Figure 2.12: Elements of a collaborative culture (Barratt, 2004)

When developing a CPFR model for a specific industry, it is important to consider the level of collaboration, together with the different elements that are required to establish a collaborative culture within a supply chain environment. This will help to identify the right dimensions that need to be included in the framework and incorporated into the different phases and steps of the model, specifically for the collaboration between a bottling facility and selected supply chain partners in the case of this study. Integrating supply and demand processes within a supply chain can be achieved by using CPFR as a roadmap for successful collaboration.

Based on preliminary discussions with some industry stakeholders, this feature does not currently have a strong presence and could be an area to address in this industry. Before implementing this initiative, several enablers and barriers have to be taken into consideration, while considering factors such as the advantages, disadvantages, information sharing and technological requirements, as well as who to collaborate with and to what extent supply chains must collaborate with each other.

2.4.5.1 Enablers

Collaborative enablers dictate the number of mutual actions used to drive supply chain performance. Numerous literature sources have deemed the quality of information sharing, trust and technology as powerful CPFR enablers along with several other important enablers listed in Table 2.4. A high level of trust between buyers and suppliers positively relates to many collaborative planning processes, which include information sharing and use of technology (Petersen *et al.*, 2005). Building a trustworthy relationship between supply chain partners is a very important enabler of collaborative success. However, these enablers are not the only key to success as some other enabling factors also contribute towards successful implementation.

Table 2.4: Summary of CPFR implementation enablers

Enabler	Source(s)
Trust	(Hollmann <i>et al.</i> , 2014), (Panahifar <i>et al.</i> , 2015), (Singh <i>et al.</i> , 2018), (Petersen <i>et al.</i> , 2005), (Attaran & Attaran, 2007)
Quality of information sharing/ information exchange/ data exchange	(Panahifar <i>et al.</i> , 2015), (Hollmann <i>et al.</i> , 2014), (Singh <i>et al.</i> , 2018), (Petersen <i>et al.</i> , 2005), (Simatupang & Sridharan, 2003)
Use of adequate ICTs/technologies	(Fliedner, 2006), (Attaran & Attaran, 2007), (Pramatari, 2007), (Singh <i>et al.</i> , 2018), (Hollmann <i>et al.</i> , 2014)
Incentive alignment	(Simatupang & Sridharan, 2003, 2005), (Singh <i>et al.</i> , 2018)
Decision synchronisation	(Simatupang & Sridharan, 2003, 2005), (Ramanathan & Gunasekaran, 2014)
Goal congruence	(Cao & Zhang, 2011), (Ralston <i>et al.</i> , 2017)
Management involvement	(Ralston <i>et al.</i> , 2017), (Attaran & Attaran, 2007), (Singh <i>et al.</i> , 2018)
Performance measurement	(Attaran & Attaran, 2007)
Adequate staff training	(Attaran & Attaran, 2007), (Skjoett-Larsen <i>et al.</i> , 2003)

The transformation and availability of new technologies has radically transformed the landscape of SCC in recent years. New technologies, enabling the availability of software applications used to capture and share information across the supply chain have been increasing. Using innovative IT strategies can benefit the implementation

and advancement of CPFR collaborations (Attaran & Attaran, 2007). Moving away from traditional Electronic Data Interchange (EDI) towards the use of new methods of information exchange, such as retail exchanges and internet-based communication platforms, enables businesses to interact virtually to conduct one-on-one or multiple transactions (Pramatari, 2007). Using innovative technology allows buyers to have contact with multiple suppliers and suppliers can gain access to more buyers. It enhances supply chain efficiency and allows more rapid communications, improving planning and execution of tasks along all the supply chain channels.

The establishment of a collaborative culture and the increasing willingness of supply chain partners to adopt collaborative practices as part of their business model, allows a closer partnership-type of relationship (DeMin, no date). It is important to keep in mind that the collaborating networks must have the appropriate levels of scalability, performance, reliability and security in place in order to maximise the potential of having a more integrated and coordinated supply chain approach. This may require several structural adaptations to take place, especially in advanced cases of CPFR implementation and it frequently involves changing the attitude of employees (Skjoett-Larsen *et al.*, 2003). This will be an important factor for the success of wine bottling facilities and their supply chain partners.

Investing in more intangible investments such as human resources, plays an integral part in the establishment of a collaborative culture. Employees along all the channels of the supply chain must have adequate knowledge to handle collaborative platform technologies, exchange the relevant data, and plan, forecast and replenish accordingly (Skjoett-Larsen *et al.*, 2003). Human resources will also be very important for identifying exceptions and during the analysis phase of any CPFR process, as they must have the necessary knowledge to add value to the process in this regard. Employees must be motivated to participate in training activities that explain the rationale for integrated collaboration and that equip them with the necessary skills to execute new processes and handle new IT tools.

It is also important for businesses who intend to enter a collaborative partnership to safeguard themselves against opportunistic behaviour. This often occurs in lower level collaborative partnerships, and can be prevented by traditional legal contracts (Skjoett-Larsen *et al.*, 2003). In developed and advanced CPFR, parties are usually more integrated and the joint spirit of collaboration acts as prevention mechanism for

opportunistic behaviour. Parties involved must build trust between each other, either via social contact or through a stable partnership to ensure that they have confidence in each other, preventing the fear of opportunistic behaviour.

Ramanathan and Gunasekaran (2014) conducted a study in the textile industry to test various hypotheses regarding the relationship between various factors and the success of collaboration and future collaboration. The results indicated significant relationships between collaborative planning, collaborative execution, collaborative decision-making and the success of collaboration. Collaborative execution also has a significant effect on future collaboration. The study also found that in order to ensure collaborative execution, one has to implement collaborative planning, reinforced by collaborative decision-making.

VICS (2010) provides eight critical elements that will help functionally focused organisations, with limited supply chain collaboration between trading partners, to move towards a strategically focused organisation that is able to pursue long range relationships with key trading partners. These eight elements are:

1. Developing a clear multi-year strategic plan consisting of key assumptions that are continuously reviewed for the planning horizon of each planning cycle.
2. Senior management must become the drivers of strategies and execution within the business as the planning horizon is extended.
3. Linking daily business execution to strategic goals by implementing structured business reviews to clarify the roles, responsibilities and accountability of all the participating members along the various channels of the supply chain.
4. Building trust amongst the different trading partners by enforcing a discipline of getting things done and setting clear responsibilities. This will lead to improved work ethics, better performance and increase the competitive advantage.
5. Cross functionality between collaborative teams across organisational boundaries to produce more efficient and effective work.
6. Driving group performance and responsiveness by having aligned incentives and shared risks and rewards.
7. Facilitating technological use to allow fast and accurate replanning and reconciliation.

8. All strategic aligned partners following a single operating plan to ensure that firms stay strategically focused during collaborating activities.

However, Danese (2011) argues that these enablers cannot succeed alone; the success of the implementation of CPFR is also dependent on the contextual factors, such as demand uncertainty, process goals, number of products, supply chain spatial complexity and the levels and scope of collaboration as mentioned previously. From the perspective of a firm that plans to implement a collaborative planning initiative it is important to ensure that the enabling factors are in place or realistically achievable in the context and setup of their supply chain. Establishing a collaborative partnership will start at the eight elements provided by VICS and focus on building a trustworthy relationship between firms. This will ensure strategically focused and successfully collaborated supply chain operations at bottling facilities and their supply chain partners.

2.4.5.2 Barriers

Most barriers to CPFR implementation relate to the lack of visibility throughout the supply chain. This includes several organisational and technological challenges that companies face when planning and implementing collaborative strategy. Several sources in the literature provide comprehensive summaries of barriers to supply chain collaboration and more specifically barriers to the implementation of CPFR (ex. Barratt & Oliveira, 2001; Panahifar *et al.*, 2015; Singh *et al.*, 2018). A summary of some of the main barriers associated with the implementation of CPFR is provided below (refer to Table 2.5).

Table 2.5 Summary of CPFR implementation barriers

Barrier	Source(s)
Technical uncertainty -Reliability -Complexity	(Pramatari, 2007), (Fliedner, 2006)
Information sharing	(Barratt, 2004), (Singh <i>et al.</i> , 2018)
Technology/software availability and investment	(Fliedner, 2003), (Fliedner, 2006), (Hollmann <i>et al.</i> , 2014), (Pramatari, 2007)
Lack of internal integration/collaboration (collaborative culture)	(Fliedner, 2003), (Fliedner, 2006), (Singh <i>et al.</i> , 2018), (Ramanathan & Gunasekaran, 2014)
Information confidentiality and security	(Audy <i>et al.</i> , 2012), (Fliedner, 2003)

Barrier	Source(s)
System compatibility	(Fliedner, 2006), (Pramatari, 2007)
Lack of trust	(Fliedner, 2006), (Hollmann <i>et al.</i> , 2014), (Barratt, 2004), (Skjoett-Larsen <i>et al.</i> , 2003), (Attaran & Attaran, 2007), (Singh <i>et al.</i> , 2018), (Márcio <i>et al.</i> , 2014)
Selecting collaborative partners	(Audy <i>et al.</i> , 2012)
Lack of security protocols	(Attaran & Attaran, 2007)
Lack of training	(Singh <i>et al.</i> , 2018)

One of the major barriers that often hinders CPFR implementation is trust. Supply chain partners are hesitant to share sensitive information with other supply chain trading partners, due to the competitive nature of supply chain environments. However, this fear can be overcome by the negotiation of appropriate front-end agreements, non-disclosure agreements and limiting the access to information (Fliedner, 2006). Being a long-term perspective, Barratt and Oliveira (2001) suggest that the development of trust takes place over an extended period. The front-end agreement set at the start of a collaborative partnership must establish a single point of contact for every supply chain partner, then define a collaboration agenda and systematically expand the scope and complexity of collaborative projects. This possibly entails increasing the number of collaborative processes, adding trading partners, increasing the level of information sharing, automating the process and integrating results. As information sharing between partners continues, it is natural for a trust-based relationship to be established amongst the involved members.

Information and data security is a barrier that goes hand-in-hand with trust. Supply chain partners who consider entering collaborative partnerships are hesitant, as sensitive information and data are more freely available if security protocols are breached or if systems are hacked. This topic requires further research at the hand of the evolution of Industry 4.0, the digitalisation of supply chain processes. This barrier can be overcome by the construction of appropriate and secure supply networks and distribution channels (Szozda, 2017).

It is important to pay close attention to the establishment of a collaborative culture, as the benefits related to CPFR are dependent on the level of both internal and external cooperation between supply chain members. It is also important to keep in

mind that technological availability and technical capabilities of the members involved will have a big influence on the success of any collaborative initiative. As technology is the key enabler that connects all the members of the various supply chain channels, it is essential to have technology that can be integrated across the SC. The initial investment to attain these technologies and the training of employees to equip them with the required skills and knowledge to manage the technology often requires large capital investment. Synchronisation of network structures to support large-scale usage involving many supply chain partners can also be somewhat costly and time-consuming, especially when there is a lack of mutual trust. However, as trust develops and the willingness to collaborate increases, this factor can be minimised. (Fliedner, 2006)

Barriers arise as the complexity of supply chains and the diversity of the involved members increases. As in the agricultural industry, the typical supply chain is a complex and extended process, involving many entities. This results in a large amount of interactions, transactions and information sharing (Matopoulos *et al.*, 2007). Given the possibility of a diverse range of entities being involved, it is important to consider the differences between all the stakeholders involved, in terms of size, structure, technical capabilities, operational complexity and access to the necessary information communication technology (ICT) when developing a framework and implementation guidelines. The most important is to negotiate the front-end agreements, collaborative agenda, followed by expanding the scope and complexity of collaboration amongst the various stakeholders involved in the wine bottling SC.

2.4.5.3 Benefits related to CPFR implementation

The possible advantages that collaborative supply chain partners can gain when implementing CPFR can help the industries to gain competitive advantage. There are several studies in literature that report on the benefits of CPFR (Simatupang & Sridharan, 2003, 2005; Petersen *et al.*, 2005; Cao & Zhang, 2011; Ramanathan & Gunasekaran, 2014; Panahifar *et al.*, 2015) and several of these benefits are valuable to the wine SC.

VICS (2010) differentiates between several types of benefits of linking CPFR and S&OP. Hard benefits include sales growth, margin growth, ability to tailor product offering to both the retailer's and manufacturer's brand and perfect order performance. Soft operational benefits include visibility and knowledge across boundaries throughout

the SC, integrated sales planning and improved understanding of what causes forecasting errors. Soft strategic benefits include the involvement of senior management enhancing integrated business planning (IBP), improved scenario planning and probability assessment as predictability increases, coordination of new product planning, improved life cycle planning, coordination of promotions and ultimately better aligned strategic objectives. A summary of the various benefits found in literature is given below (refer to Table 2.6).

Table 2.6 Benefits related to CPFR implementation

Benefit	Source(s)
Reduces inventory in the supply chain	(Panahifar <i>et al.</i> , 2015), (Márcio <i>et al.</i> , 2014), (Petersen <i>et al.</i> , 2005), (VICS, 2010), (Fliedner, 2006), (Ramanathan & Gunasekaran, 2014)
Improves sales and other operating and financial performance	(Panahifar <i>et al.</i> , 2015), (Márcio <i>et al.</i> , 2014)
Faster order-response times	(Panahifar <i>et al.</i> , 2015), (Márcio <i>et al.</i> , 2014), (Simatupang & Sridharan, 2003), (Fliedner, 2006), (Petersen <i>et al.</i> , 2005), (Ramanathan & Gunasekaran, 2014)
Development of better products	(Panahifar <i>et al.</i> , 2015), (Márcio <i>et al.</i> , 2014), (VICS, 2010)
Improved production processes	(Panahifar <i>et al.</i> , 2015), (Hill <i>et al.</i> , 2018), (Márcio <i>et al.</i> , 2014), (Simatupang & Sridharan, 2003), (Fliedner, 2006)
Improved product availability	(Panahifar <i>et al.</i> , 2015), (Márcio <i>et al.</i> , 2014)
Reduced lead times	(Simatupang & Sridharan, 2003, 2005)
Reduced forecasting error	(Panahifar <i>et al.</i> , 2015), (Márcio <i>et al.</i> , 2014), (VICS, 2010), (Fliedner, 2006)
Improved stock levels (higher service levels)	(Simatupang & Sridharan, 2003, 2005), (Fliedner, 2006)
Improved responsiveness	(Petersen <i>et al.</i> , 2005)
Reduced purchase price	(Petersen <i>et al.</i> , 2005)
Improved quality	(Petersen <i>et al.</i> , 2005)

Benefit	Source(s)
Cost reduction	(Ramanathan & Gunasekaran, 2014), (Simatupang & Sridharan, 2005)
Supply chain performance improvement	(Hill <i>et al.</i> , 2018)

Benefits that are specifically attractive to wine bottling facilities include faster order-response time, improved product and stock levels and improved responsiveness. With the development of a customised CPFR framework and implementation guidelines one can focus the initiative around these benefits and more, to extract the most value. Selecting the right partners to collaborate with is important in order to achieve these benefits.

2.4.5.4 Selecting collaborative supply chain partners

Before the implementation of a collaborative supply chain initiative, it is important to select the appropriate collaborative partners. When selecting collaborative partners, it is more important to select the best trading partner according to your firm's requirements, than to select the best trading partner in the industry (Ralston *et al.*, 2017). Furthermore, the focus of collaborative partnerships must rather be on manifesting a close relationship with a smaller number of partners as collaborative initiatives are resource intensive (Barratt, 2004).

According to Chen, Yang and Li (2007) firms must focus on collaborating with their suppliers, rather than with their customers. An exception may be when suppliers are able to receive information from retailers that will improve the overall performance of the firm. In addition to this, Vanpoucke *et al.* (2017) elaborate and specify that when the aim of a collaborative strategy is to improve cost performance, the focus must be on upstream partners, whereas when the focus is on improving delivery performance, collaborating with both suppliers and customers will be most beneficial.

One way to identify suitable partners to collaborate with is by using segmentation (Barratt, 2004). Segmentation decisions use information about the service levels and lead times of suppliers, supplier costs and customer expectations. Inventory management and replenishment are two key factors to consider when selecting appropriate suppliers and corresponding collaboration strategy (Barros, Paula, Póvoa & Castro, 2008). Decision factors include purchasing volume, demand volatility, risk of supply, importance of the relationship between buyer and supplier, LT and shelf life. Barros *et al.* (2008) used a simple matrix to plot the appropriateness of one of four

collaborative strategies according to the operation of a specific SC. This includes one of four collaborative strategies: traditional supply chain, VMI, information exchange, and synchronised supply (refer to Figure 2.13 below).

Planning Collaboration	Yes	<p style="text-align: center;">Information Exchange</p> <ul style="list-style-type: none"> • Exchange of demand information • Alignment of forecast for capacity and long-term planning • Collaborative forecasting 	<p style="text-align: center;">Synchronised Supply</p> <ul style="list-style-type: none"> • Merge the replenishment decisions with the production and material planning of the supplier • Supplier takes charge of customer's inventory replenishment and uses this visibility to plan his own supply operations
	No	<p style="text-align: center;">Traditional Supply Chain</p> <ul style="list-style-type: none"> • PO is the only information exchanged • Bullwhip problem • Excessive inventory investment to cope with demand uncertainty 	<p style="text-align: center;">Vendor Managed Inventory</p> <ul style="list-style-type: none"> • Supplier takes responsibility for maintaining customer's inventory • Easier to manage short product life cycle • In shortage situations the supplier prioritises customers for whom it is responsible for managing inventory
		No	Yes
Inventory Collaboration			

Figure 2.13: Possible supply chain configurations for collaboration (Adjusted from Barros et al. (2008))

In such a *Traditional Supply Chain* environment, each buyer and supplier is responsible for their own inventory control, production and distribution activities. Following a *Vendor Managed Inventory* (VMI) approach implies that the supplier is responsible for maintaining the inventory levels of the buyer. The advantages of following this approach include reduced stock levels over time, improved customer service levels, reduction in errors as manual paperwork is eliminated, improved planning and reduced replanning, as well as improved risk and opportunity management.

Entering such a buyer-supplier relationship involves sharing information about expected orders in the future and raw data for material planning, but orders are still made independently. This approach is an *Information Exchange* configuration. Adding forecasting as an element of information exchange aligns this approach with CPFR. Using this approach VICS (2004) suggest following one of four collaborative role alternatives (as shown in Figure 2.14) depending on the supply chain configuration. In contrast to this, when a supplier plans his supply and production using customer information, it is considered as *Synchronised Supply*. The information shared includes forecast data, orders, stock levels and consumption. This allows full information

visibility throughout the supply chain allowing replenishment orders to be made by both the buyer and the supplier.

Alternatives	Sales Forecasting	Order Planning / Forecasting	Order Generation
Option A (Conventional order management)	Retailer	Retailer	Retailer
Option B (Supplier-Managed Inventory)	Retailer	Manufacturer	Manufacturer
Option C (Co-Managed Inventory)	Retailer	Retailer	Manufacturer
Option D (Retail VMI)	Manufacturer	Manufacturer	Manufacturer

Figure 2.14: Alternative collaborative roles (VICS, 2004)

Once suitable partners have been identified, several other factors must be considered. This includes: (1) the number of partners to include in the collaboration, (2) the number of partners for a specific collaborative aspect and (3) the nature of the competitive market place that affects the collaboration (Ralston *et al.*, 2017). Using supply chain mapping is a simple tool that will help to keep track of all the members in the supply chain involved, including second or third-tier partners. This will assist with the selection of supply chain collaborating partners. Once this has been done, performance benchmarking can be applied (Simatupang & Sridharan, 2003). Benchmarking partners will enhance the quality of the extended relationship between upstream and downstream partners and allow partners to have a clear understanding of the linkage between the aim of collaboration and the collaborative practices implemented. Benchmarking can typically be performed using five primary levers: supply chain network, configuration, enabling practices, organisational structure and technology.

Collaborative efforts are most likely to fail if organisations try to collaborate with too many of their suppliers and customers, as it requires a significant amount of resource dedication to implement this on large scale. Barratt (2004) suggests following a segmented approach, limiting collaboration to a small number of critical suppliers and customers in order to derive the most value from such an effort. The outlines provided in this section will guide businesses in identifying and selecting the most suitable partners for SCC. Based on the benchmarking of selected partners, one can identify performance opportunities and develop meaningful collaboration as the maturity of

collaboration increases. As performance delivery is important in the case of a wine bottling facility, collaborating with upstream and downstream partners will be beneficial. It is important to identify the appropriate collaborative strategy (using Figure 2.14) and then identify the suitable supply chain partners to collaborate with when initiating a collaborative initiative.

2.4.5.5 CPFR maturity

Levels of collaboration vary from different collaborative initiatives as it can be implemented in various ways and differentiated in different terms of the scope and depth of collaboration (Skjoett-Larsen *et al.*, 2003). Simatupang and Sridharan (2005) suggest that the development of a Collaborative Performance System (CPS) is one of the first steps to achieve supply chain collaboration success.

A CPS is a means to establish a common guideline to measure customer service delivery and enabling supply chain members to make rapid changes to supply chain operations to improve overall performance. The recommended framework consists of three cycles of continuous improvement. Collaboration improves over time as trust increases and overall performance standards increase. The first is the exception cycle, aiming to improve collaborative order fulfilment, while simultaneously decreasing the effect of market changes and supply chain disruptions on sales, which is achieved by integrating collaborative planning with execution of supply chain activities. This cycle links directly to the analysis cycle of the VICs CPFR model explained in Section 2.4.3, used to manage exceptions, as deviations from the original plan can be detected and responded to in order to limit supply chain disruptions, followed by the improvement cycle which aims to improve supply chain performance through the implementation of new capabilities. In the case of the wine bottling industry, performance gaps include reliability and responsiveness, which can be addressed by improvement levers that include mutual supply chain capabilities such as technology. The final cycle is the review cycle. During this cycle performance metrics are monitored and revised by analysing the supply chain environment, which is then used to alter the collaborative strategy by addressing issues that inhibit supply chain members from achieving their mutual objectives.

A guided process to implement CPS consists of three components: internal assessment, collaborative performance systems and external benchmarking. Members must first have a clear understanding of their current utilisation of enablers that drive their

supply chain processes, followed by measuring their current level of collaborative performance, and then by external benchmarking to identify the gaps between current performance and best-in-class performance. The implementation of such a system relies heavily on collaborative enablers (mentioned in Section 2.4.5.1) such as synchronised decision-making and visible information sharing.

Danese (2006) measures CPFR maturity using two primary measures: the number of interacting units and the depth of collaboration. The number of interacting units represents the number of supply chain partners involved in the collaboration. The depth of collaboration consists of three levels of collaboration that are determined by the number of business processes involved and the level of integration. These three levels are communication, limited collaboration and full collaboration.

The study by Danese (2006) found that with a high number of interacting units, the level of collaboration increases as the degree of sophistication of the ICT used for collaboration increases. This illustrates the importance of technology as an enabler to mature collaboration. The depth of collaboration is reliant on the number of interacting units and the degree of complexity of liaison devices. At a communication level, the degree of complexity is low for both cases of a high and low number of interacting units and only requires basic liaison positions to exist in order to collaborate. However, an increase in depth of collaboration will require more complex liaison devices. This includes general meetings in the case of a low number of interacting units and integrated managing practices when a high number of interacting units is involved.

These are all factors that need to be considered when designing a CPFR framework that is supply chain specific, as the number of interacting units and the depth of collaboration will differ, resulting in different levels of collaboration. Having different levels of integration requires customised planning initiatives and the appropriate use of enablers, such as sophistication of ICTs and complexity of liaison devices. This will determine the maturity level that collaborative partnerships between wine bottling facilities and their supply chain partners need to reach to be beneficial in this supply chain environment.

2.4.5.6 Role of technology and information sharing

As research about CPFR evolved, it became evident that SCC is increasing its reliance on information sharing and technology when being successfully implemented. The level

and amount of information sharing that is required are important functions (Panahifar *et al.*, 2015). Real-time data and information sharing is characterised as an integral lever of efficient SCC (Xu, 2011). As a result, sophisticated information systems are an important characteristic when wanting an integrated and collaborative supply chain network throughout the entire SC. Thus, information sharing and technology are regarded as core enablers of collaboration and although CPFR is not fundamentally dependent on these two factors, it enhances process facilitation, being a crucial tool for large-scale implementation (Sattar, 2012).

The ability to have visibility into the data and information captured by the systems of supply chain partners is regarded as efficient information sharing (Simatupang & Sridharan, 2003). This includes activity tracking, process monitoring, and access to consumer data, order status, inventory status and tracing the location of products. These are all information elements that are important in the daily functioning of wine bottling facilities. Uncertainty in the supply chain is usually caused by demand volatility, changing orders and lead time changes (Vanpoucke *et al.*, 2017).

Having information visibility enables supply chain partners to decrease the uncertainty in the supply chain by anticipating these changes and managing exceptions accordingly, making it an important key performance metric. Both upstream and downstream partners must aim to have visible information flow and incorporate this characteristic when doing collaborative planning (Barratt *et al.*, 2001). This will permit agile demand planning, as production and quality issues can be identified and addressed sooner (Simatupang & Sridharan, 2003).

2.4.5.7 Information visibility

Utilising new technologies can significantly contribute to effective and efficient information sharing to convey the data and information relevant to all the supply chain channels. It provides relevant and accurate information in a timely manner, which allows decision synchronisation, as effective decisions about supply chain planning and execution can be made accordingly (Simatupang & Sridharan, 2005). A typical example is if dry goods are not going to arrive on time for a scheduled bottling run at a bottling facility, the bottling schedule can be changed to bottled wine for which all dry goods and wine are available. As ICTs are rapidly advancing, companies are more willing to adopt collaborative initiatives (Danese, 2006).

The evolving concepts related to Industry 4.0, such as the IoT and RFID technology,

are transforming supply chains as we know them. Research by Caniato *et al.* (2009) found that the leveraging the internet can be useful to streamline supply chain process, smooth flow of information, reduced costs and increased responsiveness. Some key aspects of efficient and effective information sharing involves a clear understanding amongst the various supply chain partners about the cause of collaboration, to implement a clearly defined process and know what information is required to enable the defined processes to be executed successfully (Barratt, 2004). Combining efficient information sharing with operational integration, and not information sharing alone, will create operational benefits for all the supply chain partners and without a sufficient information technology (IT) system, creating an information platform that allows partners to coordinate supply chain decisions is very difficult (Vanpoucke *et al.*, 2017).

IT is an important enabler of supply chain integration and collaboration. It enables real-time information sharing, increasing the visibility throughout the SC. A survey done by Petersen *et al.* (2005) found that successful collaborative planning requires firms to continue using traditional modes of communication and information sharing, as well as linked information systems. Thus, IT is used in addition to traditional communication modes to facilitate the flow of information and improve the quality of information across organisational boundaries. This includes simple technologies, such as spreadsheets, fax and emails, as well as more complex communication technologies as web portals, data transfer interfaces, simulation, synchronised joint forecasting and collaborative platforms (Márcio *et al.*, 2014). It is important to understand the current use of IT in the wine supply chain and what it is used for in order to be able to incorporate current operations and improvements to this when developing a collaborative framework.

Collaborative planning is highly dependent on the quality of information sharing (Petersen *et al.*, 2005). Quality of information includes various dimensions such as accuracy, timeliness, ease of access, completeness and compatibility across users. From a buyer's perspective information accuracy is more important and from a supplier's perspective information timeliness is more important. As IT improves the speed and accuracy of data sharing, while simultaneously enabling and simplifying large amounts of data sharing, it is a key element of the success of information sharing between buyers and sellers.

In most cases, upstream partners benefit more from collaborative information sharing than downstream partners (Vanpoucke *et al.*, 2017). This can be ascribed to the fact that it is often the downstream members of the supply chain that initiate collaboration activities and then request upstream members to partake, by performing specific tasks or investing in assets that enable integrated information sharing, resulting in larger investment cost for upstream partners. However, these integration activities still improve the performance of both buyers and suppliers, allowing data to be shared and analysed in order to optimise planning, ultimately improving the delivery performance of all the members involved.

In the case of CPFR, specialised technology enables larger scalability (VICS, 2004). This includes using technologies that enable information sharing related to the following:

- Historical data and forecasts;
- Automated collaboration agreements and joint business plans;
- Exception condition evaluation;
- Revision and commentary.

The technology required to enable this type of information sharing can be used as a peer-to-peer network of CPFR application operating together as a shared solution (VICS, 2004). A shared solution setup will involve using the extranet of either the manufacturer or the retailer, or alternatively a third party can host it. Peer-to-peer network communications involve direct flow of information between the suppliers and manufactures or via proxies. This will create a virtual supply chain that is information-based rather than inventory-based. This allows technology to enable internal functional stakeholders to accelerate collaboration with external trading partners and vice versa. Software solutions can be used to monitor capabilities, send alerts when plans are not synchronised as planned and allow issues to be addressed and changes to be made quicker than when a manual process is used (VICS, 2010).

Pramatari (2007) conducted three case studies in the grocery retail sector to show the different aspects involved when implementing supply chain collaborative practices. The three case studies all involved different settings of electronic interaction along the channels of the SC. The study found with the selection of a technological approach to follow when implementing a collaborative strategy, it is important to consider the

process complexity and information intensity related to the specific supply chain environment. This was then used to develop a simple matrix to provide assistance when selecting an appropriate technical approach shown in Figure 2.15.

In cases of low process complexity and low information exchange intensity, using a centralised platform seems to be the best solution. This provides a single point of links for information management and data validation. Decentralised solutions are well suited for situations with increased transaction volumes and high frequency interaction between supply chain partners, like when using RFID technologies. It is important to deploy a set of technology models that are flexible across industries, with the possibility to be extended to include all the supply chain processes and which allow open, yet secure communication (Attaran & Attaran, 2007).

Process complexity	high	De-centralised solution	De-centralised solution
	low	Centralised web-platform	Centralised web-platform OR De-centralised solution
		low	high

Information intensity

Figure 2.15: Technical approach versus depth of collaboration (Pramatari, 2007)

As the complexity of processes increases, it requires more involvement from the employees of different collaborating partners, web-paradigm solution is not sufficient and a decentralised (i.e. Web-services) solution is more appropriate. Some approaches can also use a decentralised solution while still relying on some centralised elements. It is however necessary to assess individual supply chain environments in order to determine the best technical approach. ICTs are typically divided into four distinctive groups (Danese, 2006), the first being non-sophisticated tools used for information and data exchange (i.e. fax or email). The second consists of technology supporting electronic data exchange and integrating it into a company's system, while the third includes Advanced Planning and Scheduling (APS) tools and tools that allow

electronic data exchange between companies. The most adopted CPFR internet-based solutions include (Seifert, 2003):

1. Web-based collaboration, allowing information and process sharing between multiple supply chain trading partners. This includes inventory plans, forecasts, promotions, POS data, distribution arrangements and changes to previous planning agreements.
2. Event management and analysis, which enables exception management. Such an application allows participants to review exceptions and take the necessary action, by identifying variations in data sets and then issuing a notification online to inform the appropriate people.
3. Tracking and reporting, enabling the generation of management reports by using the analysis of performance against the key indicators.

The popularity of web-based solutions is increasing as they are faster and relatively affordable. Older communication techniques are not only slower, but also more prone to errors due to manual entering of data. They may be more capital-intensive to invest in making them less affordable and they delay information exchanges as they are often done in batch file mode (Fliedner, 2006). Using web-based solutions effectively requires the establishment of the necessary security provisions to ensure that the information shared can only be accessed by the authorised users (DeMin, no date).

2.4.6 Concluding remarks

IT and information sharing play an enabling role in implementing collaboration practices and are an important factor for this research study. The evolution of collaborative capabilities relies on the sophistication of the underlying IT infrastructure supporting information sharing (Pramatari, 2007) in order to enable supply chain partners to plan, forecast and replenish in a collaborative nature. This will allow wine bottling facilities to have visibility along the various channels of the SC, tracking order status and location, particularly of raw materials and dry goods, to optimise production scheduling and increase responsiveness and reliability.

The level of information sharing involved in SCC requires CPFR frameworks to exploit computer networks, ICTs and internet based technologies (Ramanathan & Gunasekaran, 2014). Thus the realisation of CPFR requires the creation of an information sharing platform that is able to group information on demand,

adjustments, production scheduling, transportation plans, etc. between the various supply chain partners (Huo & Jiang, 2007). As the South African wine industry is still very reliant on basic use of information sharing and communication technologies it calls for a more mature approach to enable collaboration between stakeholders.

2.5 Supply chain digitalisation

The rise of the fourth industrial revolution, termed Industry 4.0, entails utilising advanced technological approaches including the IoT and cyber physical systems to improve supply chain operations (Wakenshaw, Maple, Chen & Micillo, 2017). Industry 4.0 is German engineered and often referred to as an evolution and initiative jointly done by politics and science, rather than a revolution. The traditional approach of using EDI to facilitate collaborative practices evolved rapidly in the past few years to include far more technological advanced solutions such as web-based platforms and RFID technology (De Mattos & Laurindo, 2015). Extended supply chain visibility calls for a digitalised supply chain approach, enhancing operational efficiency, resource productivity and planning effectiveness (De Mattos & Laurindo, 2015). Using a digitalised technological advanced approach improves information exchange and benefits role players as it significantly reduces cycle time, lowers inventory levels and improves the coordination of production processes (Szozda, 2017; Vanpoucke *et al.*, 2017).

The availability of real-time information, including tracking, traceability and identification of goods in the supply chain has proved to be difficult information to obtain, but with the advancement of digital tools such as the cloud computing and the IoT, this is more accessible (Gnimpieba Z, Nait-Sidi-Moh, David & Fortin, 2015). This improves interoperability between supply chain partners. Gnimpieba Z *et al.* (2015) states that the use of collaborative web portals is common in the agricultural sector, but these platforms rarely include real-time event processing and notifications (Gnimpieba Z *et al.*, 2015).

In essence, digitalisation is a key enabler to advance and develop the evolution of the application of the Industry 4.0 concept across different supply chain environments. Utilising the technologies of the Industry 4.0 era will be a crucial component of implementing collaborative initiative such as CPFR (Liu & Sun, 2012) and enable production to be decentralised, develop products that are more personalised and allow users to participate in product creation (Wakenshaw *et al.*, 2017).

2.5.1 Impact of Industry 4.0

The introduction of concepts such as the IoT and collaborative platforms forms part of the evolution of Industry 4.0. The IoT allows the creation of colossal collaborative platforms that will allow users to share large amounts of information that are required to successfully collaborate about supply chain processes (Ralston *et al.*, 2017). This in return ensures improved collaborative initiatives and supply chain interoperability as relevant information regarding processing, transfer, storage and sharing is captured (Gnimpieba Z *et al.*, 2015). Wine bottling facilities and their supply chain partners can utilise this tool to ease collaborative interaction.

Traditional supply chain systems restrict supply chain visibility as these commonly do not allow total visibility on orders and demand (Gnimpieba Z *et al.*, 2015). Having the shared visibility between suppliers and different customers configured in the same supply chain will allow suppliers to respond to collective orders instead of individual isolated customer orders, allowing joint planning, production and delivery of customer requirements (De Mattos & Laurindo, 2015; Machado & Shah, 2016). In return, this will improve overall response to market demand, (Gnimpieba Z *et al.*, 2015).

Having these supply chain capabilities will allow informed manufacturing, which is categorised into four different elements: people, products, processes and infrastructure (Machado & Shah, 2016).

People: Utilising the IoT and related platforms to connect people across supply chain boundaries to equip them with real-time information that will allow improved operational decision-making.

Products: Having software applications, controls and sensors that allow real-time tracking of finished goods as they make their way to the production line.

Processes: Information sharing and visibility between suppliers and customers leads to informed processes which in return lead to more adaptability and flexibility of the SC.

Infrastructure: In order to accomplish efficient manufacturing, smart infrastructure components interacting with products, people and mobile devices can be used to manage complexities within the supply chain environment.

In a case study done by Liu and Sun (2012) in the automotive industry, proved that CPFR in conjunction with the IoT can lead to a successful IoT enabled CPFR model,

allowing the generation of large amounts of data that can be transformed into supply chain intelligence. This allows for enhanced supply chain integration (Wakenshaw *et al.*, 2017), linking people, products, processes and infrastructure. Utilising the IoT in the deployment of CPFR ensures real-time visible supply chain management, effective use of resources and increased agility, allowing improved responsiveness and reliability (Liu & Sun, 2012) which is a key focus in the South African wine industry.

Industry 4.0 aims to optimise production and/or changing the existing business model of companies who combine their current supply chain practices with the new digital technologies. Wine bottling facilities process small to medium batch sizes and customised bottles of wine, as per the specification of each customer. Industry 4.0 can ensure changeable production scheduling. Having interconnected platforms allows the facilitation of management, control, tracking and coordination of the logistical flow of goods along the various channels of the supply chain (Gnimpieba Z *et al.*, 2015). If deviation from the original logistical and production planning is detected well in advance, production scheduling can be reordered to ensure that as many orders as possible can be fulfilled on time. However, the integration of new technologies will definitely present some challenges (Ralston *et al.*, 2017).

2.5.2 Internet of Things

The newly introduced information architecture, the IoT, is a term that has recently evolved consisting of objects that are able to communicate through the internet, which in return facilitates improved information flow in supply chain networks around the globe (Xu, 2011). IoT technologies have a diverse range of applications, are able to transform standard business processes and are mostly related to data connection and transfer (Szozda, 2017). For instance, such technologies can be utilised to provide more accurate information about supply chain processes and real-time visibility into the movement of products and materials (Lee & Lee, 2015).

IoT applications are used to achieve either one or two goals: the first being the improvement of the internal capabilities of a company and the second being the improvement of external customer-facing capabilities (Milojevic, 2017). Collaboration and interoperability within the supply chain is enhanced when deploying technologies that allow automatic notification of linked logistical events between various parties in the supply chain network (Gnimpieba Z *et al.*, 2015). Literature distinctively associates five technologies with the successful deployment of IoT products, services and

processes that allow real-time visibility of material movement and provide more accurate information on these movements (Lee & Lee, 2015). This includes:

1. Radio frequency identification (RFID) used for automatic identification and data capturing.
2. Wireless sensor networks (WSN) comprise of devices equipped with autonomous sensors used to monitor environmental and physical conditions. These technologies are often used in conjunction with RFID systems to improve location accuracy, temperature control and movement of things.
3. Middleware is software used to integrate legacy technologies and new technologies, simplifying input/output communication for software developers.
4. Cloud computing allows immediate access to information and data in a pool of shared resources.
5. IoT application software used to enable and facilitate device-to-device and human-to device collaborations.

These technologies are divided into three enterprise application categories: (1) information sharing and collaboration; (2) monitoring and control and (3) big data and analytics (Lee & Lee, 2015). Information sharing and collaboration involve sensing a predefined event to improve situational awareness, avoiding the delay of information sharing and distortion. Data collection is the primary function of IoT technologies that are responsible for monitoring and control. This allows real-time tracking of performance measures, which in return helps to reveal operational patterns, identify areas of improvement and optimise operations. These two categories are particularly important for the operations at wine bottling facilities and having improved capabilities in these categories could be beneficial. Lastly, large amounts of big data are generated by IoT technologies as it often has actuators and sensors that generate data that is transmitted to analytical tools to aid humans with decision-making. The use of big data and analytics is prevalent in the healthcare industry as it allows personalised patient care (Xu, He & Li, 2014).

However, there are a few concerns related to the deployment of IoT and its associated technologies in supply chain networks, the biggest being the risks and security concerns related to information sharing between the different supply chain environments (Milojevic, 2017; Ralston *et al.*, 2017; Wakenshaw *et al.*, 2017). This

includes challenges related to consumer privacy, storage management, data centre networking and server technologies (Lee & Lee, 2015). Integration of existing technologies with IoT compatible systems is also a concern that often arises (Gnimpieba Z *et al.*, 2015). Table 2.7 gives an overview of some of the main advantages and disadvantages that are associated with the deployment of IoT systems. The importance in the end is to balance the cost associated with security solutions, the benefits of a solution and the overall risks of launching an IoT system within a specific supply chain network (Wakenshaw *et al.*, 2017). In return IoT can be utilised for CPFR management within different supply chain networks to optimise the process of supply chain management by increasing supply chain visibility and transparency of information (including availability of real-time data and information tracking), to achieve a high degree of integration and agility (Liu & Sun, 2012).

Table 2.7: *Advantages and disadvantages of IoT* (Machado & Shah, 2016)

Advantages	Disadvantages
Improved monitoring capabilities and more agile supply chain as inventory levels can be monitored in real time in order to improve decision-making regarding supply chain processes affected by the availability status of goods.	As IoT systems function as a part of very large network, security and privacy of data is a huge concern.
Increased availability of data that can be transformed into useful information that can aid decision-making.	Complexity of IoT systems, as it has a large amount of connected devices and interfaces that interact with one another, causes more opportunity for failure.
Reducing time requirement to execute supply chain processes and indirectly saving money .	Legacy system compatibility and integration as larger networks allowing more IP addresses are required. Current lack of international compatibility standards for monitoring and tagging equipment is also a concern.

In the case of a supply chain environment such as the wine bottling industry in South Africa, the IoT can be useful to connect the various role players across the different channels of the SC, mainly focusing on the improvement of the facility's internal capabilities. The networking layer of IoT networks can be used to support information transfer, while the service layer integrates application and services using middleware technology and the interface layer enables interaction with the system as it displays all necessary information to the appropriate users (Xu *et al.*, 2014). RFID technologies

can be helpful to track and query inventory (Huo & Jiang, 2007), which in return will assist with optimised scheduling of bottling if delivery delays can be identified in advance and the production schedule reshuffled accordingly if possible.

2.5.3 Collaborative platforms

Collaborative platforms contribute towards revolutionising traditional supply chains, as these platforms present the opportunity for suppliers and their respective customers to collaborate using data and information made available by the use of the IoT (Gnimpieba Z *et al.*, 2015). Having the right people, products, processes and infrastructure in place will allow the successful functioning of the different sub-systems' platforms and the interfaces between them (De Mattos & Laurindo, 2015).

Utilising collaborative platforms will be dependent on technological readiness and technological integration, also requiring willingness to share the required information to plan and execute collaborative activities (De Mattos & Laurindo, 2015). In return, this will increase supply chain visibility, improving internal and external integration and develop more strategic supply chain partnerships, which is the aim of introducing a collaborative initiative such as CPFR at SA wine bottling facilities. De Mattos and Laurindo (2015) gives examples of different portals that can be designed to fulfil different functionalities for various supply chain management aspects. This includes:

- Collaborative Planning and Schedule Acceptance: Automatic updates of purchase orders as they are accepted.
- Supplier Delivery Schedule: On-screen visualisation of schedules and automatic notification of new schedules or schedule changes.
- Advance Shipment Notice: Shipment information from the supplier.
- Supplier Payments: Use the web to control payments to suppliers.

Such collaborative platforms are found in many areas, including agriculture, goods transportation, the health sector, the environmental sector etc. (Gnimpieba Z *et al.*, 2015). In order to develop the required collaborative platforms for the different sectors, the IoT is a fundamental platform that is used to ensure connectivity and event monitoring (Ben-Daya, Hassini & Bahroun, 2017). The IoT combined with cloud-computing allows the design and formation of collaborative platforms that are able to meet industrial demand (Xu *et al.*, 2014; Wang *et al.*, 2015; Ben-Daya *et al.*, 2017).

De Mattos and Laurindo (2015) highlight several advantages related to using collaborative platforms. Typical advantages include reduction of average time used for information exchange, reduction of percentage errors found on invoices, inventory visibility to the supplier, client and on the road, improved failure reporting and faster recovery times. For collaborative tools, such as collaborative platforms to have full effect, it is important to ensure that external integration is realised (Lee, Kwon & Severance, 2007). But in the same sense it is just as important for internal integration to be ready and to achieve optimal information flow, otherwise benefits related to external relationships will be compromised, according to the research of Lee *et al.* (2007).

In terms of utilising collaborative platforms for the purpose of this research, the different functionalities that it enables can be useful to improve inventory management, production scheduling, order tracking, exception notification and their management. The implementation of a collaborative platform will enable easy cross-organisational collaboration. A simple example of having visible shipment information provided by other supply chain partners will allow early schedule changes if need be and in return, the supplier delivery schedule can be updated accordingly and further collaborative planning and scheduling will be possible. This will improve the management of exceptions as part of the CPFR process.

2.6 Literature summary and conclusion

This chapter served to review different aspects related to supply chain collaboration, the evolution of collaborative initiatives and specifically more information about CPFR, relating to Research Objective 1. These concepts are fundamental to the development of a collaborative framework and implementation guidelines aiming to improve the operations at SA wine bottling facilities. Throughout the review, several key concepts and aspects are correlated with its relevance to wine bottling facilities. These are key inputs for the formulation of the remainder of this research project and are listed in the Table 2.8.

Table 2.8: Key literature concepts

Key Concepts	Importance
Formulation of a collaborative agreement	This involves formulating a communal strategy and developing a joint plan that suits all the stakeholders involved. These are important elements to establish a collaborative relationship between stakeholders.
Supply and demand planning	This concerns sales and order forecasting as well as the identification and resolution of any exceptions.
Execution of orders and tracking them	This concerns the implantation of a collaborative initiative and the operational elements involved. Shared forecasts are translated to generated orders that are replenished.
Performance measurement	Although it is not very prominent in existing CPFR models, this important dimension allows stakeholders to avoid repeating mistakes.
Enablers and barriers	Some enablers to highlight are trust, adequate use of technology, decision synchronisation and performance measurement. In contrast barriers to keep in mind are lack of trust and collaborative culture as well as the absence of technology.
Benefits	Benefits include faster order-response times and improved responsiveness.
Technology, information sharing and visibility	Technology and information sharing play an enabling role in implementing collaboration practices, allowing supply chain visibility.

Chapter 3 aims to analyse the current operations at wine bottling facilities, the existing level of collaboration between supply chain partners, current challenges and to identify how collaboration can address the opportunities for improvement. The chapter is based on semi-structured interviews with industry stakeholders. The information gathered will serve to identify the applicability of different dimensions associated with CPFR approaches in order to formulate design requirements that will aid wine bottling facilities in the pursuit to improve collaboration with their supply chain partners.

Chapter 3

Exploration of the South African Wine Bottling Industry

The previous chapter reviewed some key literature concepts that are related to the concept of CPFR and how digitalisation can enhance supply chain processes. CPFR is an existing concept in collaborative literature that will be used from here on as the cornerstone for the development of a collaborative framework along with the integration of digital technologies specifically to enhance supply chain processes at South African wine bottling facilities.

This chapter aims to give the reader a better understanding of the South African wine industry. It introduces the current supply chain operations at selected wine bottling facilities, with specific focus on their production planning and execution processes, as well as the interaction between a bottling facility, wine producers and dry goods suppliers. It will provide an overview of the process of current planning of dry goods requirement and production scheduling, how it is forecasted and how dry goods are replenished in order to fulfil customer specific orders. This aligns with Research Objective 2 that aims to investigate the supply chain operations of wine bottling facilities and their direct supply chain partners.

The content of Chapter 3 aims to provide answers to the following research questions (RQ) and the related research sub-questions highlighted in Table 1.3 (Section 1.3), repeated here for the reader's convenience:

- RQ 2: How are South African wine bottling facilities and their direct supply chain partners currently doing the planning, forecasting and replenishment of raw material required to produce bottled wine?
- RQ 3: What are the key success factors for improved collaboration between wine bottling facilities and their direct supply chain partners?

This chapter guides the development of an appropriate collaborative planning framework that will facilitate collaborative planning, forecasting and replenishment.

The information was gathered by conducting semi-structured interviews and will be combined with the literature reviewed concerning supply chain collaboration, CPFR and supply chain digitalisation.

3.1 Qualitative data collection methodology

The formulation of this chapter is based on an inductive qualitative approach due to the conceptual nature of the collaborative framework developed. The information in this chapter is mainly based on primary data obtained during semi-structured interviews with stakeholders in this specific segment of the wine supply chain. The interviews focused on the planning and replenishment of dry goods at wine bottling facilities and their influence on the adherence to scheduled production.

a) Research planning

The first steps towards successfully completing a research project is to plan a strategy to solve the problem identified. After conducting some informal discussions with industry stakeholders clarifying the extent of the problem and providing some background information surrounding the industry specifics, literature helped to identify how a collaborative initiative such as CPFR can aid supply chain operations at wine bottling facilities. Thereafter, the researcher sets out to conduct semi-structured interviews with industry stakeholders, who would be willing to share the necessary information. After identifying such people, the researcher explained the research and the information required to them. All ethical considerations as stipulated in Section 1.7 were explained to each party and the case was brought before the Research Ethics Committee of Stellenbosch University for approval before the commencement of information collection. All interviewees involved in the research signed the relevant agreement documentation.

b) Collecting the data

A standard list of questions focusing on existing process execution and collaboration between supply chain partners was compiled based on knowledge acquired during preliminary industry interviews during the problem formulation phase and the literature review performed in Chapter 2. Refer to Appendix A for a full account of the questions asked. The questions were structured to analyse the basic business process of wine bottling facilities, the functioning of their supply and replenishment process of dry goods needed for the fulfilment of a contracted bottling order as well as the

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interaction between the facilities, their suppliers and clients. Furthermore, it also served as a tool to identify problem areas concerning these aspects and identifying opportunities for improvements.

The researcher continuously verified the relevancy of the three bodies of literature (supply chain collaboration, supply chain digitalisation and CPFR), used for the development of the framework by providing interviewees with the basic background of the bodies of literature. This allowed the researcher to ensure that the inputs used are verified and deemed relevant and accurate for the development of the framework. The framework is developed based on the information collected through the semi-structured interviews reported on in this chapter and thereafter refined during different phases using various inputs for validation purposes. Along with the explorative interviews at the wine bottling facilities, several other interviews were conducted with other stakeholders, including wineries, label suppliers, glass bottle suppliers and cork suppliers. A brief summary of interviewee profiles is provided in Table 3.1.

Table 3.1: Interviewee profile summary

Case Interview	Interviewee Profile	Experience
SAWIS	Certification course representative	The representative who presented the certification course has knowledge of multiple departments in SAWIS; involved in wine certification processes for more than 15 years.
Bottling facility 1	Dry Goods Manager	Has 17 years' experience in the wine industry, managing dry goods at a leading South African wine bottling facility located in the Cape region. This includes all tactical and operational elements related to dry goods required for wine bottling as well as supply chain stakeholders.
Bottling facility 2	Distribution & Warehouse Manager	Having 16 years' experience in the wine industry, the participant has a vast range of knowledge of multiple fields. This includes logistical operations, warehouse management and more importantly, the planning and execution of contract bottling.
Supplier 1	Production and Quality Manager	Qualified Industrial Engineer with six years' experience in the supply of a dry goods material to the wine industry. Involved in supply and demand planning, as well as production processes and quality checks.

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Case Interview	Interviewee Profile	Experience
Supplier 2	Key Account Manager	Supplier representative responsible for negotiations with all clients. This specifically includes negotiations with wineries and wine bottling facilities.
Winery 1	Logistics Coordinator & Bottling Administrator	Coordinates dry goods demand planning, ordering and replenishment for one of South Africa's largest producer cellars.
Winery 2	Winemaker	Seven years' experience at estate making wine and handling ordering of all dry goods as well as planning and scheduling bottling activities.

As the successful implementation of a collaborative initiative is dependent on the cooperation of multiple stakeholders, it is important to have insight regarding the operations of as many entities as possible. This expands the scope for identifying possible challenges and opportunities for improvement, aiming to develop a collaborative framework that is as comprehensive as possible.

c) Recording and documenting the information

The researcher followed a predetermined interview protocol for all semi-structured interviews conducted. Before the interview, the researcher distributed a two-page document containing basic information about CPFR, highlighting its potential applicability to the wine industry. Before commencement of the interview, the researcher gave background on the research study and its objectives, and explained how the questions relate to the research project. Interviewees were free to add additional information as they deemed necessary or to ask questions at any time.

Interviews were selected as the primary information collection method, as the interviewer could ask investigative questions should an answer be unclear or insufficient. This helps to keep information more reliable and unbiased, as there is less room for own interpretation. The researcher transcribed all the interviews and follow-up questions were sent to interviewees in the case of uncertainty.

d) Analysis of the information

After conducting the interviews, a general understanding of the information gathered was acquired by meticulously reviewing all the written transcripts and additional notes made during the interviews. This helped to provide the researcher with a holistic view of the planning, forecasting and replenishment processes involved for all the

stakeholders interviewed. These processes were connected to dimensions of CPFR to formulate design requirements for the framework developed in Chapter 4.

3.2 Wine bottling background

In recent years, both the export and domestic market for South African wines has been steady. Bulk exports have, however, been steadily increasing since 2011, contributing to most of the export volume (see Figure 3.1). In the middle of the first decade of the 2000s, the packaged export segment contributed to approximately 60% of the export volume, with the packaged: bulk export ratio being 38:62 in 2018. Exporting packaged wine strengthens the South African market share and can contribute to the international success of the South African wine industry. The aim of the WISE initiative (as mentioned in Section 1.1.2) is to increase the market share of packaged exports by 2025, increasing the quantity of packaged exports as indicated by the 60:40 ratio indicator in Figure 3.1.

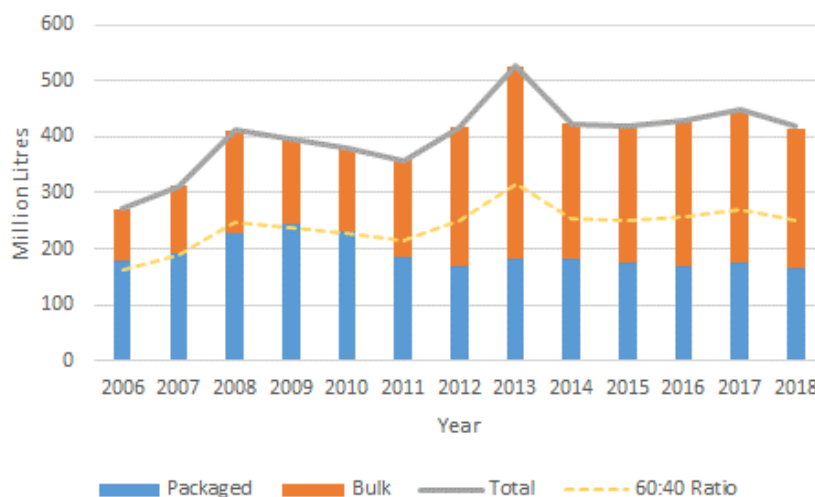


Figure 3.1: Exported volume of packaged and bulk wine (2006-2018) (Adapted from SAWIS (2017, 2019))

As the WISE initiative aims to change this ratio to 60:40, the reliability and responsiveness of the wine bottling process will contribute significantly to the realisation of this goal due to an increase in bottling capacity requirement. The bottling and packaging cost component contributes quite a substantial amount to the total production and manufacturing cost of packaged wine, estimated to be 30% (PWC, 2015). Consolidation and collaboration between industry stakeholders can potentially help to increase responsiveness and reliability while also aiming to reduce costs to benefit all the stakeholders involved.

The process of wine bottling requires thorough planning as most value is added to the wine during the bottling and packaging process. Wineries tend to postpone bottling to minimise overproduction and if demand is not as anticipated, the wine can then still be sold in bulk (Knoblauch, 2018). This mechanism reduces cash tied up in make-to-stock inventory. However, close attention should be paid to planning wine bottling to avoid empty shelves and full tanks (bulk wine) possibly leading to missed sales opportunities or too much wine in bottles but no demand. This creates the requirement for a responsive supply chain with reliable supply capabilities.

The dry goods required for bottling are a costly production element. The correct number of bottles, capsules, corks or screwcaps and labels should be available with a minimum surplus due to the complexity and the multiple unique branded product options. These are all elements contributing to cash being tied up in inventory if wine is bottled in anticipation of demand rather than in response to demand. The packaging and bottling costs for premium and super premium wines differs quite a lot. This can be attributed to the fact that screw caps and thinner glass bottles are used for premium wines (typically in a price range of R30 to R80), while labels and boxes require less crafting, such as embossed engravings on textured paper (Hauptfleisch, 2016). Such design elements can increase label prices by up to R5 per label.

The printing of labels can thus be a relatively expensive cost component. Labels printed for a specific blend or yearly harvest are not reusable for other batches. Thus, it is essential to ensure that the correct number of labels is ordered and also to double-check the information sent to the printers as reprinting labels due to incorrect information related to alcohol percentages, wine origin, certification, etc., adds unnecessary costs. These costs of dry goods vary depending on the quality and customisation of the dry goods used.

Bottling and packaging can become particularly expensive for super premium customised packaged wine blends, a prevalent trend at small-medium-sized wineries (Knoblauch, 2018). Bottled wine ties up large amounts of the wineries' cash and being unable to sell those wines can lead to big losses. The forecast and planning elements in this supply chain environment, especially the ordering of dry goods and scheduling of bottling, are a challenging aspect during the planning phases of the wine making process. These elements should be structured and coordinated to ensure efficient tactical and operational planning and execution.

For the purpose of this research, wine bottling facilities located in the Western Cape region of SA were chosen. Optimal planning and decision-making is required in order to ensure that the bottling can take place as scheduled or to cause the least disruption if rescheduling needs to take place. Interviews were also conducted with several other stakeholders who have close interaction with the wine bottling facilities. This includes suppliers of dry goods as well as the South African Wine Industry Information & Systems (SAWIS) organisation. This aids a thorough understanding of how stakeholders interact with one another and serves to identify overlapping processes executed by the individual entities that can be potential areas of collaboration.

The findings of the semi-structured interviews follows in this section. This primarily includes communication and information sharing between the bottling facilities and their direct supply chain partners, the medium- and short-term planning and scheduling process and the policy related to dry goods supply.

3.3 Case interview: SAWIS

The South African Wine Industry Information and Systems (SAWIS) organisation plays a critical role in the production of South African wine. The main functions of the organisation are the collection, processing and dissemination of industry information along with coordination of the industry's *Wine of Origin (WO)* system. The information given in this section is based on information gathered during a wine certification course that the researcher attended at SAWIS headquarters.

Certification of wines: Wine of Origin

The *Wine of Origin* system is a certification scheme formulated in 1972 and instituted in 1973. This scheme aims to protect not only the origin of South African wines, but also wines made from a specific vintage or cultivar. SAWIS is responsible for the daily application and operation (level 2 operations) of this scheme, along with several other schemes deployed by the Wine and Spirit Board, under the control of the Department of Agriculture, Forestry and Fisheries. The responsibilities of SAWIS include on-site inspections, taking wine samples, wine analyses, sensorial wine tastings, reporting irregularities, the receipt and processing of several applications as well as the notice and issuing of wine certification seals. This forms part of the level 2 operations of the Wine and Spirit Board along with several other level 1 operations displayed in Figure 3.2 below.

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The WO scheme primarily aims to serve as a guarantee to the public that the wine coming from the bottle they purchased is truly the wine of origin, vintage or cultivar claimed on the packaging. Using the unique seal number allocated to a specific bottle of wine, a consumer can trace all the information related to the bottle of wine consumed, from the growing of the grapes, through the wine making process, to the certification of the packaged product. The origin of wines is related to the production area of the grapes. There are four types of production areas:

1. Geographical units: provincial units for example Western Cape, Eastern Cape etc.
2. Regions: specific wine producing area within a geographical unit, such as the Breede River Valley in the Western Cape.
3. Districts: places within a region, such as Stellenbosch in the Coastal Region.
4. Wards: smaller areas within a district such as Simonsberg, situated in Stellenbosch.

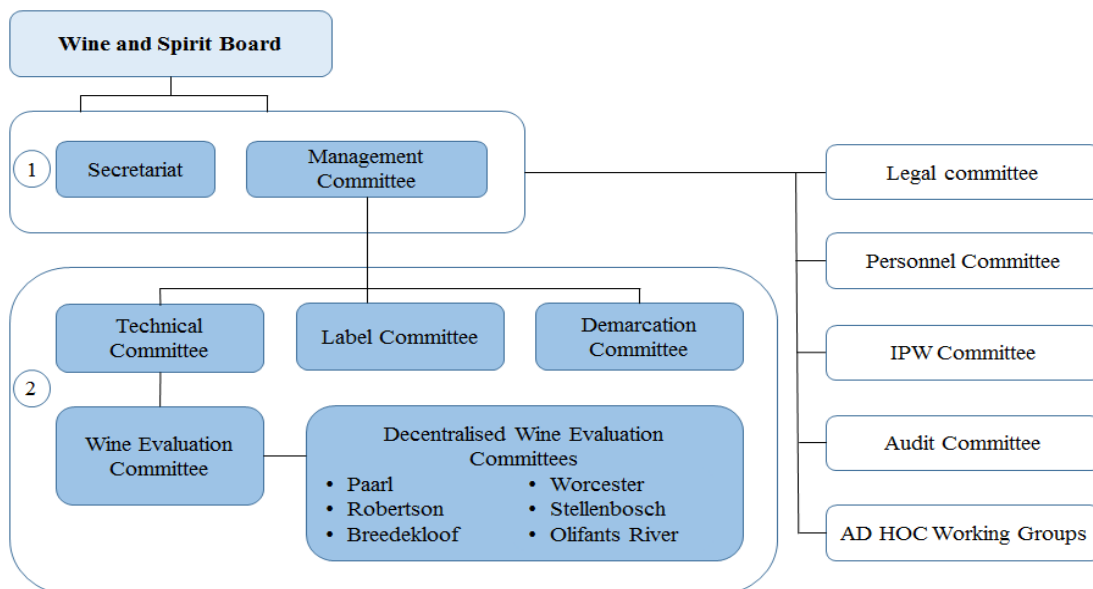


Figure 3.2: Wine and Spirit Board Operational Layout (Adapted from SAWIS (2017b))

Any claims made on labels relating to these factors are thoroughly investigated and tested by the Wine and Spirit Board to ensure that they are authentic and that all legal requirements are met. This also includes a sensory evaluation by one of the tasting panels of the board to ensure that the wine does not have any undesired quality characteristics. The characteristics tested during sensorial evaluation include clarity, colour, flavour and taste.

Certification of Wines: Integrated Production of Wine

In addition to the WO scheme, SAWIS is also driving the Integrated Production of Wine (IPW) scheme, which is a voluntary environmental sustainability project established in 1998. A wine that is IPW certified implies that all the production processes and practices on farms and/or cellars comply with the international wine industry environmental sustainability criteria. This includes compliance to the 'Global Wine Sector Environmental Sustainability Principles' and the 'Guidelines for Sustainable Viti-viniculture: Production, processing and packaging of products' published by the International Federation of Wine and Spirits (FIVS) and the Organisation of Vine and Wine (OIV).

Being IPW certified ensures that the whole process followed to produce a specific bottle of wine was completed in a sustainable manner, following the criteria set by the parties mentioned above. This includes compliance with guidelines that ensure environmental impact care, sustainable water usage, health and safety and the protection of unique biodiversity.

All wine that obtains this certification is clearly marked by a joint, voluntary seal for WO and IPW (visual 'a' in Figure 3.3) with a unique traceability code for each product. This seal serves as a visual indication of the integrity of the origin and/or vintage year and/or cultivar of the wine being consumed. Furthermore, it also guarantees the execution of sustainable production practices and allows traceability up to product level. Some wines are only certified for their origin, vintage year and cultivar which is marked by a different seal (visual 'b' in Figure 3.3), indicating that it only complies with the WO standard. Other wines have no seal at all and are only sold as red, white or rosé with no information related to their origin, vintage year and cultivar allowed on the label of the packaged wine.



Figure 3.3: a) IPW certification seal



b) WO certification seal

Consumers can use SAWIS's website and the unique traceability codes found on IPW or WO seals to view the certification status of the wine they are drinking. If this code is entered on the SAWIS seal search portal, the following information can be verified: production area, cultivar(s), type, vintage, estate, application number, code serial number, Wine and Spirit Board certification number, sensorial evaluation date and the sustainability status.

The Certification Process

Running these certification schemes requires SAWIS to be involved in the entire process of wine production, from farm to table. The certification serves as a means for the end user to trace the origin, vintage and cultivar shown on the label of a bottle all the way back to the vine from which it was produced, indicating if it has been produced sustainably (if IPW certified) and any bottle containing one of these seals is guaranteed 100% South African.

The certification process starts at the block of vineyards from which grapes are harvested as wine producers give SAWIS notice of harvesting and pressing of grapes. At least 30 days before the expected date on which pressing will commence wine producers producing WO wines must apply for a special batch number. This compels the wine producer to complete a standard form, known as the BG1, which specifies the origin, vintage and cultivar of the grapes intended for the production of specific wines. This process allocates a Wine Seal (WS) number to a specific batch of grapes, ensuring traceability. One day prior to pressing SAWIS must be notified, supplying the WS number, date of pressing, cultivar, origin and address of the premises concerned (with special exceptions for some grape types). This starts several notification processes that are concerned with the harvesting, transfer, bottling and submission of wine samples in preparation to deliver a certified packaged product to the end consumer.

The certification process is summarised concisely in Figure 3.4 below. This covers the entire process that is followed to ensure that all the quality and label requirements are adhered to that allows 1) WO or 2) WO and IPW seals to be issued for a specific batch of wine produced and bottled in South Africa. Label requirements play quite an important role for certification purposes as the content that appears on the labels must adhere to very specific requirements and SAWIS monitors this aspect very strictly.

Labelling requirements for South African wines

Labelling requirements for both local and exported packaged wines are quite strict for WO or IPW certified wines. All the information that appears on the label must be verifiable, true and relevant to the wine in that specific bottle. When a WO or IPW seal is on a bottle of wine, SAWIS guarantees that they have the means to verify the information portrayed on the label of that bottle. Labelling of wines, which includes front and/or back labels as well as certification seals if applicable, can be performed either simultaneously with the bottling or after bottling. However, if wine is bottled and labelled simultaneously, one runs the risk of the wine not passing the final approval tasting procedure and analysis conducted by SAWIS.

When printing information related to origin, vintage and cultivar on labels, the following requirements must all be adhered to:

- **Origin** of grapes: 100% of the grapes used to produce the wine must be from the origin specified on the label.
- One **cultivar**: at least 85% or more of the wine must be made from the specified cultivar.
- **Cultivar blend**: two or more cultivars constitute $\geq 80\%$ of the blend and each of the two or more cultivars contributes to $\geq 20\%$ of the blend. If not, all cultivars must be mentioned.
- Order of **cultivar blend**: descending order of volume.
- **Vintage**: $\geq 85\%$ of the wine must be made from the vintage claimed on the label.

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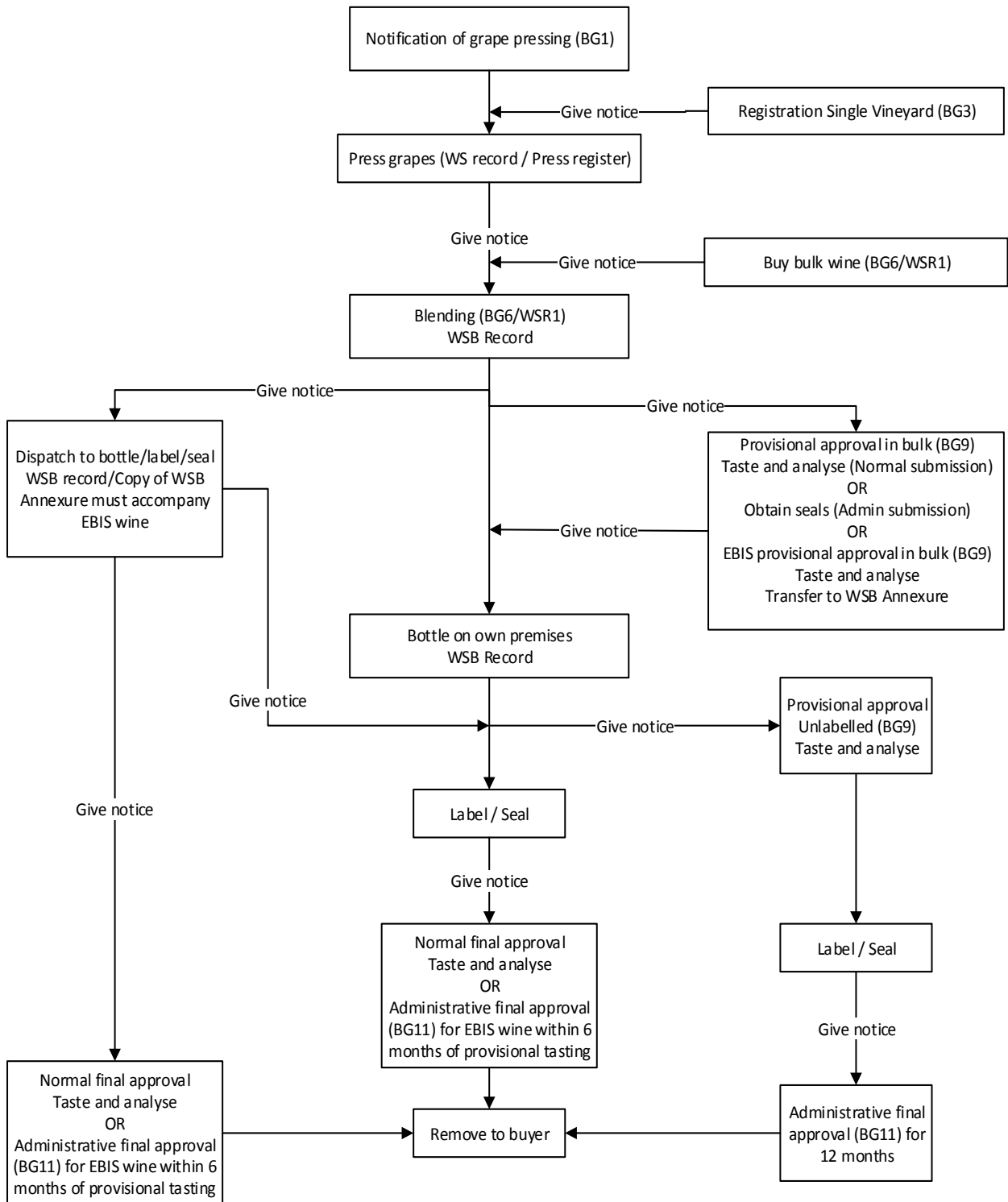


Figure 3.4: SAWIS certification process (Adapted from SAWIS (2017b))

Several other visual requirements must also be met. A typical example of the information that must be present on a label and the specifications of each element are shown in Figure 3.5. If wine is bottled and labelled, but does not pass the quality test executed by SAWIS, the wine producer is obligated to remove the labels and correct them. The removal or substitution of labels from approved wines is subjected to several regulations set by SAWIS. A typical example is alcohol content printed on the label and the tested alcohol content that is not within the specified tolerances. During the course, the presenter mentioned that several other problems often also arise with labels and the information shown on them.

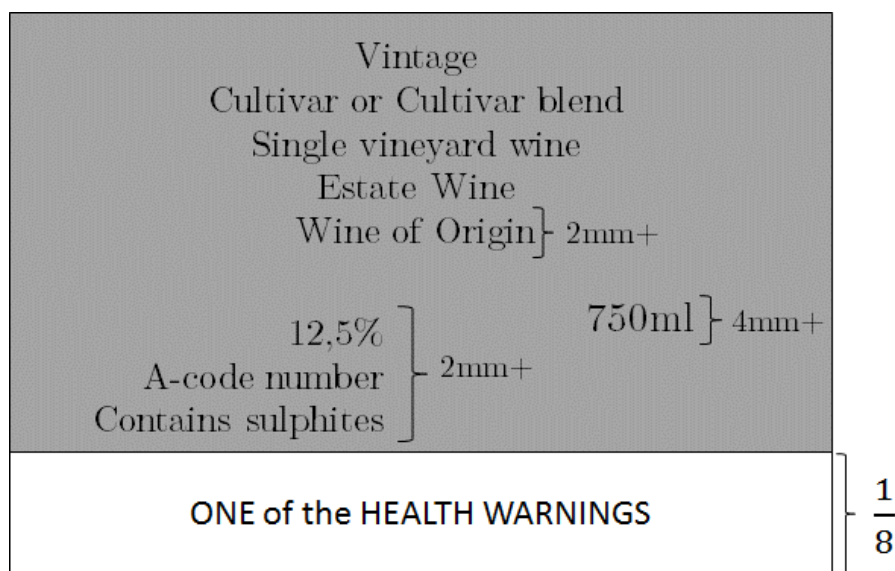


Figure 3.5: Labelling requirements for South African wines

In some cases, wine producers specify the cultivar or cultivar blend on the label and print them before approval from SAWIS. Due to different scenarios, the cultivar or cultivar blend printed on the label and tested for sometimes differ and the label must be adjusted, resulting in quite a costly mistake as labels are an expensive packaging component and reprinting, for example, 10 000 labels amounts to a very large sum of money. Furthermore, if bottles are already incorrectly labelled, the handling cost related to the removal of the labels and relabelling them results in additional expenses.

Analysis and sensorial tastings

The analysis of bottled wines and tasting them is compulsory for all WO or IPW certified wines. SAWIS does basic quality tests and analyses of bottled wine. This ensures that all legal requirements are met and that basic quality standards in terms of oxidation, sulphate compound and the colour of the wine are in line with requirements.

The BG9 and BG11 process steps (see Figure 3.4) are the process steps concerned with tasting and analyses of wine. The BG9 process primarily serves to obtain certification seals for a batch of wine. Wineries have the option to apply for certification seals using the BG9 application form. The option *with samples* indicates that a winery is applying for a set of seals and will send samples for tasting and analyses as well, while *special tariff* indicates that the winery will only send samples for testing and analyses (without applying for a set of certification seals). A winery can also choose to apply for certification seals only by choosing the *admin* option. Other information that is important for this application is the cultivar or cultivar blend percentages that will appear on the label of the bottled wine, an indication whether IPW seals are required and also any additional lab particulars that must be tested for (sometime due to export destination country regulations).

The administrative approval of wine analytically and sensorially approved in bulk and stored in bulk (known as EBIS wine) is valid for a period of six months. This means that wine adheres to all the quality standards as per the SAWIS regulations and can be bottled and sealed within the next six months. If submission for administrative final approval (BG11), which is the tasting of bottled wine, is after six months of the BG9 certification, the wine has to be resubmitted for analysis and tasting. Bottled wine or bulk wine intended for immediate bottling submitted for provisional approval and approved can use this certification for final administrative purposes for a period of either 12 or 18 months depending on the type of wine tested.

The execution of the BG11 process takes place only once bottling and labelling is completed. This final sensorial and analytical evaluation of wine is required before the distribution of wine to the end consumer, which includes a blind tasting by a panel of experts. Each participant tastes a particular wine twice before approving or rejecting the wine. For a sample to be rejected, half plus one of the participants must reject the sample given to them during the tasting. Tastings are scheduled on specific days on a weekly basis based on the origin of the wine submitted for tasting. An application for tasting is subjected to submission rules, depending on the origin of the wine submitted.

Labelling requirements and the process of analysis and sensorial tasting play a significant role from a bottling perspective. Wine readiness and label requirements influence the ability of wine bottling facilities to adhere to production schedules and the coordination of overlapping processes.

3.4 Case interviews: wine bottling facilities

The researcher investigated operations at two contract wine bottling facilities located in the Cape region. The interviews focused on developing an improved understanding of daily operations in terms of scheduling, execution and interaction with their supply chain partners.

3.4.1 Wine bottling Facility 1 review

Bottling Facility 1 is a winery with their own bottling facility, responsible for both in-house wine bottling and contract bottling. The facility bottles 33% of their own brand, while the rest of the bottling is contracted by wineries deemed their clients.

The basic business model of the facility functions on just-in-time (JIT) delivery of dry goods supply. It is mainly the responsibility of clients to order their own dry goods and have these delivered to the bottling facility three days before production, as storage space is limited at the facility. The facility provides their clients with bottling and labelling services, and clients have the option to require one or both of the two services.

At the end of each year, a preliminary production forecast is conducted in anticipation of the bottling requirements of clients based on the production schedule of the current year. About 60% of the bottling runs at the facility are fixed by the end of January, as the prediction is based on the annual bottling capacity of recurring clients. Scheduling of the remainder of the bottling runs is performed on a planning horizon of three months. During the week of the scheduled bottling run, the availability of all the necessary components is reconciled in order to know whether the run will be able to take place as scheduled.

Collaboration between the facility and their direct supply chain partners (being the suppliers of dry goods and wineries) is limited to 1–2 times per week. The reasons for collaboration, which in this case is more for information sharing and communication purposes, include:

- Distribution of specification document containing Bill of Material (BOM), the required quantities and the scheduled bottling date;
- Enquiries regarding delivery of dry goods (if not yet received three days prior to scheduled bottling date);

- Issues related to quality of wine.

These elements are all communicated using basic email or phone practices. The specification document containing all the information relevant to a specific bottling run is communicated using a paper-based system. This document contains the information related to the bottle type, screwcap or cork, label, packaging, etc., needed for the specific batch produced during the scheduled bottling run as per client specification. This specification page is used to check that the required dry goods are available for the scheduled production run (see Appendix B, Figure B.1). The sheet is then transferred to the production line staff to use during the bottling run to ensure the correct dry goods are set up at the corresponding bottling line.

Consolidation of dry goods ordering, receiving, quality checks, availability and invoicing for services rendered for the scheduled production run are all managed using a standard set of paper-based documents. Using this system, the bottling facility plans weekly production based on pre-planned bottling slots using a visual whiteboard setup. The scheduled production is cross-referenced with the availability of the required dry goods and the wine is tested at an on-site laboratory to establish if production can take place as planned. The facility makes use of a standard “*dry goods checklist*” (refer to Appendix B, Figure B.2) that is used to check the availability of the required materials. Once this is completed and the wine-readiness has been confirmed by the on-site wine testing laboratory, the production line is set up according to specification.

The wine tested at the on-site wine laboratory is also subjected to analysis by SAWIS, as wine intended for bottling has to comply with certain legal and quality requirements (see detailed explanation in Section 3.3). Absence of this analysis is listed as one of the two main causes of deviation from the pre-planned bottling schedule; the other being the unavailability of dry goods.

In the case of unavailability of dry goods due to delivery delay, the client is informed by email (typically two days prior to scheduled production run) and it is their responsibility to contact the relevant supplier to identify the cause of delayed delivery if the cause is identified to be at the supplier itself. This problem was highlighted as one of the primary problems (along with readiness of wine and line breakage) causing delays or deviation from the planned production schedule. In the case of a dry goods item not being available for the scheduled bottling run, the run is either switched with a bottling run which has all its dry goods available or cancelled and only rescheduled

when there is an open bottling slot. This often results in a long waiting time (typically weeks) and missed order fulfilment opportunities, as bottling is scheduled long periods in advance and the missed bottling run can only be incorporated at a later stage. Clients are subjected to pay a penalty fee, should a bottling run be cancelled due to any problems not related to the wine bottling facility itself, due to the bottling facility losing out on a bottling opportunity.

There is no communication or information sharing visibility between the bottling facilities, wineries and dry goods suppliers in the current supply chain configuration. The required communication and information sharing is done by each responsible individual and then communicated back to the third party. The following reasons contribute to a lack of visible information sharing and communication networks:

- Lack of trust related to required commitment to input information requirements into a visible communications platform;
- Technical uncertainty;
- Information and data security.

Furthermore, one major concern related to such an initiative is the financial investment that is often required to use platforms that allow for improved planning, management and communication. Although these are some of the concerns that were highlighted during the interview, the interviewee confirmed that having improved collaboration between the bottling facility and their direct supply chain partners would be beneficial for all the parties involved. Given a list of benefits related to improved collaborative practices and specifically CPFR, the interviewee stated that the following will be most beneficial to the facility:

- Faster order response times in terms of both dry goods and bottling;
- Improved production processes;
- Improved dry goods and raw material availability;
- Improved responsiveness and reliability;
- Reduced idle time.

In addition to these improvements, having more visibility across the supply chain channels will allow wineries and bottling facilities to be able to measure supplier reliability. Currently, they have no system in place to measure supplier performance.

This will likely directly influence the delivery reliability of suppliers and adherence to promised delivery date.

3.4.2 Wine bottling Facility 2 review

Bottling Facility 2 is a bottling facility which performs contract bottling for various wineries located in the Cape wine region. They have approximately 90 wineries as clients who bottle their wine at the facility on an annual basis. The facility bottles a variety of glass-packaged products including still wine, sparkling wine and ready-made drinks. About 70% of the products bottled at this facility are for export purposes while the remainder is for the South African market.

All the products mentioned above are included during the planning process to determine the scheduling of production runs. The basic business model of the facility functions on just-in-time (JIT) delivery of dry goods supply. The facility offers a standard range of dry goods, which they coordinate the availability, and delivery of. Approximately 50% of their clients makes use of this standard range of dry goods for their bottling, while the remainder of their clients are responsible for ordering their own dry goods by choice, mostly due to customisation requirements, and have it delivered to the bottling facility two days before production.

The bottling runs are scheduled using a preliminary sifting method, where incoming bottling requests are grouped according to the following categories:

- The cultivar of wine to be bottled;
- The type of bottle used;
- The method of sealing, thus screwcap or cork.

These categories are used to ensure that changeover time is kept to the minimum as part changes are required when bottling requirements are changed using one of the above-mentioned category specifications. The short-term planning horizon is fixed at 3 pm, five working days prior to the day of bottling. Thus, the coordination between the clients, suppliers and the facility is crucial to ensure the reliability of dry goods availability.

Due to the nature of this short-term planning business model followed, the facility uses *EzyWine ERP Winery Management System*. This on-site management system allows for the material requirement planning of dry goods needed for the wine bottling

process. The systems mostly serve as a mean to keep track of the specific sequence of the bottling runs and the specifics of the schedule runs. This includes the type of wine bottled, the duration of the bottling run and the information related to inputs required for the run. With this system it is easy to measure the stock levels of dry goods (if available in storage at the bottling facility or at the winery) and to identify the required quantity of dry goods to be delivered by the suppliers in order to complete bottling successfully.

Using this system makes collaboration between the facility and their direct supply chain partners much easier and allows for easier identification of possible shortages of dry goods. However, there is no link between this system and the supplier's system. All the information captured in this system is communicated manually to the respective wineries and suppliers. Scheduled collaboration between the facility and their direct supply chain partners (being the suppliers of dry goods and wineries) occurs 1–2 times per week during the weeks prior to bottling and every day during the week of the scheduled bottling run. The reasons for collaboration, which is limited to information sharing and communication, include:

- Distribution of Bill of Material (BOM) one week prior to bottling run, showing the available stock quantities of a client on site, the required quantities for the scheduled run and the scheduled bottling date;
- Enquiries regarding delivery of dry goods (if not yet received two days prior to scheduled bottling date);
- Issues related to printing of labels;
- Issues related to quality of wine.

In the case of unavailability of dry goods due to delivery delay, the client is informed by email or telephonically (two days prior to scheduled production run) and it is their responsibility to track the root cause of delay. If the root cause is supplier delivery delay, the winery is responsible for negotiating delivery terms to be on time for the scheduled bottling run. The interviewee highlighted the delay of dry goods availability as one of the primary problems along with readiness of wine and line breakage, causing delays or deviation from the planned production schedule. When given the situation of availability problems related to dry goods sourcing, the dry goods manager and in this instance the interviewee, will try to reshuffle the order of bottling by filling the slot with another client's bottling run that has availability of all the required inputs.

There is no communication or information sharing visibility between the bottling facilities, wineries and dry goods suppliers in the current supply chain configuration, unless specifically communicated by one party to another and further along the supply chain. The interviewee is of the opinion that reasons for lack of visible information sharing and communication networks can be contributed to the following reasons:

- Lack of trust related to required commitment to input information requirements into a visible communications platform;
- Information and data security.

Although these are some of the concerns that were highlighted during the interview, the interviewee confirmed that having improved collaboration between the bottling facility and their direct supply chain partners would be beneficial for all the parties involved. The interviewee corroborated that having improved collaborative practices will help the facility to benefit in the following ways:

- Faster order response times;
- Improved production plan adherence;
- Improved dry goods and raw material availability;
- Improved responsiveness and reliability;
- Cost reduction.

In addition to these improvements, the interviewee mentioned that having more visibility across the supply chain channels will allow wineries and bottling facilities to improve supplier reliability measurement and trace other reasons for delayed delivery. This facility currently measures supplier reliability and general supplier performance by conducting an annual survey. This survey allows clients not only to give performance feedback about suppliers, but also about the bottling facility as well. This survey allows clients to assess a service provider based on personnel competence, communication, responsiveness, tangibility in terms of physical evidence of the service such as telephone access and use of technology and finally based on service received in terms of timelines, value and quality. At the end of the survey, an overall rating is arrived at, of which one of the four given criteria is reliability. The company classifies reliability as *the ability to perform the promised service in a dependable and accurate manner, the service is performed correctly on the first occasion, the accounting is correct, records are up to date and schedules are kept.*

Certain representatives of the company are regularly involved in the industry meetings hosted by Vinpro on a quarterly basis. These meetings involve inputs from several industry players and help to identify problem areas along the different channels of the wine supply chain. The general outcome of these meetings involves compiling a 60-day priority action list of all the immediate problems that need attention. Recent trends indicate that the export wine market for the year 2018 has seen some decreases in terms of volume for both packaged and bulk wine, which is worrying as the industry focus is to increase packaged exports.

The interviewee believes improved collaboration between the facility and their direct supply chain partners will not only improve the bottling process, but also supplier reliability. Furthermore, it will enhance customer relationships that will drive a more market-orientated approach in the South African wine industry. According to the interviewee, key success factors that will contribute to the establishment of a well-defined collaborative relationship include mutual trust, commitment to such a project and well-established relationships between the involved parties.

3.4.3 Process summary

Analysing the information obtained during the semi-structured interviews with key employees at the wine bottling facilities assisted the research with a general understanding of the current planning and execution of bottling activities at these two facilities (refer to Figure 3.6). The interviews revealed a lack of availability and visibility of information, translating into uncoordinated planning and execution of supply chain processes not only at wine bottling facilities, but also at other stakeholders influencing timely execution of bottling.

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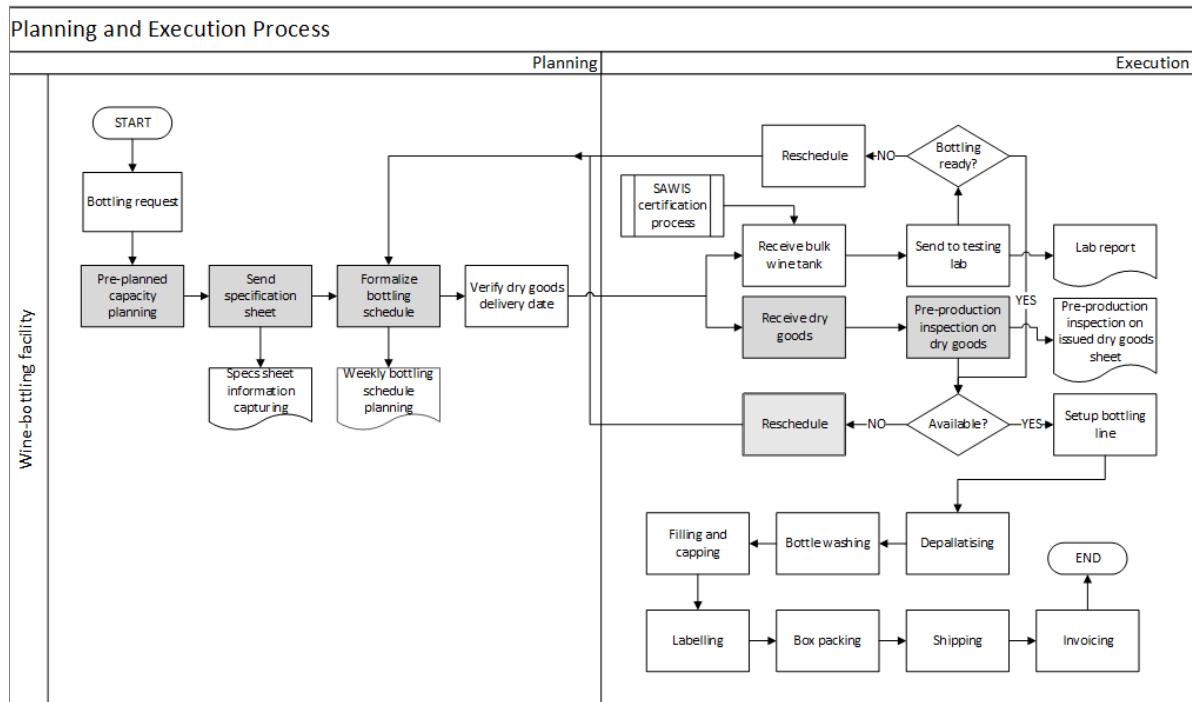


Figure 3.6: Basic process planning and execution at wine-bottling facilities

The steps highlighted in grey in Figure 3.6 are all possible areas of collaboration. Table 3.2 summarises the opportunities for collaboration that exist given the basic planning and execution process of wine bottling facilities performing contract bottling.

Table 3.2: Collaborative opportunities for wine bottling facilities

Process step	Opportunity for collaboration
Pre-planned capacity planning	Link pre-determined wine bottling schedule to create visible demand requirement for specific bottle type and expected delivery date of order based on pre-scheduled bottling date: information available for all the stakeholders involved.
Send specification sheet	Client order and bottling schedule information visibility to ensure effective allocation and distribution of dry goods: prioritise orders based on scheduled bottling.
Formalise bottling schedule	Share production planning schedule and bottling schedule to ensure coordination and exception management : information visibility.
Receive dry goods and pre-production inspection of dry goods	Track and trace bottling schedule and possible changes: on-time delivery and availability of dry goods or shifting delivery of orders if bottling schedule changes due to availability problems.

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Process step	Opportunity for collaboration
Reschedule	Communicate schedule changes to other stakeholders to confirm if stakeholders can accommodate changes.

Having improved information sharing capabilities, availability and visibility amongst the different stakeholders involved in the planning and execution of bottling activities can assist bottling facilities with coordinating dry goods availability and wine readiness for scheduled bottling runs. Furthermore, in the event of exceptions such as a specific dry goods item not being available for a scheduled bottling run, improved collaboration can assist bottling facilities with rearranging the bottling schedule to be aligned with suppliers' capability to supply the new set of dry goods required on-time and in full.

A typical example of managing an exception is illustrated in Figure 3.7 and Figure 3.8 below. In the example, client 1's (C1) order is scheduled for *Run 1* on *Day 1* and has a specific bill of material (BOM). The BOM code indicated on Figure 3.7 illustrates bottle (B) intended for run 1 (1) of type (1) and supplied by supplier (X), equating to BOM code B11X. Should supplier X have a problem with supplying bottle type 1 (type being the specific bottle shape and colour requested) on time for this specific bottling run, timely information sharing and visibility (in this case 2 days prior to bottling) will allow a bottling facility to rearrange the bottling schedule. Should information be available and visible to bottling facility staff on the availability of component scheduled for *Run 4* on *Day 2*, which is still a run scheduled for bottle type 1 (B41Y), changeover time can be minimised should *Run 4* and *Run 1* be switched as it is the same bottle type. It will also provide information on whether the shift for the latter run for C4 is possible with the full complement of dry goods availability being tested.

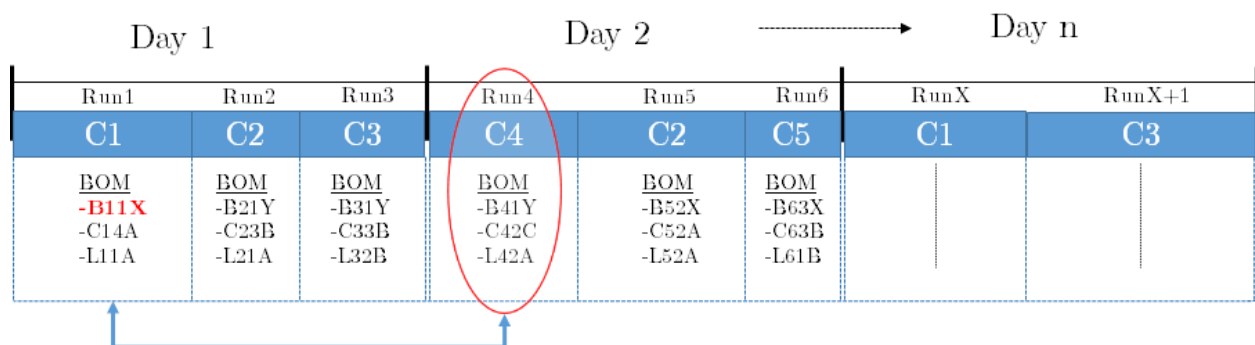


Figure 3.7: Illustrative basic bottling scheduling problem

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Collaboration between supply chain stakeholders will also imply that label supplier A will have information available indicating that labels printed for client 4 (C4) must be prioritised before the label printed for client 1 (C1), as there has been a shift in the bottling schedule. Collaborating on the availability of dry goods can assist bottling facilities to reschedule a bottling run successfully in order to improve capacity utilisation and reduce rework time in the case of a specific dry goods item not being available.

The bottling schedule can be rescheduled as illustrated in Figure 3.8. Having this information available to all stakeholders involved in a specific bottling run could potentially help suppliers to prioritise orders differently for short-term planning, knowing what the specific bottling sequence is or if changes are made to the sequence. Sharing the pre-determined bottling schedule amongst supply chain stakeholders can additionally aid medium-term production planning, as this will provide a good indication of dry goods requirements over a longer planning horizon. In addition, any dry goods supplier can request a shuffle to reduce their set-up and changeover time, based on their preference to manufacture or transport certain labels, corks or bottles together.

Day 1			Day 2			Day n	
Run1	Run2	Run3	Run4	Run5	Run6	RunX	RunX+1
C4	C2	C3	C1	C2	C5	C1	C3
<u>BOM</u> -B12Y -C12C -L12A	<u>BOM</u> -B21Y -C23B -L21A	<u>BOM</u> -B31Y -C33B -L32B	<u>BOM</u> -B41X -C44A -L41A	<u>BOM</u> -B52X -C52A -L52A	<u>BOM</u> -B63X -C63B -L61B		

Figure 3.8: Illustrative shifted bottling schedule

Taking such a simple scheduling example clarifies the purpose of collaboration and opportunities that exist in this supply chain setup, which is applicable based on the process steps highlighted previously in Figure 3.6. These are steps identified by the researcher as potential process steps that can be enhanced by collaboration with other supply chain stakeholders. This specifically focuses on information sharing, availability and visibility, which are typical elements of collaboration. Capturing and disseminating timely and relevant information for decision-makers to plan and control supply chain operations will allow for improved decision synchronisation and incentive alignment.

3.5 Case interviews: dry goods suppliers

The supply of dry goods plays an integral part in the wine bottling process. The supply of dry goods is particularly challenging as planning, forecasting and replenishment of various stakeholders is somewhat structured around a specific bottling run at the wine bottling facility. If the necessary dry goods are not available as per the planned bottling schedule, it causes disruptions at the bottling facility and further along the channels of the supply chain. Figure 3.9 illustrates the typical dry goods required for each bottle of wine bottled at a bottling facility. Although certification seals are also typically included, not all wines are certified. Wine bottling facilities and wineries must work closely with dry goods suppliers to ensure that dry goods are available when required at the wine bottling facility.

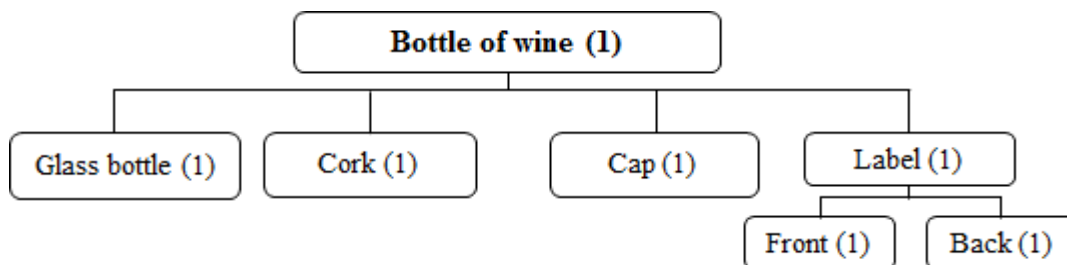


Figure 3.9: Typical dry goods BOM for bottled wine

Even though this BOM appears simplistic, there is some degree of complexity involved. This can be attributed to the fact that the market is aiming for product diversity in terms of bottles used and their type of cork or screw cap and branding. Furthermore, each of the labels of a batch of wine contributes to the uniqueness of that product and increases the complexity to plan and coordinate the BOM for the that batch. In addition to this, wine readiness and the SAWIS certification process increases the complexity of delivery of a finished product.

The planning, forecasting and replenishment aspects are different for the variety of dry goods required for bottling. After conducting several interviews with individuals responsible for the planning and supply of dry goods to wine bottling facilities and wineries, interviewees stressed that there are several challenges as well as some opportunities for improvement related to these aspects. Integration and coordination of information elements exchanged between stakeholders can potentially improve the supply of dry goods to bottling facilities to improve on-time order completion.

Typical planning of dry goods requirements range from one week to 6 months. Wineries are responsible for communicating the quantities of specific dry goods to respective suppliers in order to ensure that materials are available when the specific bottling slot is scheduled. As explained previously, some larger wine bottling facilities have a standard set of dry goods on offer that their clients can purchase directly from them instead of purchasing their own set of materials and arranging delivery to the wine bottling facility.

As different dry goods materials have different lead times related to manufacturing, ordering and importing as well as customisation, planning and coordination of all the different components is challenging. Suppliers are reliant on timely communication from their clients (typically wineries and in some cases bulk orders from wine bottling facilities), which is used for planning production schedules if dry goods are manufactured by the company themselves or for ordering if manufactured at production facilities elsewhere. In some cases, wineries provide suppliers with an estimated requirement (to some extent a forecasted value) of monthly and accumulated annual demand of specific dry goods and in other cases some suppliers keep track of historic ordering patterns of their clients which they then use to forecast upcoming orders. Suppliers often use this data to predict the ordering patterns of their clients and track ordering accordingly to ensure that demand can be met.

3.5.1 Process summary: Supplier X

The researcher conducted an interview with one of Supplier X's key employees involved with planning and managing the demand of glass wine bottles. This helped to gain a basic understanding of the interaction between the company, wineries and wine bottling facilities. Figure 3.10 is a basic representation of the process followed to plan dry goods demand, production and delivery.

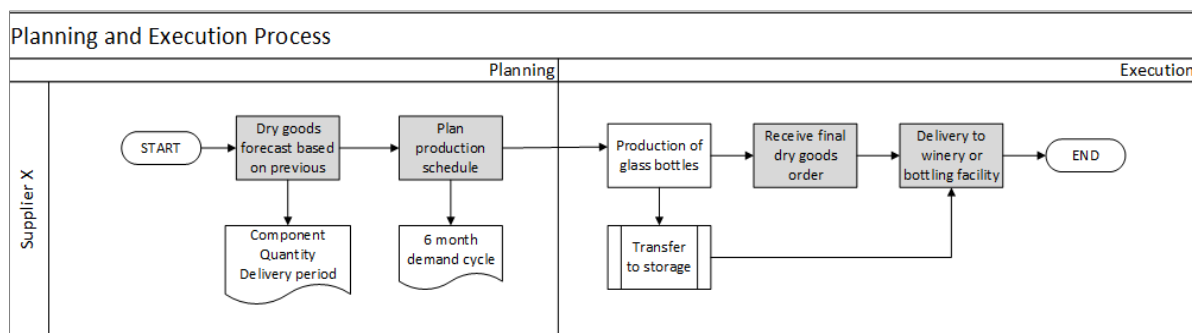


Figure 3.10: Basic process flow of Supplier X

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The manufacturing process of wine bottles is quite complex, as the production of glass wine bottles of different shapes, volumes, weights and colours all require different production setups for the furnaces and manufacturing lines. In addition, the supplier also manufactures several other SKUs, summarised in Table 3.3, for a diverse range of industries. This contributes to the complexity of the manufacturing process as there are many SKUs. The supplier relies on a forecast generated internally based on previous demand and feedback from clients indicating anticipated demand requirement for the upcoming 6 months. The company has a large number of SKUs; a specific SKU is manufactured in a large batch size, with large production intervals between manufacturing runs as the setup for each of these glass products varies. The interviewee mentioned that this approach is somewhat inaccurate as demand requirements were not always made available by clients in a timely manner.

Table 3.3: Profile of SKUs manufactured by Supplier X

Product	Size	Weight	Colour
Beer	330ml, 340ml, 500ml, 550ml	210g to 390g	Dark green/emerald green/amber/flint
Wine	750ml, 1.5L	350g to 720g	Dark green/flint/dead leaf
Food jars	125ml, 375ml, 750ml	126g to 320g	Flint
Water/juice	330ml, 500ml, 750ml	220g to 460g	Flint
Spirits	750ml	520g	Flint/amber

With reference to Figure 3.10, the researcher identified several steps in the process that are suitable for collaboration. These process steps relate to the scheduling of a specific bottling run. Information availability and visibility relating to anticipated bottling demand and scheduled production can aid planning and execution of production, aiming to improve on-time delivery of dry goods to wine bottling facilities. The researcher identified several collaborative opportunities, summarised in Table 3.4 below.

Table 3.4: Collaborative opportunities for Supplier X

Process step	Opportunity for collaboration
Dry goods forecast based on previous demand	Link pre-determined wine-bottling schedule to create visible demand requirement for specific bottle type and expected delivery date of order based on pre-scheduled bottling date: information available for all the stakeholders involved.
Plan production schedule	Share production planning schedule and bottling schedule to ensure coordination and exception management : information visibility.
Receive final dry goods order	Client order and bottling schedule information visibility to ensure effective allocation and distribution of dry goods: prioritise orders based on scheduled bottling.
Delivery to winery or bottling facility	Track and trace bottling schedule and possible changes: on-time delivery and availability of dry goods or shifting delivery of orders if bottling schedule changes.

These collaborative opportunities are based on the observation that information is not distributed along all the channels of the supply chain when available, causing uncoordinated planning and execution of supply chain processes. Improved information sharing and visibility will allow stakeholders to collaborate, synchronise decision-making and to align incentives. Ensuring information availability and visibility along all the channels of the supply chain can assist the supplier to improve their forecast and production schedule to improve its alignment with anticipated completion of bottling.

3.5.2 Process summary: Supplier Y

Supplier Y is responsible for the supply of corks to wine industry stakeholders. This includes different types of corks subjected to different branding and quality requirements. Figure 3.11 is a basic representation of the planning and execution for the supply of corks for bottling purposes. Corks are imported and the lead time from order generation up until delivery to the South African plant is 8 weeks. However, shipping is also bound to minimum shipment quantities. Thus, the supplier mostly groups different order batches from different wine producing customers to generate full shipments. This implies that clients must ensure that demand requirements are sent to a supplier in advance to enable the supplier to coordinate shipments appropriately.

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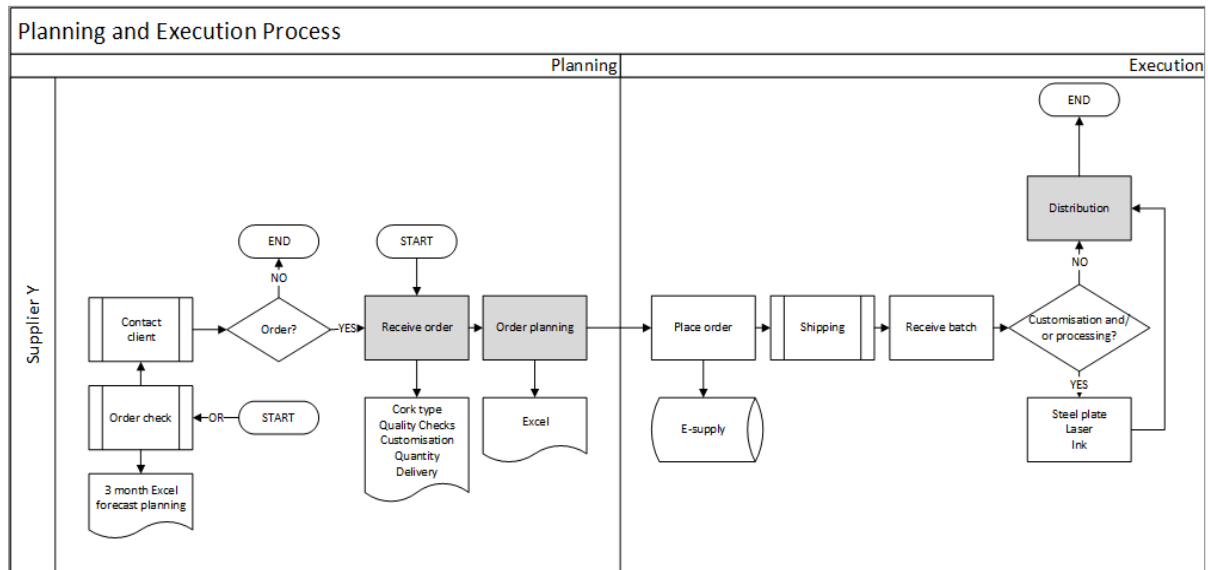


Figure 3.11: Basic process flow of Supplier Y

The supplier keeps an internal record of previous demand requirements of clients. This includes an approximate reference of time for when the demand is required, allowing them to plan order shipments. The supplier often relies on their own initiative to contact clients to confirm whether the previous year's orders are to be generated again, based on their internal Excel records. Seeing that the lead time is eight weeks and orders must be grouped to fulfil shipment quantity requirements, order history is checked three months relative to the delivery date of the order of the previous year. The interviewee mentioned that clients often neglect to communicate dry goods requirements to them, even when bottling has already been scheduled. Branding of corks is also a challenge as the lead time differs for different branding methods (i.e. ink, laser or steel plate). Limited machinery is available for branding in SA and scheduling is an important factor.

Another factor worth mentioning is the quality checks performed for some order batches, often conducted for corks intended for premium wines. A small number of employees performs all these quality checks manually, which is a time-consuming process that affects delivery of corks to wine bottling facilities. Order prioritisation in terms of bottling date and sequence of clients can benefit the supplier to arrange production schedules accordingly, ensuring on-time delivery and availability of corks at the bottling facilities. The process steps highlighted in Figure 3.11 are possible areas of collaboration and collaborative opportunities for Supplier Y are discussed in Table 3.5.

Table 3.5: Collaborative opportunities for Supplier Y

Process step	Opportunity for collaboration
Receive order	Create demand requirement for specific cork and expected delivery date as soon as pre-planned bottling schedule is set: information available for all the stakeholders involved.
Order planning	Shared visibility of bottling schedule of all clients to enable order batching (for shipment purposes) and production planning : information visibility and order prioritisation based on bottling schedule.
Distribution	Track and trace delivery of dry goods: on-time availability of dry goods and order prioritisation if shift in bottling schedule.

3.6 Case interviews: wineries

Wineries play an important role in the wine making process, as they are after all responsible for the most important component required to deliver a product to the market, which is the wine itself. Based on prior findings in case interviews, a winery is involved in the bottling process from start to finish. A winery is the initiator of the entire process when a bottling slot is requested and the final product is delivered to the consumer as a unique branded product of the particular winery who produced the wine.

For the purpose of this research study, the researcher visited two wineries and interviewed individuals responsible for planning and overseeing the execution of wine bottling. The background and basic process information is given in the sections that follow.

3.6.1 Winery 1 case interview

This section provides information regarding the supply chain operation at one of SA's largest producer cellars located in Paarl. It focuses on planning of tactical and operation elements involved that enables the wine cellar to bottle wine.

Dry goods requirements planning and wine readiness assessment are the two major components that wine cellars pay attention to leading up to bottling. The logistics coordinator, the interviewee in this case, completes a preliminary scheduling plan, based on anticipated wine harvests for the year. The interviewee mentioned that this

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plan is relatively accurate except for some export orders that are often unanticipated. This scheduling plan consists of the information related to the wine cultivar, anticipated bottling requirement, the BOM items required for the unique product as well as a time window during which the wine is expected to be bottling-ready. From this point onwards, the interviewee starts informing the necessary stakeholders about the demand requirements for the products that they intend to bottle. Figure 3.12 illustrates the basic process flow involved in the production of wine at a wine cellar.

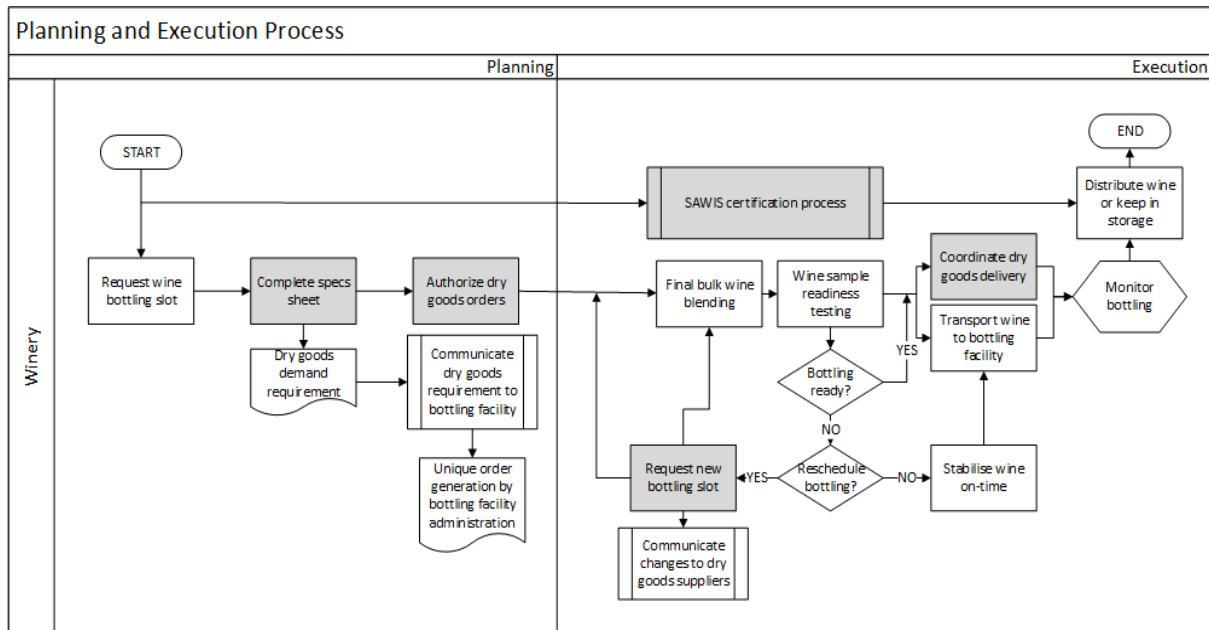


Figure 3.12: Basic process flow at winery in preparation of wine bottling execution

The communication to the bottling facility has to officially take place one week prior to the week during which the bottling needs to be schedule, usually the Monday before the week of bottling. The bottling administrator is responsible for communicating the official bottling capacity requirement to the bottling manager, using a standard specification sheet, which is communicated via email and allows the interviewee to generate a request for a unique bottling order. The administrative personnel at the bottling facility is responsible for creating a unique order, which in return is used to schedule bottling based on cultivar, bottle type and sealing method.

The interviewee mentioned that this is a crucial step in the process, as several problems can arise. As the winery has the option to request some dry goods from the bottling facility instead of ordering it themselves, special attention must be paid to ensure that the dry goods BOM specifications are correct. If for example, the administrator specifies the wrong glass bottle, the run sometimes continues and the

batch is in essence faulty, as it does not conform to the correct requirements. Such a batch often requires rework or is sold at discounted prices, which is a costly mistake considering highly customised or branded products. The originally intended bottling runs also need to be replanned as the product could not be shipped to the customer on time.

The dry goods that are not ordered from the standard list of dry goods offered by the bottling facility, have to be coordinated for timely delivery to the wine bottling facility by the wine cellar themselves. The interviewee highlighted the availability of dry goods and wine readiness as the main challenges that causes bottling delays. Dry goods that are customised to some degree, even just being a unique coloured screw cap, tend to be a problem. The problem arises as this is a typical make-to-order (MTO) item rather than a standard make-to-stock (MTS) item. In the case of a dry goods item not being available, the supplier communicates the problem to the wine cellar, who is responsible for finding a solution or inform the bottling facility to try to manage the exception and still be able to bottle in time for on-time order delivery. Printing of labels is also challenging, especially with exports and is attributed to different export countries having different legal requirements and customers who have variable customisation requirements related to specific markets.

The other challenge, wine readiness, is heavily reliant on the stabilisation process of the wine before it is bottling ready having an approximate lead time of 21 days. After the stabilisation process, pre-bottling wine samples are sent to the bottling facility for analysis on a Wednesday, the week prior to bottling. The results are received by the wine cellar on Thursday who in return are responsible to ensure that any nonconformities are taken care of. If the wine sample conforms to all standards, bottling proceeds as scheduled. However, in the case of non-conformance, the wine cellar is responsible to correct the composition of the wine and have it ready in time for bottling or they forfeit their bottling slot (sometimes at a penalty cost) and have to wait until the next available slot.

Export orders are subjected to an approximate lead time of 28 days. This lead-time is linked to factors such as wine readiness, branding requirements of screw caps or corks as well as the printing of labels. Export wines are often bottled with wine intended for the local market as it is wine produced from the same batch of grapes, but kept unlabelled in storage until the order is received. This postponement strategy is followed to avoid labelling excessive stock quantities that might not correspond to

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orders, but leading to rework. A typical example is labelling a large stock quantity, but the international client requires a different back label. This result in rework to remove the label (also adding administrative work due to SAWIS requirement), printing new labels and scheduling a labelling slot. This results in unnecessary additional expenses.

The interviewee highlighted an important new trend. Latest market research shows that wineries should rebrand their wines every five years to increase market competitiveness. This leads to increased supply chain complexity, as rebranding requires new customisation of dry goods, such as the label and screw cap or cork. Branded screw caps are starting to become of particular importance and this not only increases supply chain complexity, but also results in increased dry goods cost per bottle of packaged wine.

As the focus of the WISE initiative is to increase packaged export, coordination between wine cellars, wine bottling facilities and dry goods suppliers is becoming more important. There are several process steps executed by wine cellars identified by the researcher (listed in Table 3.6), linked with operations of supplier and bottling facilities that provide opportunity for collaboration between the stakeholders.

Table 3.6: Collaborative opportunities for Winery 1

Process step	Opportunity for collaboration
SAWIS certification process	Automatic notification of SAWIS application deadlines for respective certification processes for different bottling batches and visible information sharing of intended completion of bottling to enable order prioritisation.
Completion of specification sheet and authorisation of dry goods orders	Distribution of demand requirement to all relevant stakeholders relative to intended bottling date: information available to all stakeholders influencing on-time order delivery.
Coordination of dry goods delivery	Track and trace delivery of dry goods: on-time availability of dry goods and management of exceptions if a problem is detected
Request new bottling slot	Information transparency to communicate schedule changes to other stakeholders and receive confirmation from stakeholders whether they can accommodate changes or not.

3.6.2 Winery 2 case interview

Winery 2 is small producing wine estate located in Stellenbosch that bottles less than 100 000 litres per year. This wine cellar produces wine on a small scale, only bottling wine produced by the estate themselves and uses mobile bottling services. The winemaker (in this case the interviewee) is responsible for planning all bottling related requirement and overseeing the execution thereof.

The winemaker plans bottling based on wine readiness or if space is needed in the cellar for the production of new wine or alternatively if there are out of stock situations. The interviewee plans to ensure that there is always stock available to cover demand requirements of two months, based on previous sales. As the estate uses mobile bottling, bottling, labelling and packaging of wine is completed on separate days. Wine is bottled and stored in bins to minimise processing time on the day of bottling. A mobile labeller thereafter completes labelling based on demand characteristics of a product and during this run, the wine is packaged in boxes, ready for delivery or shipment.

Wine is bottled approximately four times per year, bottling one or two consecutive days per run at a capacity of 10 000 litres per day. As the mobile bottling service has a tight schedule, booking two to three months in advance is essential. The interviewee is then responsible for ordering dry goods, if required, and must ensure that the wine is ready by the scheduled bottling date. As the estate bottles small quantities of wine annually, dry goods items are ordered in bulk quantities if possible to benefit from economies of scale. However, branded items that continuously change such as labels, depending on the harvest season, alcohol percentage, etc., are ordered as needed.

When scheduling a bottling slot, several components must be available when the mobile bottler arrives on the day of bottling, all having different lead times and varying demand planning requirement. Table 3.7 contains a summary of the demand planning characteristics.

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Table 3.7: Demand planning characteristics of dry goods required for bottling

Dry goods item	Lead (LT)	Time Planning characteristics
Bottles	3 weeks	Small order quantities, only send demand requirement once bottling slot is booked
Corks	2 weeks	Suppliers keep stock in warehouse, short lead time except winemaker requires imported corks for a batch of wine
Screw caps	8 weeks	Minimum order quantity due to branding requirements

The availability of these components, along with wine readiness, is crucial to ensure that bottling can take place as scheduled to avoid out-of-stock situations, as missed bottling often results in bottling delays of 4–8 weeks, because the mobile bottler is always booked well in advance, and can only accommodate clients who have missed their slot if there is a cancellation. Furthermore, penalty costs are charged.

On the day that labelling takes place, the winemaker has to ensure that labels, capsules and boxes are available and all the required SAWIS documentation must be in place. With meticulous planning, these elements and the elements required for bottling can be readily available. However, the interviewee highlighted that labels are a challenge, as these require very specific information that requires approval before printing can proceed. Changes made to existing label designs, such as change of harvest year or alcohol percentage, must be signed off before printing can commence. This requires a tremendous amount of coordination and communication between the winemaker and the label printing company. As labels are also often the most expensive dry goods item, depending on the nature of the design of the label, wineries try to avoid any mistakes on printed labels.

Regarding export orders, the interviewee mentioned that these orders are typically subject to a lead time of six weeks, if bottling and labelling still has to be arranged. If wine is already bottled and only labelling is required, orders can be exported within three weeks, while bottled and labelled wine requires a lead time of two weeks. Export order lead times are dependent on stock-on-hand, label requirements, the SAWIS certification process (based on validity of sensorial tasting dates) and the completion of export certification documents.

The interviewee stressed the importance of dry goods planning and the timely delivery thereof as it is a determining factor to proceed with bottling. Based on years of experience working in the wine industry, specifically responsible for wine readiness and

dry goods planning the interviewee acknowledged the challenges existing and corroborates that improved collaboration between industry stakeholders can be beneficial. Even though mobile bottling is excluded from the scope of this study, such stakeholders can potentially be included in a collaborative initiative in this industry.

3.7 Case interviews summary: Coordination of processes

After conducting several interviews with various stakeholders in the industry, it is clear that there is room for collaborative efforts to enhance the execution of multiple tasks that influence wine bottling. There are different processes and steps involved for each stakeholder to deliver dry goods at the right time, at the right place and in perfect condition. Suppliers sometimes find it challenging to anticipate demand, receive orders on short notice and branding of some dry goods components is time consuming.

Based on findings from the case interviews, the research was able to construct an own interpretation of a wine supply chain diagram that builds on the basic representation of a wine supply chain by Garcia *et al.* (2012) in Section 1.1.1 to highlight the complexity of the segment investigated. This configuration in Figure 3.13 illustrates the functioning between wine producers, bottling facilities and dry goods suppliers.

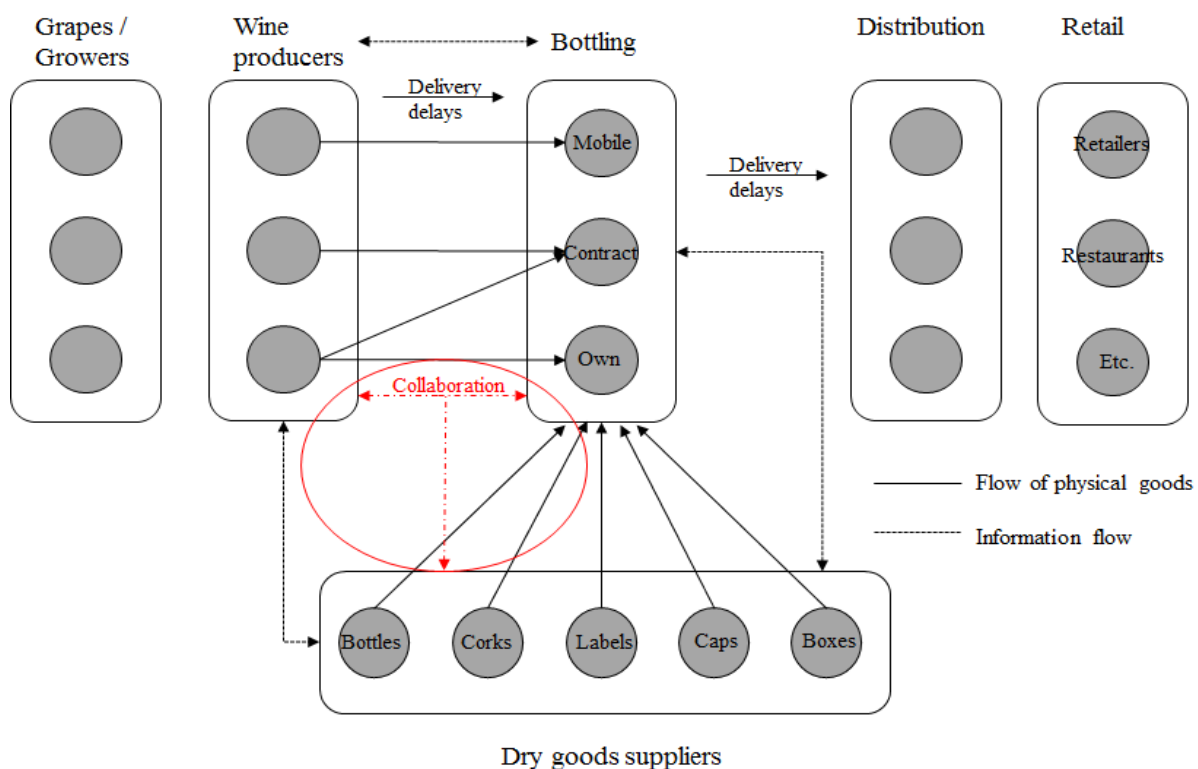


Figure 3.13: Wine supply chain representation

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Bottling can either be performed as a service, by contract bottling facilities or mobile bottling companies, or wine producers sometimes have their own bottling line and they do not use a third party bottler. Privately owned bottling is usually performed on a very small scale as wine producers often do not invest in more than one bottling line, seeing that it is quite capital intensive and in some cases extra bottling is completed by a third party. Flow of physical goods, in this case dry goods materials and wine, flows from the wine producers and suppliers to the bottling facility. Information flows between wine producers and bottling entities, dry goods suppliers and wine producers and in some cases bottling entities and dry goods suppliers if bottling entities supply dry goods to their clients. All this information is exchanged between two stakeholders. To execute bottling, three parties (the bottling entity, wine producer and supplier) are involved with the coordination of processes and this requires a three-way collaborative relationship.

Stakeholders have limited capabilities to coordinate supply chain planning, forecasting and replenishment activities as well as their execution. In essence, wine bottling is the bottleneck point where the supply of multiple components that contribute to the successful manufacturing of a finished product is integrated. If upstream planning and its execution is not properly coordinated, production processes at wine bottling facilities are affected, ultimately affecting the ability to meet distribution demand requirements. Thus there are several improvement opportunities, discussed in Table 3.8, that wine bottling facilities can capitalise on to improve their supply chain operations.

Table 3.8: Main opportunities for improvement identified for all stakeholders involved

Improvement opportunities	
1. Joint order planning:	Stakeholders are to share demand and supply information under joint collaborative agreement terms.
2. Order prioritisation:	Collaborate on planning and forecasting of demand requirements and supply capabilities. Ensure that information is made visible to all relevant stakeholders.
3. Exception management:	Track execution of supply chain activities based on a collaborative supply and demand plan to manage exceptions by making amendments if possible and where appropriate. Having information available and visible to supply chain stakeholders will enable early detection and management of exceptions.
4. Performance measurement:	Establish and enhance a mutual relationship of trust. Create a sense of accountability and responsibility amongst stakeholders to ensure sustainability of a collaborative relationship.

Timely execution of wine bottling and the delivery of finished products is important, especially for export purposes as there are fixed shipping dates and various certification processes prior to shipping to ensure that bottled wine complies with different export standards. A delay in bottling can influence the completion of downstream analysis and tasting processes of finished products (if a tasting day is missed and special arrangements cannot be made), potentially leading to missed export opportunities. In order to develop a framework addressing the challenges and opportunities identified requires the formulation of suitable design requirements. The following section serves to provide an outline of these design requirements.

3.8 Design requirements based on findings from case interviews

The operations in the supply chain environment investigated, exhibit complexity for a number of reasons. This includes the complexity of the product, the number of stakeholders and relationships between them, the nature of the requirements of final customers, continuous pressure of local and external competitors in the market and the legal constraints related to both packaged and bulk wine for local and export purposes. Several steps involved in the planning and execution phases of the various stakeholders lack integration. Based on the main challenges experienced by the various stakeholders and the improvement opportunities identified (listed in Table 3.8) in Section 3.7 developing a collaborative framework for this supply chain environment is subjected to a set of design requirements. These design requirements, presented in Table 3.9, are formulated to provide a guideline for the formulation of an appropriate collaborative framework that will help to address the challenges and opportunities currently present.

Table 3.9: Collaborative framework design requirements based on industry challenges and opportunities

Design requirement	Value added to wine SC
Foster a collaborative culture	Internal and external collaboration or linkages are both needed to drive innovation. It increases predictability and creates solid partnerships between wine bottling facilities, dry goods suppliers and wine farms (Palm & van Eeden, 2018). Setting joint goals can drive such a collaborative relationship between stakeholders. Supply chain collaboration or linkage is considered important for supply chain reliability (Lee <i>et al.</i> , 2007), which in return influences supply chain responsiveness.

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Design requirement	Value added to wine SC
Guide wine bottling facilities to establish a strategic collaborative relationship with clients and suppliers	Assist bottling facilities with identifying collaborative partners to allow process integration. Aligning the supply chain and operational strategies of the supply chain partners to ensure that the entire supply chain competes as an industry unit. It aims to improve supply chain performance as the responsiveness is influenced to a certain degree by the ability and performance of their suppliers (Hamister, 2012).
The framework should improve planning and procurement of dry goods	Includes sales and operations, range forecasting, collaborative forecasting, planning, information sharing, strategic sourcing and sourcing information, supplier development and supplier relationship management. These are key aspects for agricultural procurement in order to realise improved reaction to changed demand characteristics (Du <i>et al.</i> , 2009).
Facilitate information sharing	The framework assists stakeholders with identifying the relevant information to share. Sharing high quality and relevant information enhances the level of information sharing and the quality of a strategic supplier partnership. Accuracy, timeliness and credibility of shared information are important factors to improve supply chain performance (Li <i>et al.</i> , 2006; Hamister, 2012).
Improve information sharing, information visibility and supply chain transparency	Refers to the extent that non-public information is shared and communicated amongst the different supply chain partners and channels - an aspect of successful implementation of SCM practices that contribute toward improved supply chain responsiveness (Li <i>et al.</i> , 2006; Koh <i>et al.</i> , 2007; Lee <i>et al.</i> , 2007). Information sharing is a key enabler to ensure improved responsiveness to changing demand requirements as it allows for improved exception management (Enslow, 2007).
Identify appropriate digital technologies to utilise	Digital technologies to improve the facilitation of sharing larger volumes of information are regarded as core enablers of collaboration and although CPFR is not fundamentally dependent on this factor, it enhances process facilitation, being a crucial tool for larger-scale implementation (Sattar, 2012).
Enable performance measurement and feedback	Will allow stakeholders to repeat successes and eliminate failures with more success.

Interviewees corroborated that improved collaboration, enhanced information sharing and its availability can potentially help to improve planning, forecasting and replenishment of all the components required to complete the bottling process.

Willingness to enter a collaborative relationship with supply chain partners is present; however the absence of guidelines and an appropriate platform to deploy such an initiative inhibits its realisation. These design requirements are translated into a collaborative framework developed in Chapter 4. The framework will focus on incorporating dimensions of CPFR reviewed in Chapter 2 and the industry-related challenges and opportunities identified in Chapter 3 to aid collaboration in the highlighted areas.

3.9 Chapter summary

This chapter and Chapter 2 serve as inputs for the development of the collaborative framework. It gave a brief overview of the planning and execution activities at wine bottling facilities and some of their supply chain partners and is aligned with Research Objective 2. It discussed the challenges experienced by the stakeholders, leading to the identification of several improvement opportunities. A set of design requirements was subsequently constructed to build a framework that will address the challenges and opportunities existing in the industry.

Chapter 4

Framework Development

This chapter aims to combine the information gathered through the literature review process in Chapter 2, along with the information presented in Chapter 3 to develop a collaborative framework. The content of this chapter aims to provide answers to the following research questions (RQ) and the related sub-questions highlighted in Table 1.3 (Section 1.3):

- RQ 4: How can a collaborative planning framework be developed for a wine bottling facility and their direct supply chain partners?

This aligns with Research Objective 3, which aims to develop a collaborative planning framework. The framework will integrate the dimensions, challenges and benefits of CPFR and the opportunities identified through engaging with industry stakeholders to provide guidelines for enhanced collaboration through effective and visible information sharing.

4.1 Conceptual framework development theory/methodology

Many multidisciplinary bodies of knowledge related to different phenomena exist. All of these sources can be combined and incorporated into one framework to link different concepts that are relevant to a specific phenomenon. Conceptual frameworks are a useful theoretical approach that can be used to improve the understanding of the phenomenon that it addresses and it can easily be modified to incorporate new concepts that are valuable for the specific application of the framework (Jabareen, 2009).

Jabareen (2009) defines a conceptual framework as a product of qualitative processes of theorisation. Using this definition it is useful to define the term *concept* and the idea of a *conceptual framework*.

4.1.1 What is a concept?

There are several definitions related to the term *concept*. In essence, a new concept usually contains bits and pieces of information captured by the idea of a concept that

was previously developed (Jabareen, 2009). Thus, a new concept is always created using some theory or application of theory that already exists.

Saunders *et al.* (2015) refer to a concept as a box in which we place things we believe have common aspects and having a clear definition of concepts is an integral part of completing research. The definition used for specific concepts related to a phenomenon needs to be understood by parties in the academic environment as well as in practice. Once concepts are clearly defined and grouped, they can be combined into a conceptual framework that clarifies how the relevant information and concepts are connected and this framework can be utilised as a guide to build a theory.

4.1.2 What is a conceptual framework?

Jabareen (2009) defines a conceptual framework as “*a network of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena*”. It is a combination of concepts and pieces of information that relate to a phenomenon or phenomena (Saunders *et al.*, 2015).

Each of the concepts that is included in the construct plays an important role to improve the understanding of the phenomena, primarily based on the interpretation of intentions and social reality. Subsequently, conceptual frameworks provide a guideline for theory building (Saunders *et al.*, 2015), including an ontological and epistemological assumption that is used for model development. Thus, a conceptual framework is considered a ‘pre-theory’ that can be used to develop a practically implementable model.

Developing conceptual frameworks usually relies on following an inductive approach, as the ‘pre-theory’ developed by constructing a conceptual framework usually emerges from existing data and information (Saunders *et al.*, 2015), which in return provides new insights regarding a phenomenon or phenomena. The data used to construct such a framework is often qualitative (Saunders *et al.*, 2015). Conceptual frameworks specifically focusing on supply chain collaboration tend to explain organisational and functional aspects, rather than evaluating performance as is the case with mathematical or simulation models (Ramanathan, 2014).

4.1.3 How to develop a conceptual framework

When developing a conceptual framework using an inductive qualitative approach, the two main inputs are experiential knowledge and literature reviewed. The first element

consists of research background, technical knowledge and personal experience. The second includes related theories and research applicable to the specific research topic (Chetty, 2015), which is relevant as conceptual development must improve the understanding of a phenomenon by formulating the ideas, information and data gathered in the most appropriate way (Saunders *et al.*, 2015).

The key steps to start conceptual framework development suggested by Chetty (2015) includes (1) Identifying key variables for the research subject of the project, (2) Highlighting the key variables using existing literature, (3) Gather further information relating to key variables identified and (4) Determine the interrelatedness of these variables, converting this into a concept that explains the phenomenon. The research conducted when formulating a conceptual framework explores research with the help of stakeholders and does not specifically conduct research for the stakeholders in all cases (Saunders *et al.*, 2015). The stakeholders are involved in the development during the following four stages:

1. Problem formulation – using literature as well as knowledge from those who experience the problem.
2. Research design – discussing formulated research methodology with technical experts.
3. Theory building – inductive theory development and validation of theory by consulting experts within the field of the research.
4. Problem solving – apply findings and engage with experts to interpret meanings, uses and relevance to the field of research.

These steps include identifying, reading and categorising the relevant data sources (reported on in Chapter 2 and Chapter 3), followed by the deconstruction, categorisation and integration of all the concepts into a comprising framework (following in this chapter). The necessary verification, validation and refinement of the framework follows in Chapter 5.

It is important to understand that conceptual frameworks are not able to predict outcomes as they are not deterministic. Typical conceptual frameworks are developed using the process of qualitative analysis and Jabereen (2009) suggests using the grounded theory method, developed by Glaser and Strauss in 1967, for the construction of conceptual frameworks using multidisciplinary texts. According to

Orlikowski (1993) grounded theory mostly relies on a contextual, procedural, and inductive approach to formulate a theory that explains a phenomena. An inductive approach suggests that new theories are generated from existing information and data (Gabriel, 2013).

As proposed by Willig (2013), this method uses an initial research question to drive the exploration of a phenomenon and allows the researcher to move back and forth between the processes of information collection and analysis. Data collection methods often include semi-structured interviews and the analysis of existing documents and texts (Willig, 2013).

This continues until theoretical saturation is reached and the researcher is able to produce a research report that answers the initial research question. This theory provides a method to identify categories that relate to one another, how they are linked and helps to establish a relationship between them. The end product is a theory, presented as a framework, that addresses the initial research question and explains the phenomenon or phenomena that are being investigated. The initial research question is often changed as information collection and analysis continues, but will still be aimed at addressing the original phenomenon or phenomena.

4.2 Framework development and design

The context and intended purpose of the framework developed are guided by the results of several semi-structured interviews with stakeholders in the bottling section of the wine supply chain. The interviews helped to understand current collaborative efforts between the identified partners or the lack of these and to clarify the extent of the research problem. All this information contributed to the formulation of a framework that could prove useful. This, along with relevant literature gathered related to the concept of CPF, is the foundation of the inputs for the developed framework that is the output of the framework development as depicted in Figure 4.1. The framework developed in this research will be known as the Wine Industry Collaboration (WIC) framework.

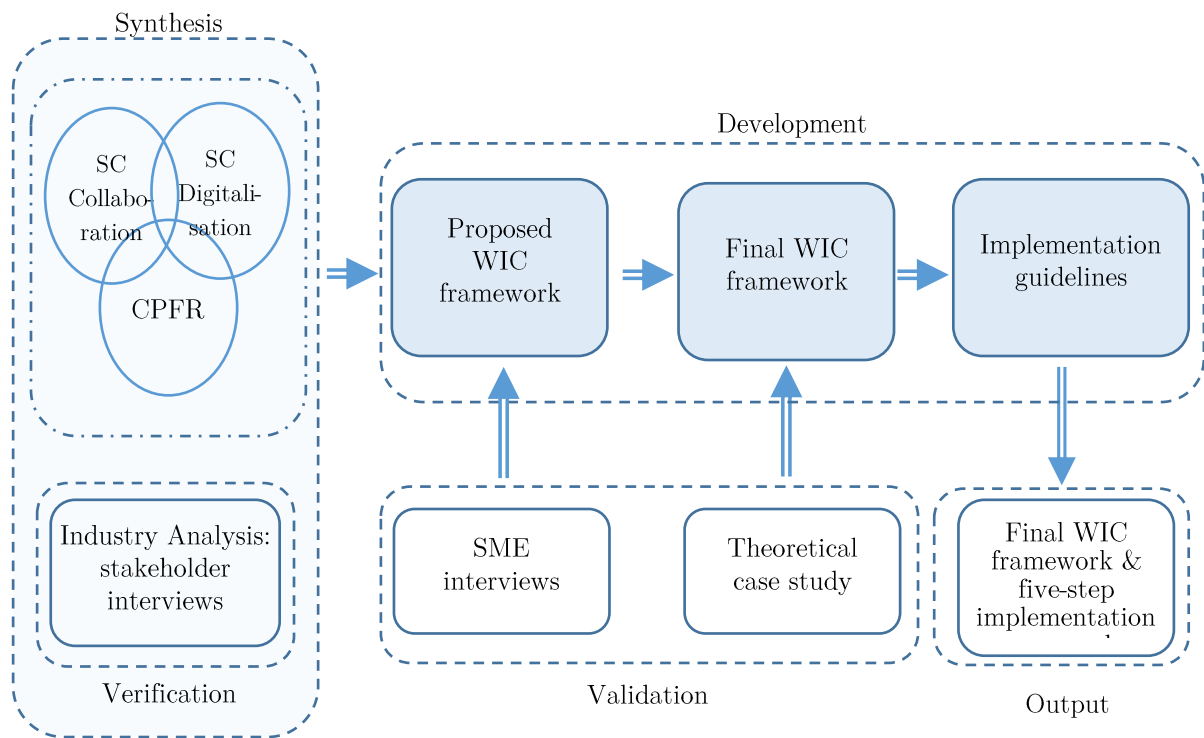


Figure 4.1: Framework synthesis and development process

The researcher verified the inputs used, in this case the literature and SME interviews continuously, as interviewees were encouraged to comment on the applicability of CPFR and related framework dimensions. Furthermore, interviews led the researcher to conduct more interviews with other stakeholders that interviewees deemed important for the development of the framework.

After conducting the literature review and investigating the current situation in this specific area of the SC, the researcher is not aware of an existing framework that is specifically adapted for the needs of the supply chain partners. The framework focuses on collaborative assortment planning for a seasonal planning horizon that typically includes a single season. Skjoett-Larsen *et al.* (2003) suggest that there is a gap between CPFR frameworks and their implementation, thus the derived implementation guidelines developed will assist the wine bottling facilities and their supply chain partners with this issue.

The WIC framework and implementation guidelines presented in this chapter are the final framework and implementation guidelines that are derived from the proposed versions after validation has taken place. The proposed WIC framework was validated through SME interviews, whereafter the researcher conducted a theoretical case study

to validate the implementation guidelines formulated based on the final framework. A detailed discussion of the validation process and the outcomes thereof is given in Chapter 5. The unvalidated version, i.e. the proposed WIC framework, can be viewed in Appendix C.

4.2.1 Purpose of the WIC framework

The WIC framework is developed to assist wine bottling facilities to improve collaborative efforts concerning the coordination of planning and execution of wine bottling. This specifically aims to improve collaborative efforts with wine cellars and dry goods suppliers having a direct influence on the on-time order fulfilment of wine bottling facilities, as these stakeholders influence the availability and readiness of several components required to perform a bottling run.

The framework operates on the strategic planning level to some extent, further focusing on the tactical and operational planning levels of bottling facilities, wineries, dry goods suppliers and supporting requirements from SAWIS. It aims to help establish collective relationships within the industry which is one of the determining factors mentioned by the managing director of Vinpro, Rico Basson, that will contribute to the success of the WISE initiative (Vinpro, 2015).

The WIC framework aims to create a comprehensive strategy that will assist the South African wine industry to shift its focus from bulk wine exports to branded packaged products (du Preez, 2017). This research targets to address this, as it is one of the WISE aims for 2025. In addition to these aims, one of the six work streams identified involves technology and innovation transfer, with a game changer being projects related to technological innovation (PWC, 2015). As the WIC framework provides guidelines for the implementation of new technologies that can enhance collaborative activities, it targets addressing this improvement opportunity.

4.2.2 Framework objectives

The research aims to *develop a collaborative framework ensuring enhanced information sharing and visibility to enable responsive decision-making*, which is the main objective of this framework and is used to derive the following framework objectives:

1. Identify wine bottling challenges and opportunities.
2. Determine appropriate collaborative tasks and technologies to improve the

distribution, availability and visibility of information.

3. Consolidate the challenges and opportunities involved in planning, forecasting and execution of wine bottling by contract wine bottling facilities into a structured framework that is easy to understand, easy to use and flexible to be adapted to other wine supply chain scenarios.

The information gathered in the literature review, together with the information obtained from industry experts, provide satisfactory information to propose a collaborative framework. This framework will be verified and validated by SMEs. The feasibility and practicality of the framework is an important factor and will also be judged during validation.

The following design principles have been established to guide the development of the framework:

- **Practicality:** The framework should be easy to understand and used to address the challenges and opportunities identified.
- **Feasibility:** The framework should fulfil its intended purpose, which in this case will be to improve collaboration between wine bottling facilities and their direct supply chain partners to aid responsive decision-making.
- **Structure:** The phases and steps of the framework should be logical and easy to follow.

Wine bottling facilities are faced with daily challenges surrounding the scheduling of bottling runs and adapting their bottling schedules due to supply chain constraints. When disruptions occur due to a supply chain constraint, causing deviations from the pre-planned bottling schedule, information availability and visibility prohibits effective and responsive rescheduling decision-making. This framework should provide the stakeholders involved with a logical and structured approach to improve collaboration between the supply chain stakeholders, to translate into improved and responsive scheduling and rescheduling capabilities.

4.2.3 Framework scope

The scope in this framework is limited to the scope of this research study. The study is limited to the exploration of processes at contract wine bottling facilities and the coordination of processes between this stakeholder, dry goods suppliers and wine cellar

clients. The focus is to empower bottling facilities to establish a mutually beneficial collaborative relationship with their clients and their suppliers, optimising supply and demand planning to improve the reliability of bottling processes as well as the responsiveness towards supply chain change.

The nature of information sharing between stakeholders described in the framework guidelines does not include any demand signals generated by the point of sales (i.e. the end consumer). However, the framework can be adjusted to include a greater number of stakeholders in the value chain such as the end consumer or stakeholders operating with other business models such as mobile bottlers. The framework includes guidelines for long-term high level strategic and tactical planning, with additional focus on operational planning elements. All opportunities, recommendations and measures stated in this framework are mere guidelines for the steps of each phase. It is recommended that this be revised and adjusted, thus customised to some degree, based on stakeholder involvement when implemented.

4.2.4 WIC framework design

The framework presented in Figure 4.2 (see p.121) is based on the existing CPFR framework developed by VICS in 2004. This framework aims to help stakeholders in the South African wine industry to increase the responsiveness of decision-making related to planning, forecasting and replenishment processes. The WIC framework addresses the lack of having a collaborative strategy involving wine bottling facilities, wine cellars and dry goods suppliers, addressing operations on strategic as well as tactical and operational level. This, along with the developed implementation guidelines derived from the framework, is expected to improve information sharing and communication capabilities concerning the capturing of information, tracking of orders and schedule changes of the supply chain partners, to enable responsive decision-making and to improve the reliability of the wine supply chain.

The framework starts on a strategic level by establishing a collaborative relationship between stakeholders. This requires wine-bottling facilities to take initiative and identify possible wine cellars and suppliers as collaborative partners, whereafter a collaborative agreement must be established.

The second phase translates to tactical planning of supply and demand. This requires participating stakeholders to communicate demand requirements for a specified planning horizon, as per agreement, to allow appropriate capacity, production and

distribution planning. Phases three and four track execution of processes to ensure on-time delivery and completion of bottling, as well as assessing the performance based on pre-determined KPIs. This allows stakeholders to identify the key problems and performance issues to improve on in the future.

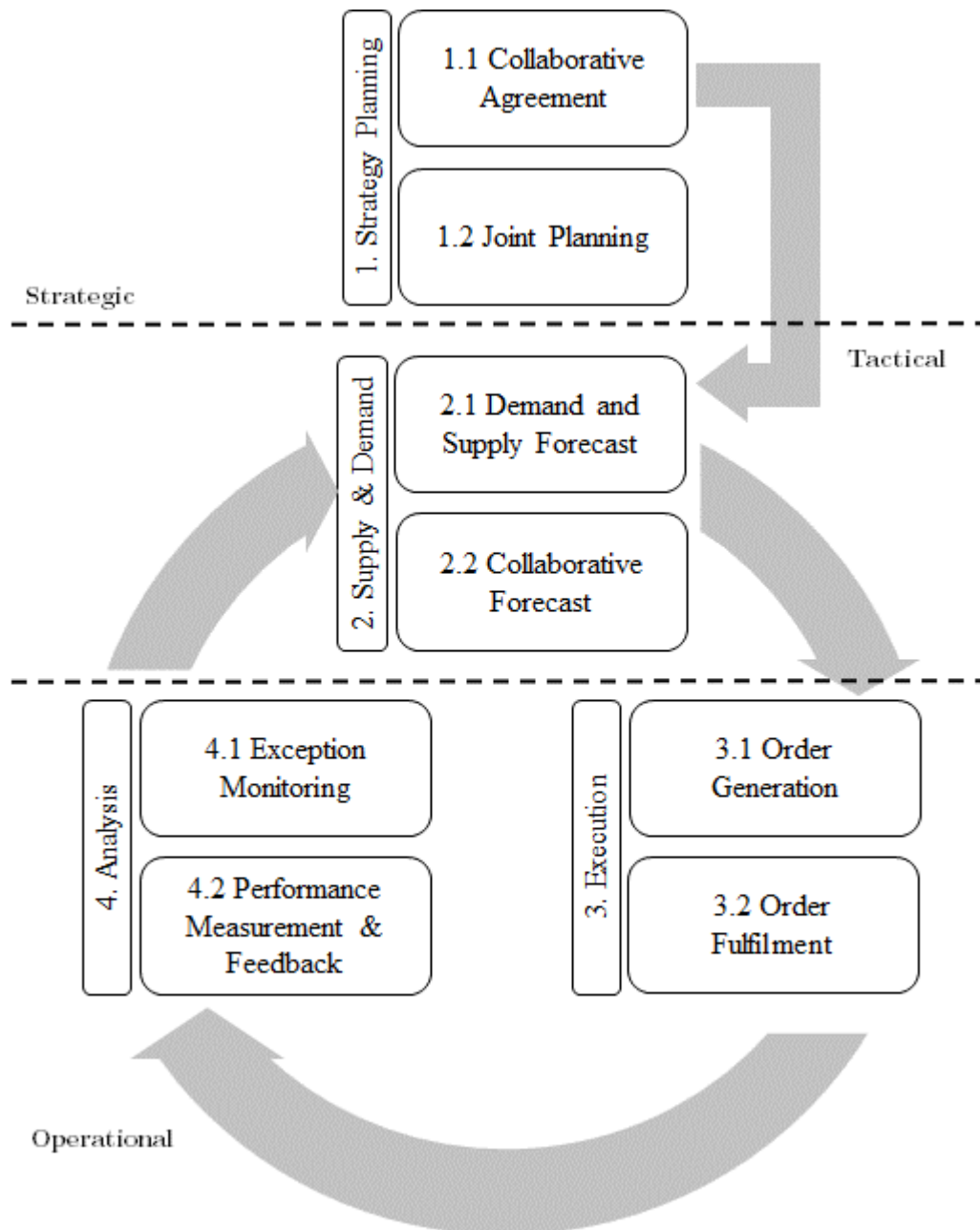


Figure 4.2: WIC framework process flow

4.3 Discussion of the WIC framework

The WIC framework consists of four phases, each consisting of two steps and several activities that guide the establishment of a collaborative supply chain partnership and its execution. These four phases are similar to the four phases presented in the latest CPFR framework formulated by VICS and also incorporate the five features gathered from literature by Thomé *et al.*, (2014) that can assist trading partners when planning and discussing the implementation of CPFR. Furthermore, it integrates other aspects specifically customised to make it fit for purpose for the wine industry. The following sections serve to provide an overview of each phase, what the steps within each phase entail and how they impact the various supply chain partners involved, whether this be the supplier, the winery or the wine bottling facility. The emphasis will be on the various collaborative tasks of the wine bottling facility and its relation to the supplier and winery respectively.

4.3.1 Phase 1: Strategy planning

Strategy planning is the first phase in the establishment of a collaborative supply chain partnership. This phase consists of two steps: (1.1) Collaborative Agreement and (1.2) Joint Planning. These two steps concern the establishment of guidelines for driving a collaborative relationship. This phase incorporates the collaborative model proposed by Matopoulos *et al.*, (2007) depicted in Figure 4.3.

Setting up the *Collaborative Agreement* starts with **partner selection** and collaborative partners must be willing to commit resources to implement and facilitate the initiative, which is an important step in this first phase of CPFR. Wine bottling facilities should focus on manifesting a close relationship with a selected number of partners, mostly focusing on collaboration with suppliers and in return, collaboration between suppliers and wineries will aid collaborative efforts of wine bottling facilities. Important decision factors in this case include the relationship between buyer and supplier, purchasing volume, LT and the risk of supply.

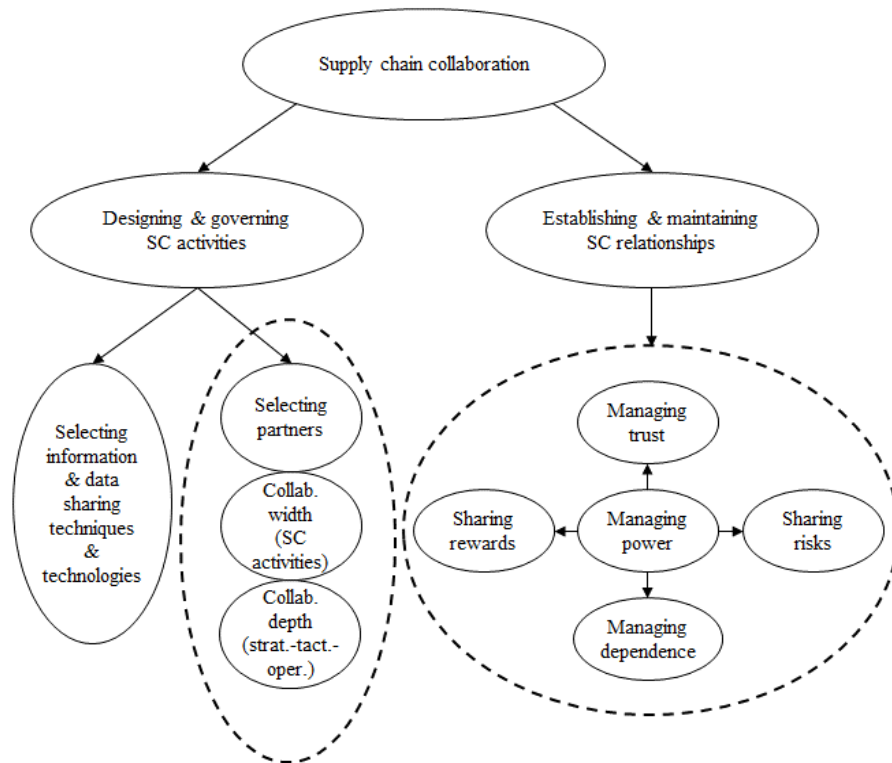


Figure 4.3: Research framework for supply chain collaboration

Partner selection will also be heavily reliant on trust between the stakeholders, management involvement and whether stakeholders are willing to assign staff and train them adequately. These are key enablers of collaboration such as CPFR (Skjoett-Larsen *et al.*, 2003; Attaran & Attaran, 2007). Hand-in-hand with partner selection runs the proposal of a **source and supply agreement**, which involves defining the collaboration width. This requires partners who enter the collaborative agreement to identify or specify the intended width of collaboration. Chapter 3 gives a detailed explanation of all the possible opportunities for collaboration explored by the researcher and this can be expanded should more stakeholders be included.

Furthermore, the source and supply agreement involves setting the terms and conditions (T&Cs) related to purchasing, often including price, quantity discount, quality, etc. An important aspect to consider is the agreement regarding fluctuating exchange rates for imported goods. Price negotiations are affected by this variable and the T&Cs should be negotiated and incorporated into the source and supply agreement, this being a certain measure of sharing risk. From a legal perspective, the relevant NDAs need to be drafted to ensure information security and establish trust amongst stakeholders. A well-written NDA is an important mechanism for managing trust.

In Section 2.4.5.4, one of four collaborative supply chain strategies is suggested (depicted in Figure 2.13), guiding the selection and involvement of supply chain partners in a collaborative strategy. For the applicable supply chain configuration, an ‘information exchange’ combined with ‘synchronised supply’ supply chain collaboration configuration is suggested. Both of these supply chain strategies are collaboration configurations emphasising planning collaboration, while synchronised supply additionally has a focus on inventory collaboration.

Information about expected orders in the future and raw data for material planning are shared amongst the supply chain partners, but orders are still made independently. Forecasting is an integral element of information sharing added to this approach to align it with CPFR. This calls for all supply chain partners involved to share a forecast² by the agreed upon due date. Along with this approach, a synchronised supply approach entails a supplier concentrating supply and production planning using customer information, or in this case the information provided by wineries. This allows a certain degree of inventory collaboration, as suppliers’ replenishment decisions are based on the visibility of production and material requirements planning of other stakeholders and vice versa.

Information exchange and the quality thereof is considered as an important enabler of CPFR (Petersen *et al.*, 2005; Panahifar *et al.*, 2015; Singh *et al.*, 2018) and other enabling factors mentioned above need to be in place to ensure that stakeholders are willing to share the relevant information. It is crucial that stakeholders trust one another and feel that their information is confidential and secure (Fliedner, 2003; Audy *et al.*, 2012). Basic information sharing elements that will be required to facilitate collaboration are listed in Table 4.1. Having collaboration focused on planning and inventory serves to guide supply and demand planning.

Establishing such a collaborative partnership demands a certain level of training and change management as the collaborative effort is heavily reliant on the human factor. As employees involved in collaborative efforts will be responsible for timely information sharing and using the information distributed to enhance decision-making, they must be well-informed about the concept of CPRF, what their specific

² Forecast in the context of this framework is not the demand of the consumer, but rather the operational demand originating at different stakeholders in the supply chain that is potentially based on consumer demand.

contribution is towards collaboration efforts and also the contribution that this makes to the operations of the business. Phased implementation of a collaborative effort will allow for proper transition and necessary change management aspects to be addressed.

Table 4.1: Collaborative information sharing elements

Stakeholders	Information sharing inputs
Bottling facility	Bottling slots availability Pre-planned bottling schedule Dry goods BOM requirement planning (verify quantities and expected delivery of dry goods)
Winery	Wine readiness date (cultivar and expected completion) Bottling volume requirement Dry goods BOM Dry goods stock-on-hand Wine readiness traceability
Supplier	Production capacity Production planning and sequencing Dry goods availability (stock-on-hand levels) Execution tracking of production processes Delivery tracking and traceability

Finalising a collaborative agreement corresponds with *Joint Planning* which involves **joint goal setting** and **synchronised decision-making**. When setting goals, individual stakeholders must look at possible benefits of CPFR, identify which benefits they want to exploit and set performance targets along with related metrics. The goals set can be related to the possible benefits of CPFR, which might include mutual goals listed in Table 4.2. When goals have been set, corresponding performance targets and related metrics must be set.

Table 4.2: Mutual collaborative goals and related performance metrics

Joint goals	Performance metrics
Improved agility	Resource utilisation
Improve responsiveness	On-time order fulfilment
Increased reliability	Overall Perfect Order Fulfilment
Higher productive capacity	Capacity utilisation

Synchronised decision-making is an important factor to consider as it is recognised as a collaborative culture initiator (Ralston *et al.*, 2017) and enabler of CPFR (Simatupang & Sridharan, 2003; Ramanathan & Gunasekaran, 2014). Typical elements included are

sales and order forecast, order multiples, minimum order sizes, lead times, the delivery lead times of orders and order placement deadlines (Simatupang & Sridharan, 2005). This aims to manage the critical decision-making of each stakeholder who commits to the collaborative initiative to help optimise profitability by managing decisions at both planning and executional level.

Stakeholders should also consider the period of information sharing and joint planning to ensure that planning is dynamic. This includes reaching an agreement on a period for planning to be accurate, not waste money or resources and enable stakeholders to make decisions and place orders within a reasonable time. This period will set the agreement that will guide supply and demand planning in Phase 2. Synchronised decision-making also involves agreeing on a frozen period that will specify the period for translating forecasts into confirmed orders in the Supply and Demand Planning phase.

Furthermore, *Joint Planning* also involves identifying appropriate **information sharing techniques and technologies**, another collaborative culture initiator identified by Ralston *et al.* (2017) and an enabler of CPFR (Fliedner, 2006; Hollmann *et al.*, 2014; Singh *et al.*, 2018). VICS (2010) mentions that facilitating technology use is necessary to allow fast and accurate replanning and reconciliation. The integration of technology listed in Table 4.3 and integrating CPFR with an IT system allows for easier documentation.

Table 4.3: Proposed technologies for improved collaboration

Technology	Capabilities	Applicable phase(s)
Bar codes and QR codes	Trace flow of goods and flow of information more accurately in the SC. This could also be beneficial for warehousing purposes and increasing the accuracy information used or distributed by stakeholders.	Phases 1 - 3
Shared platform	Collaborative Planning and Scheduling Platform: Automatic updates of planned production schedules, purchase orders as they are generated and accepted as well as tracking execution, used for the detection of capacity or supply constraints and problems.	Phases 2 - 4

Literature reviewed in Section 2.4.5.1 focuses on the implementation of CPFR. A number of success elements are identified to assist organisations with limited supply

chain collaboration between trading partners, to move towards a strategically focused organisation that is able to pursue long-range relationships with key supply chain partners. The most important elements for wine bottling facilities to focus on are listed below (VICS, 2010):

1. Developing a clear multi-year strategic plan consisting of key assumptions that are continuously reviewed for the planning horizon of each planning cycle. In this case, the *Strategic Planning* and *Joint Planning* steps are to guide the strategic plan and all the stakeholders involved should revise this on an annual basis.
2. Management must be the drivers of the collaborative strategy and its execution.
3. Link daily business execution to the strategic goals by implementing structured business reviews to clarify the roles, responsibilities and accountability of the participating members. These reviews can take place on a quarterly basis.
4. Building trust amongst the different trading partners by enforcing a discipline of getting things done and setting clear responsibilities. This will lead to improved work ethics, better performance and increase the competitive advantage.
5. Cross-functionality between collaborative teams across organisational boundaries to produce more efficient and effective work.
6. Driving group performance and responsiveness by having aligned incentives and shared risks and rewards.
7. Facilitating technological use to allow fast and accurate replanning and reconciliation.
8. All strategic aligned partners following a single operating plan to ensure that the organisations stay strategically focused during collaborating activities.

It is important to note that the collaborative agreement and joint planning aspects are revised continuously. As these are strategic planning elements, an annual revision of the agreement is recommended based on harvest periods being annual, they are important for managing trust, managing dependence as well as sharing risks and rewards which are important for establishing and managing supply chain relationships (Matopoulos *et al.*, 2007). These are key enablers to avoid barriers associated with CPFR implementation such as a lack of common collaborative goals (Barratt & Oliveira, 2001; Skjoett-Larsen *et al.*, 2003) and stakeholder integration (Fliedner, 2003,

2006; Ramanathan & Gunasekaran, 2014; Singh *et al.*, 2018).

During the rollout period of such an initiative, the stakeholders should revise the collaborative agreement continuously and on a regular basis as deemed necessary. Thereafter, annual revision of the agreement is appropriate.

4.3.2 Phase 2: Supply and demand planning

This phase of the WIC framework serves to estimate demand and order requirements for a specified planning horizon. This also includes planning replenishment requirements. This phase consists of two steps; (2.1) Demand and Supply Forecast and (2.2) Collaborative Forecast. The key focus of these steps is developing a forecast through collaborative information sharing and then aligning the forecast through collaborative decision-making. This phase could benefit from the development of a customised shared platform that will allow stakeholders to have access to shared information and real-time updates. This, however, will not be the sole success factor, as training and change management will be vital aspects.

During the Strategy Planning phase, information exchange and synchronised supply are identified as the best collaborative strategies for the supply chain environment relevant in this research. This supply chain configuration serves to guide *Demand and Supply Forecast* generation and *Collaborative Forecast* generation based on five key steps proposed by Barros *et al.* (2008) with one additional step. These steps focus on tactical planning.

Demand and Supply Forecast generation consists of:

1. Exchange demand information: this entails wineries to share appropriate approximation of bottling capacity requirement to wine bottling facilities and accordingly the anticipated demand of dry goods to suppliers. This information can also be distributed to SAWIS for relevant process planning purposes such as certification and tastings. This Master Production Schedule (MPS) and Material Requirement Planning (MRP) type of information should be for an agreed time window of approximately 6–12 months.
2. Exchange ‘inventory on hand’ information: it is important that stakeholders additionally share the inventory on hand information, especially in the case of dry goods inventory on hand at wineries or at bottling facilities. Demand information directly translated into dry goods requirements could potentially

cause a large planning error if inventory on hand quantities of standard materials are not accounted for.

3. Alignment of forecast for capacity and long-term planning: use exchanged demand information to pre-plan bottling and production schedules. This entails identifying the constraints and possible problems.

While *Collaborative Forecast* generation entails:

4. Collaborative forecasting: ensuring that all information elements are shared in a timely manner to all the relevant stakeholders as per the collaborative agreement to create a collaborative forecast for each stakeholder. The collaborative forecast is translated into collaborative MPS and MRP schedules for all the individual stakeholders based on a 6–12 month rolling period. An important aspect to consider is negotiating a frozen period related to the order delivery date, as this frozen period will set the term for order generation deadlines in order for planning to be accurate.
5. Merge replenishment of wine bottling facilities with dry goods planning and production of the supplier: ensure incorporation of lead-time requirement of each individual component and JIT delivery according to forecasted bottling schedule.
6. Suppliers coordinate winery dry goods replenishment to wine bottling facilities and both parties use this visibility in planning their own supply operations. Having visibility and updated information availability of the status of supply chain events allows for execution of forecasted plan or management of exceptions. The winery is also responsible for updating information regarding wine readiness to enable bottling facilities to keep track of wine required for scheduled bottling runs.

These key points form the foundation of the collaborative agreement, linked to the CPFR phases that follow. Step six is of particular importance as this information is transferred to the Execution phase that follows. Several inputs by various stakeholders are transformed to deliver the desired output.

The key responsibility lies with wineries, as these entities are responsible for planning demand for the year ahead (seeing that wine can essentially only be produced once a year when grapes are harvested for that specific season). Knoblauch (2018) developed a

demand planning decision-making framework for small- medium-sized wineries that assists wineries with this aspect.

The framework proposed by Knoblauch (2018) can be used by wineries who enter a collaborative partnership with contract bottlers to aid demand planning and this can be translated into improved forecasted demand. Collaboration would include sharing demand requirements over a rolling period to plan supply of dry goods and bottling for the year ahead. This can be applied to many scenarios of which a typical example is given.

Example: Several inputs are required from different stakeholders. A winery is responsible for planning different SKUs and requires the winery to compile a BOM for each SKU. From this, various ‘product families’ can be created through the aggregation of SKUs, followed by gathering data related to harvest, expected yield, wine readiness prediction and bottling requirement from wineries.

The BOM specification along with the intended bottling date needs to be distributed to bottling facilities and supplier. This allows them to do aggregate planning based on SKUs of different wineries, resulting in aggregation of SKUs to compile ‘product families’. A bottling facility will receive bottling requests based on expected bottling readiness of wine and align with available capacity. Suppliers receive SKU order quantities based on BOM and aggregate SKUs from different wineries into product family for capacity planning purposes. Wineries should also consider dry goods stock on hand quantities if applicable, wineries have excess dry goods available from a previous bottling run of an SKU of a specific product family. This influences the demand requirement for dry goods.

The information can be used for preliminary planning and allow stakeholders to identify potential demand and supply constraints and exception items due to potential before each individual stakeholder schedules production. In essence, each stakeholder can consolidate demand with supply capabilities and develop a collaborative ‘forecast’ for ‘replenishment’. The output consists of a collaborative MPS and MRP for each individual stakeholder for a 6–12 month rolling period to consolidate the schedules for all the stakeholders involved. This can be extended to include notifications related to tracking-and-tracing the execution of supply and delivery to manage potential problems arising with replenishment.

4.3.3 Phase 3: Execution

During Phase 3, orders are placed, shipments are loaded and delivered, products are received, and sales transactions are recorded. Finally, payments are made if orders are received as planned. The two steps in this phase are (3.1) Order Generation and (3.2) Order Fulfilment.

The execution of production at both the bottling facility and the suppliers are heavily reliant on confirmation of orders by wineries based on the forecasted order values. The activities involved in *Order Generation* includes **order confirmation** and **demand requirement planning**. These two steps specifically require operational planning level employees of the respective stakeholders to be involved. This could be the winemaker from the wine cellar or the dry goods and bottling managers at wine bottling facilities.

Order confirmation requires wineries to confirm the specific quantity of dry goods items and bottling capacity required for a specific SKU forecasted order. This order confirmation deadline will be based on lead-time requirements of individual SKU dry goods as per supplier agreement. An important factor is having order confirmation information availability and visibility along all channels of the SC, as each supply chain stakeholder is responsible for planning production and replenishment on their own, while still being synchronised with execution of processes of the other stakeholder. This aims to ensure that the right components are delivered in the right quantities, to the right place, at the right time and in the right condition.

Demand requirement planning follows directly after to achieve this aim. The final demand requirements (i.e., the final dry goods order quantities, the fixed bottling date and the final bottling capacity requirements) are generated to enable operational planning. A bottling facility will use this order confirmation, translate it into bottling capacity requirement and then do final scheduling. Table 4.4 lists some typical operational planning elements performed by the various stakeholders. The order generation phase is subjected to a specified frozen period, suggested to be eight weeks (based on feedback obtained from interviewees during the SME validation interviews), and these requirements are translated into *Order Fulfilment*. This step of the Execution phase consists of **execution tracking** and **exception management**. These two steps concern monitoring the flow of goods in the SC.

Table 4.4: Demand requirement operational planning elements for stakeholders involved

Stakeholders	Operational planning
1. Bottling facility	Bottling sequence, shifts, runs, number of employees, contract employees, wine readiness testing, dry goods order planning (if applicable), receiving dry goods, inspection of dry goods, bottling line setup and change over, storage and distribution of finished product.
2. Winery	Wine blending and readiness, certification seal application, label design and proofing, wine sample testing, SAWIS BG9 and BG11 certification.
3. Supplier	Production planning capacity and sequence, shifts, import order planning, delivery schedules.
4. SAWIS	Inspections, certifications, tastings.

Execution tracking requires a certain degree of information availability and visibility. This enables tracking and tracing the flow of goods and execution of operations in the different supply chain channels. CPFR solutions often rely on internet based solutions (Seifert, 2003). Web-based collaboration allows information and process sharing between multiple supply chain trading partners required in this supply chain setup. This includes inventory plans, forecasts, promotional activities, distribution arrangements and changes to previous planning agreements.

Information visibility and accessibility are important enablers of execution tracking as real-time events processing and notion of notification is required, which can be communicated using a shared collaborative platform. Such a platform could include the following elements:

- Order generation and confirmation notification: Easy accessibility to forecasted demand and generated orders to enable integrated planning and improved procurement leading up to wine bottling execution.
- Production scheduling and execution schedule: Visualisation of planned production operations (i.e. wine production, dry goods production and pre-planned bottling schedule), status updates regarding the execution of pre-planned schedule and notification if exceptions occur which affect the operations of other stakeholders.
- Supplier delivery schedule: On-screen visualisation of schedules and automatic notification of new schedules or any schedule changes.

Exception management relies on the utilisation of information availability and accessibility enabled by for example a collaborative web portal to allow for detection of

deviations from the fixed planning and execution schedule. This typically includes the detection of any dry goods not being available as planned and rescheduling bottling collaboratively as previously explained in Section 3.4.3. Improved exception management could potentially allow bottling facilities to increase the utilisation of existing bottling capacity to enable the desired shift from 40:60 packaged: bulk export to 60:40, without investing in additional bottling capacity.

Having accessibility to information related to order generation, order fulfilment and tracking their execution will allow traceability in this supply chain setup. This information can be useful in the *Analysis phase* that follows to analyse current supply chain processes, identify process deficiencies based on several performance measurements and in return help to determine causes of execution delays.

4.3.4 Phase 4: Analysis

The last phase serves to monitor the planning and execution phases (phase 2 and phase 3) for exceptions, whereafter results are aggregated and key performance metrics are calculated. The insight gained is shared between the partners and planning is adjusted to improve future supply chain operations. The two steps in this phase are (4.1) Exception Monitoring and (4.2) Performance Measurement & Feedback.

The execution of supply chain processes leading up to the execution of bottling is critical for the adherence to the planned bottling schedule. The management of exceptions is facilitated during Phase 3, whereas this phase aims to analyse the causes of exceptions to improve future supply chain operations. *Exception monitoring* involves gathering feedback from the execution phase. Having a shared platform allows traceability to monitor exception notification and at the end of a review period, bottling facilities and their respective supply chain partners who form part of the collaborative relationship have the capability to trace root causes of problems such as delivery delays.

This will allow stakeholders to revise process execution, providing feedback that can assist with avoiding similar situations in the future or develop a course of action should such a problem arise again. Being able to determine the root causes and documenting these root causes will help stakeholders to eliminate repeated failures.

The second step of this phase is *Performance Measurement & Feedback* and aims to assist stakeholders with developing a collaborative performance system that consists of metrics that will help members of the supply chain to improve the overall performance. It consists of the following:

- Define Key Performance Indicators (KPIs) for each stakeholder.
- Define an appropriate performance rating system.
- Develop a performance evaluation and feedback system.
- Facilitate performance improvement plan based on evaluation and feedback.
- Based on the performance improvement plan, appropriate training elements should be identified and introduced.

Stakeholders can use already existing performance measurement frameworks and metrics, such as those where van Eeden *et al.* (2014), Jooste (2016) and Jooste *et al.* (2015) specifically researched performance measurement in the wine industry. This step can easily be facilitated using a web-based solution that allows tracking and reporting, enabling the generation of management reports by using the analysis of performance against the key indicators. Another important component of this step is feedback, which is essential to keep track of success and failure situations in order to improve the next planning and implementation cycle.

4.4 Implementation guidelines

The implementation guidelines formulated in this section provide a stepped approach for stakeholders to implement the WIC framework and its respective phases explained in the previous section. The guidelines are based on the final WIC framework presented in Section 4.3 and the formulation thereof relies on this methodology depicted in Figure 4.4. The implementation of the framework relies on gathering several inputs that are transformed into a set of outputs by means of a process, which is in return reliant on several enablers.

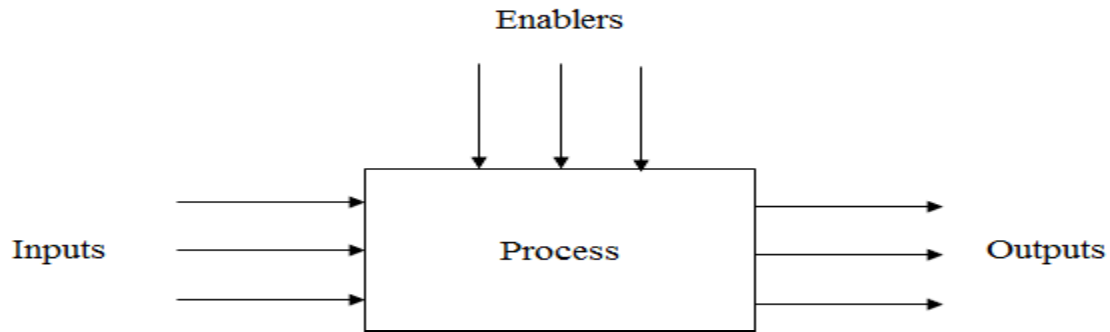


Figure 4.4: Input, process and output flow

Each step of each phase requires several inputs, based on content of the process steps discussed in Section 4.3, and facilitates the collaborative process in order to deliver a set of outputs that ultimately aims to provide stakeholders with the opportunity to improve the responsiveness of their decision-making. The implementation guidelines provided in this section are the implementation guidelines that are used for the theoretical case study of which the outcomes are discussed in Chapter 5.

4.4.1 Phase 1 implementation

Phase 1 implementation aims to establish a collaborative partnership between stakeholders and help them to set the common goals to achieve. The first step of Phase 1: Strategy Planning is setting the *Collaborative Agreement*. This involves designing and governing supply chain activities as well as establishing and maintaining a supply chain partnership of a collaborative nature at the hand of the inputs and enablers listed in Figure 4.5. This step requires a stakeholder, such as a bottling facility, to gather information related to the inputs listed, the most important being a list of clients and suppliers as this represents the starting point of a collaborative partnership partner selection.

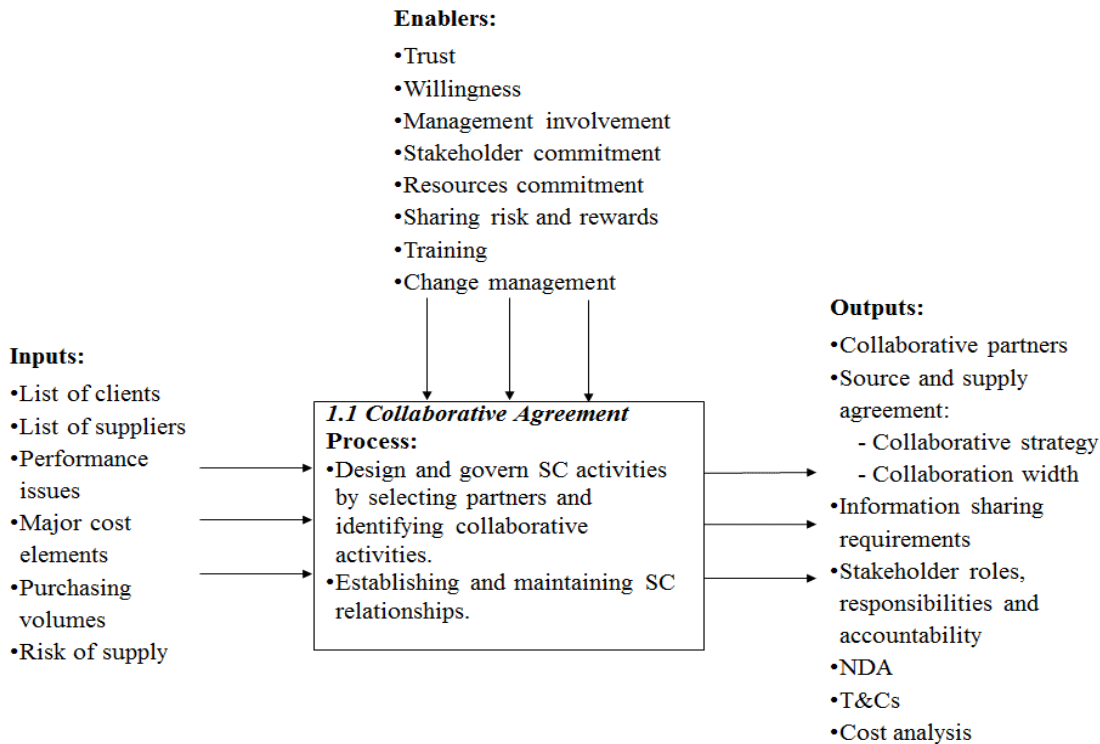


Figure 4.5: Step 1.1 implementation guidelines

Partner selection is reliant on identifying current performance issues and major cost elements or contributions, as this will guide the stakeholders towards areas that will benefit most from collaboration. Other influencing factors also include purchasing volumes and risk of supply as large purchasing volumes with a greater risk of supply can possibly have a detrimental effect on supply chain operations.

This information is subsequently used to formulate a collaborative agreement that constitutes several outputs listed in Figure 4.5. These outputs form the foundation of any or multiple collaborative partnerships it establishes, and with proper revision on an annual term helps stakeholders to maintain supply chain relationships. However, it is important to notice that the step is subject to several enablers. The design and government of collaborations and the appropriate supply chain relationship is heavily reliant on stakeholder involvement, trust and commitment, listed as the enablers of this step. In order to facilitate a collaborative initiative amongst the stakeholders will require the appropriate training and change management, as employees involved will have to adjust their mindset and approach. This ensures that the inputs required for the phases following can be sufficiently generated and translated to work towards the goals and benefits set to be achieved in the second step of this phase, which is *Joint Planning*.

Joint Planning primarily aims to allow stakeholders to get together and set joint goals, collaborative goals and clarify the benefits for all the parties involved as depicted in Figure 4.6. To enable synchronised decision-making, it is required to specify the terms related to the sales and order forecast, order multiples, minimum order sizes, delivery lead times and order deadlines. The terms set in this step will assist stakeholders with establishing the relevant terms (such as the frozen period for providing information for planning purposes) related to sharing information about bottling volume requirement, dry goods BOM, production capacity and scheduling which are information sharing requirement output criteria generated in step 1.1.

This step is reliant on enablers similar to those listed for step 1.1, but will especially require stakeholder integration. The extent of stakeholder integration is subject to training and change management highlighted as enablers of step 1.1, but it is important to ensure integrated information sharing and help stakeholders to formulate a multi-year strategic plan. Training and change management will also account for the facilitation of using identified technologies to enable collaboration. Following these implementation guidelines will allow stakeholders to design and govern collaborative supply chain activities as well as assist them with the establishment and maintenance of their collaborative partnerships, which is crucial for governance in the next phase.

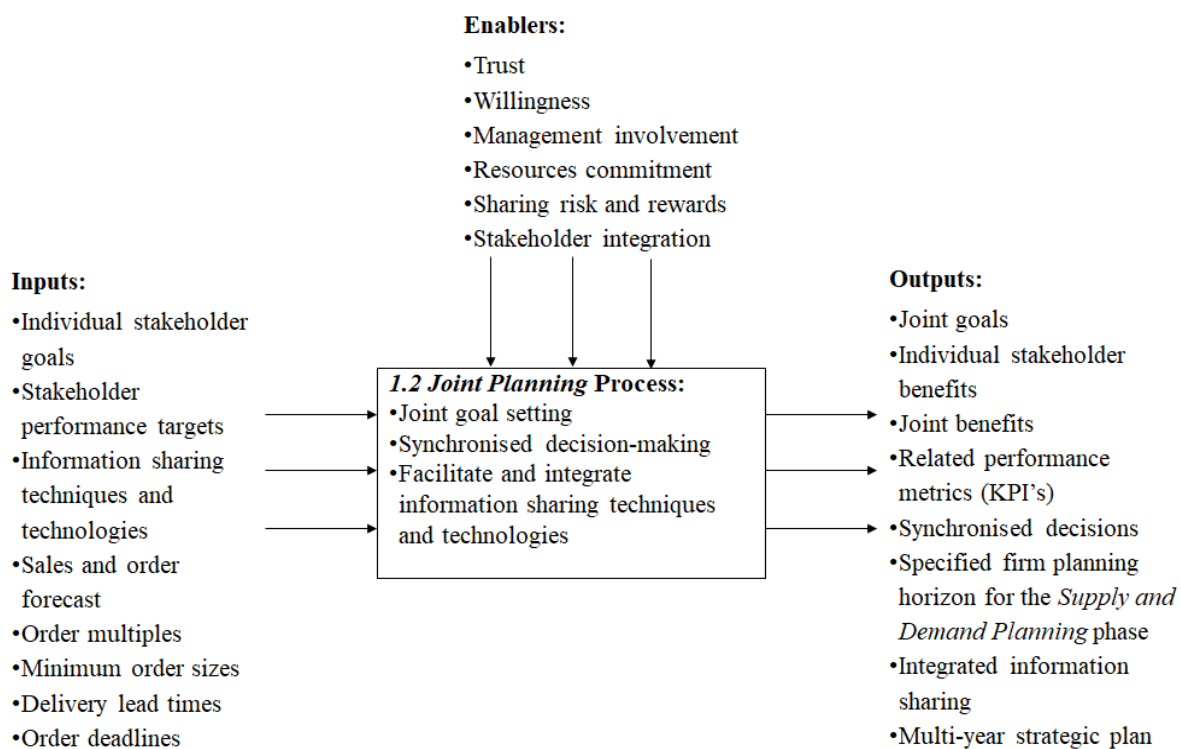


Figure 4.6: Step 1.2 implementation guidelines

4.4.2 Phase 2 implementation

The collaborative agreement and joint plan set in Phase 1 aims to govern the generation of *Demand & Supply Forecast*. This process step entails the exchange of demand information, capacity requirements and availability, subsequently aligning the forecasts of multiple stakeholders to improve planning.

Figure 4.7 highlights the key inputs and enablers of this process that are required to generate the appropriate outputs. Key inputs relate to sharing forecasted capacity requirements and distributing information regarding the availability of capacity. Stakeholders can use the approximated demand and supply specifications to develop MPS and MRP schedules for each individual stakeholder for a 6–12 months rolling period. The key focus of this is to allow stakeholders to improve planning and to identify constraints as early as possible to try to resolve potential problems of supply.

Training is listed as an enabler for step 1.1 (explained in Section 4.4.1). The training of employees is of importance to this step as the resources committed to execute the *Demand & Supply Forecast* step will have to be proficient to use the appropriate technologies (where applicable), share the correct information and also ensure timely information sharing to allow for sufficient information availability.

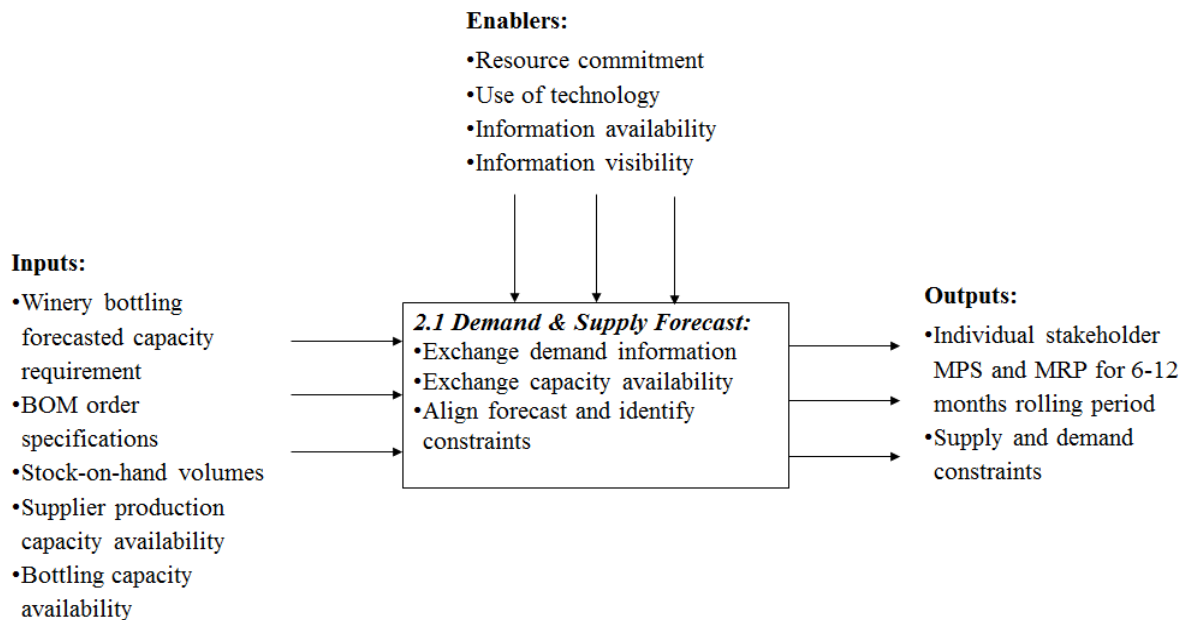


Figure 4.7: Step 2.1 implementation guidelines

After gathering the information for the demand and supply forecast step, the generation of a *Collaborative Forecast* follows (see Figure 4.8). This entails merging demand, production and replenishment of individual stakeholders to minimise the occurrence of constraints and risk of supply. This collaborative forecast is generated under the assumptions that information will be available and visible to the relevant parties and that it will be shared amongst the stakeholders using the agreed upon technologies. The final output of this phase is a collaborative MPS and MRP for a 6–12 months rolling period typically consisting of pre-planned bottling schedule, supplier production schedules, wine production schedules and basic replenishment schedules.

If stakeholders collaborate using the guidelines set in this phase, they should be able to generate an accurate demand forecast and use this information to improve preliminary planning. From this phase on forward, collaboration between the stakeholders can benefit from the implementation of a shared collaborative platform. However, it should be noted that such an initiative is not solely reliant on the utilisation of this input. It could be beneficial for coordination purposes, as it will allow visible and updated information availability of the status of supply chain events related to the execution of forecasted plan or management of exceptions that can potentially cause deviations. The commitment of the resources involved and their understanding of collaboration will rather determine the success of collaboration.

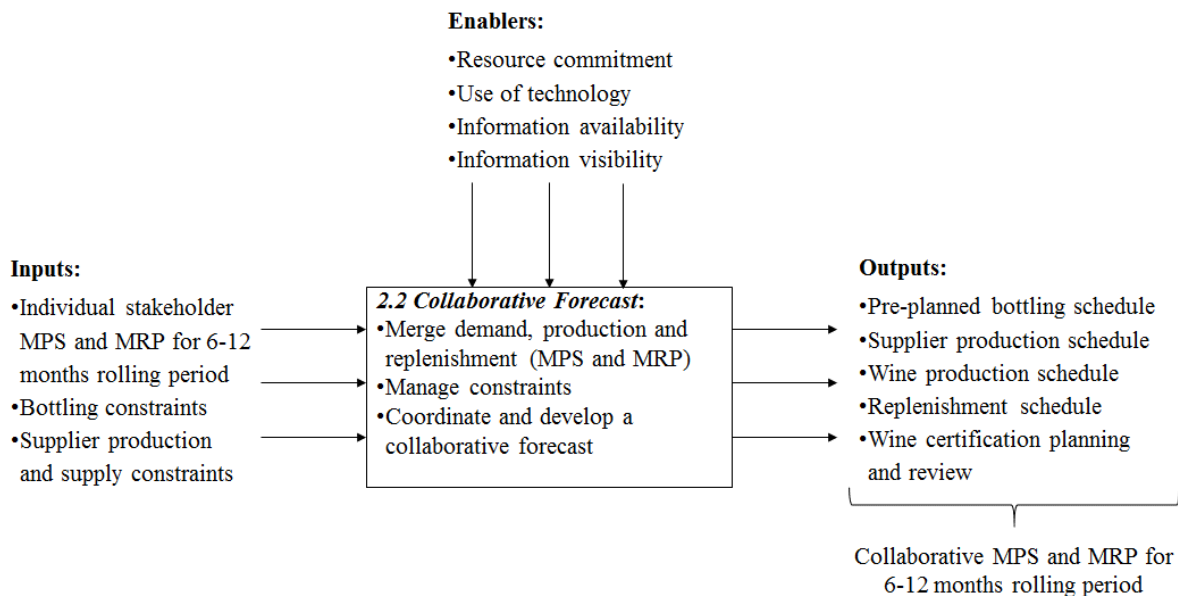


Figure 4.8: Step 2.2 implementation guidelines

4.4.3 Phase 3 implementation

Order Generation and *Order Fulfilment* focus on operational activities and requires the outputs of Phase 2 (i.e., the collaborative forecasted MPS and MRP generated in step 2.2). The implementation of this phase aims to allow stakeholders to keep better track of the generation and fulfilment of orders.

For wine bottling facilities to schedule bottling optimally, requires wineries not only to share the anticipated bottling quantities, but in addition the exact BOM for each order that is then translated into the supplier production schedule. Having a pre-planned bottling schedule allows wine production and certification processes to continue and ensure that wine is bottling ready when required. This will be determined by the outputs of this phase, which is the final bottling order (based on quantity and BOM specifications), the fixed bottling schedule, production schedules and accordingly replenishment schedules (for wine and dry goods) to the intended delivery destination. These elements are based on confirmed orders by the wineries and the final demand requirements planning performed by all the stakeholders involved as per the implementation guidelines for this steps depicted in Figure 4.9.

Having the final operational plan for all stakeholders involved with an approximate frozen period of eight weeks enables stakeholders to continue with *Order Fulfilment* based on the guidelines presented in Figure 4.10. The final order generated in step 3.1, is required to generate an order notification, which then has to be confirmed by the relevant stakeholder to generate a legally binding order, which is translated into an order confirmation notification. Subsequently, the fixed operational plan is distributed and the execution thereof tracked to ensure that stakeholders are able to detect any exception that might cause deviations or delivery delays.

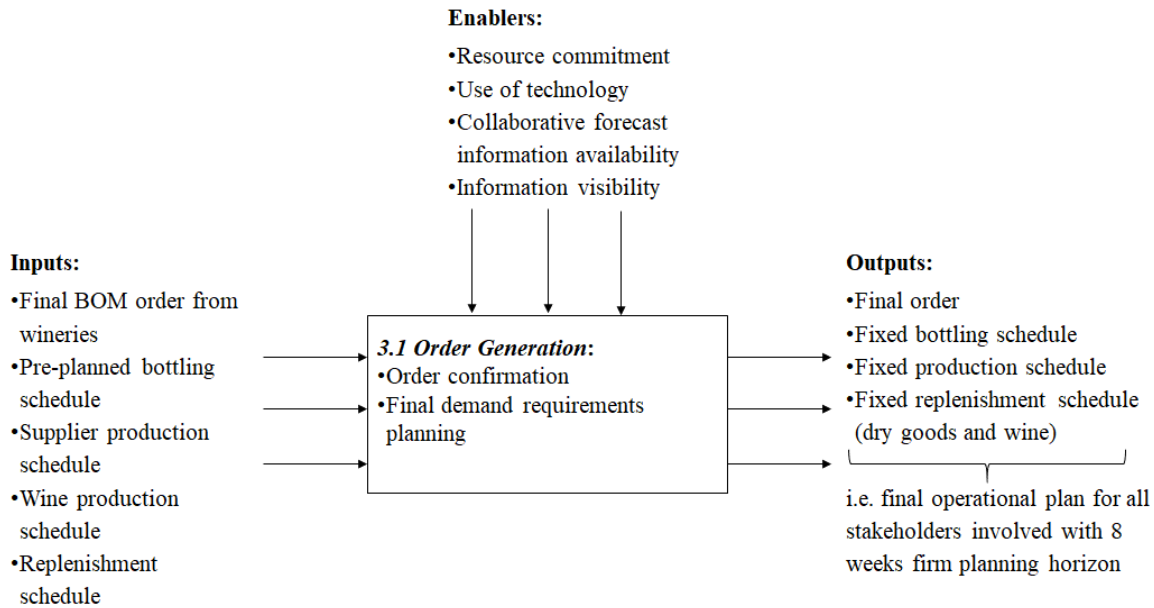


Figure 4.9: Step 3.1 implementation guidelines

This enables tracking and tracing the flow of goods and execution of operations in the different supply chain channels for example keeping track of supplier production, order completion and delivery. If any deviations or delays are detected, stakeholders should have access to this information and be able to respond instantly in order to resolve the problem. This aims to improve information sharing to enable responsive decision-making and improve on-time order delivery.

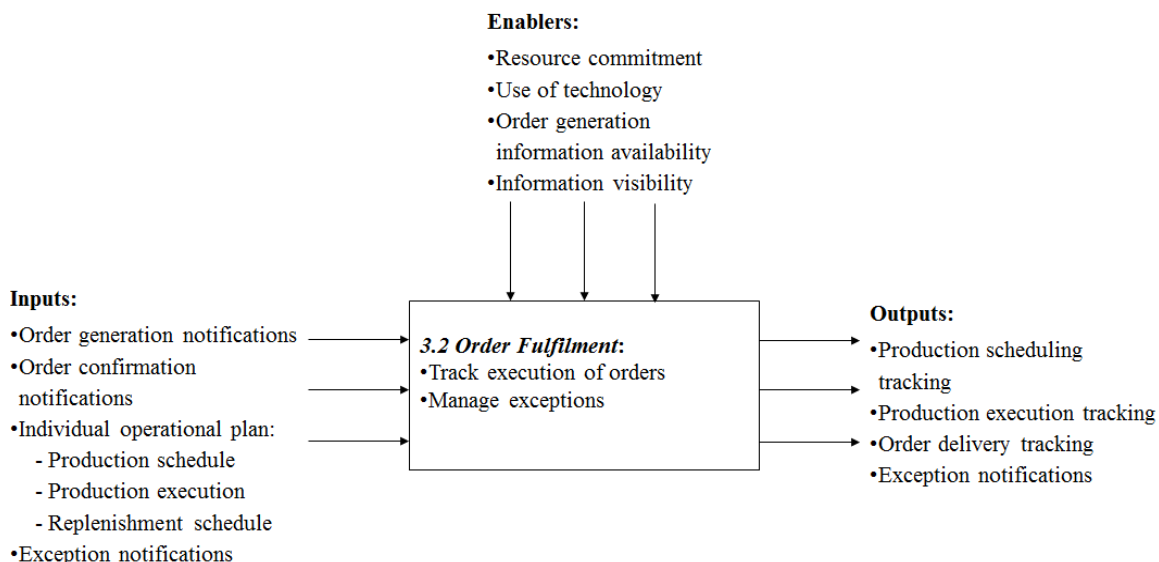


Figure 4.10: Step 3.2 implementation guidelines

4.4.4 Phase 4 implementation

The implementation guidelines of the last phase, Phase 4, serves to guide stakeholders towards improved performance measurement and feedback. This aims to monitor the planning and execution phases (phases 2 and 3) for exceptions, whereafter results are aggregated and key performance metrics are calculated.

Step 4.1, *Exception Monitoring*, focuses on monitoring previous successes and failures and will allow stakeholders to improve decision-making in the future by following the implementation guidelines presented in Figure 4.11. This will be applicable to each stakeholder involved in the collaboration, based on a combination of the agreed joint goals, individual stakeholder benefits, joint benefits and predetermined key performance metrics (KPIs) as per the *Joint Planning* phase. This step could be facilitated using a shared collaborative platform that allows notifications of exceptions, problems, deviations and performance issues that are monitored and reviewed at the agreed upon time by the stakeholders.

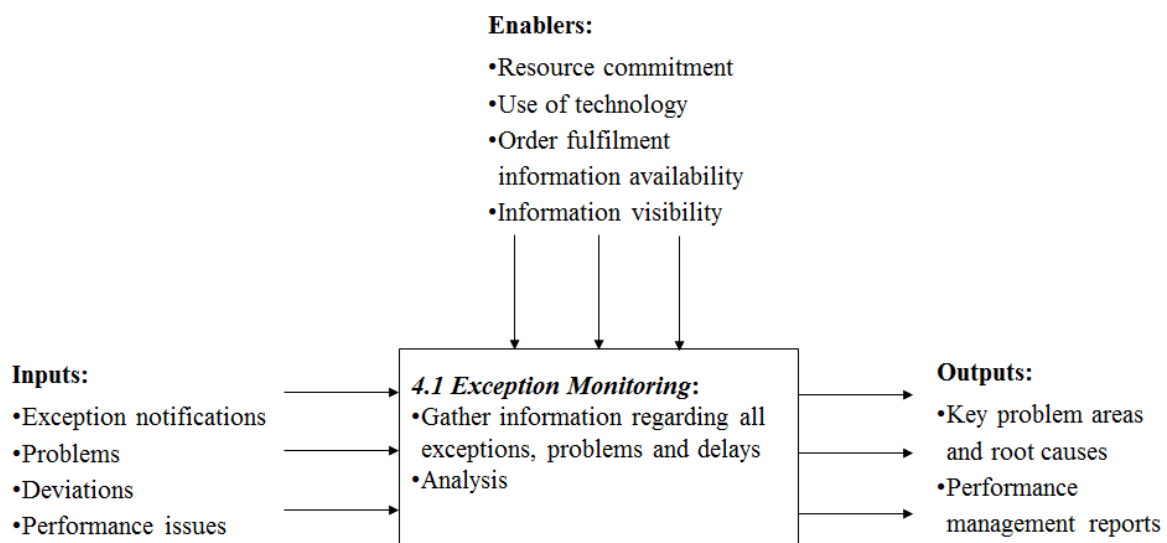


Figure 4.11: Step 4.1 implementation guidelines

Alternatively, stakeholders can evaluate other possible means of exception monitoring such as Excel, a tool currently deployed by some stakeholders in the industry. Having information available concerning the exceptions, problems and delays will allow stakeholders to identify key problem areas and their root causes by analysing the cause-and-effects of each instance, which are subsequently incorporated into performance management reports that are required to continue to step 4.2, *Performance Measurement & Feedback* depicted in Figure 4.12.

For the process of stakeholder performance measurement and evaluation, a certain set of inputs is required. This includes the KPIs and corresponding performance rating system of which all the stakeholders carry notice for the commencement of the measurement period as agreed upon in step 1.2. Based on the problem areas and root causes identified, as well as the corresponding performance management reports generated as outputs of step 4.1, stakeholders can evaluate their collaborative partners' performance.

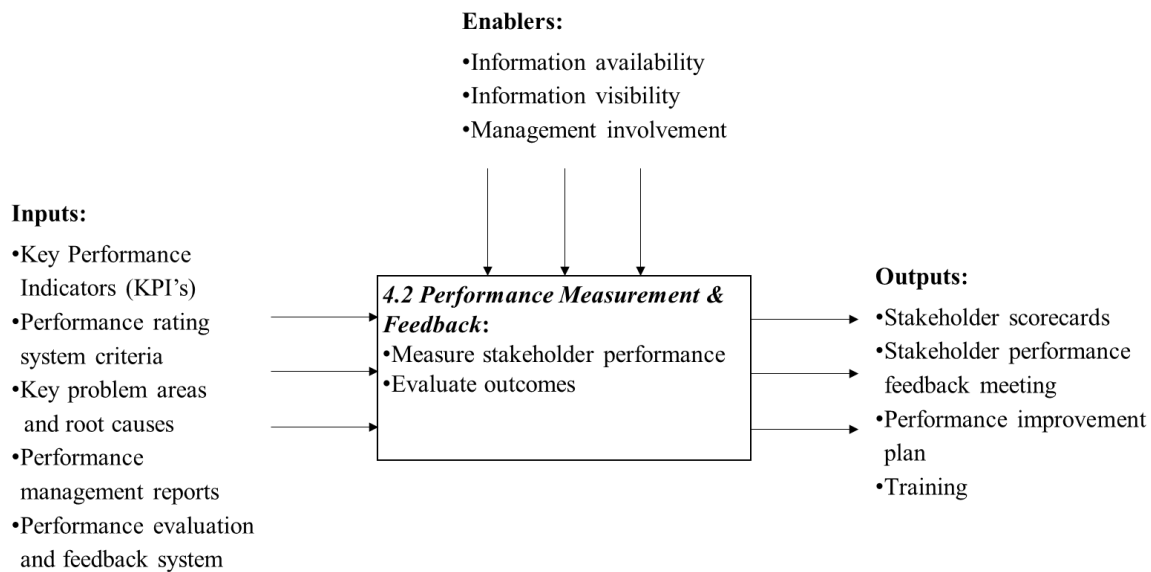


Figure 4.12: Step 4.2 implementation guidelines

The evaluation should ideally be translated in performance scorecards that are presented at a performance feedback meeting, typically occurring every 3–6 months. Based on scorecards and feedback, a combined performance improvement plan is compiled and will focus on ensuring that joint goals, individual stakeholder benefits and joint benefits as per the joint plan are reached to the satisfaction of the stakeholders. Finally, the training of employees is crucial to align performance targets with process execution. The performance improvement plan serves to generate new individual stakeholder goals and performance targets required as inputs for step 1.2 for the next planning cycle. Subsequently these goals and performance targets are incorporated into the next planning cycle completed from step 2.1 and onwards.

4.5 The five-step implementation approach

The guidelines presented in section 4.4, will assist stakeholders with implementing the WIC framework. Based on these guidelines, a five-step implementation approach is

formulated to guide stakeholders with the initiation of this collaborative initiative. The five-steps displayed in Figure 4.13 serve to guide stakeholders to align stakeholders that part take in collaboration before commencing with the planning, forecasting, execution and performance measurement phases of the WIC framework. See Appendix D for the detailed approach.

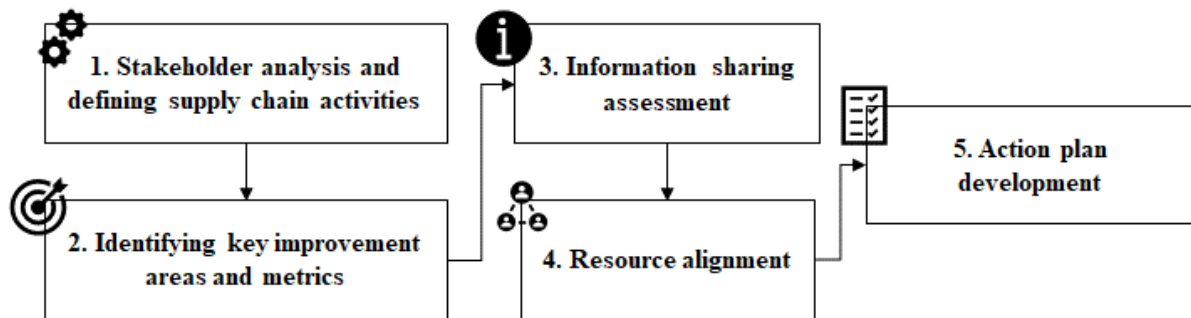


Figure 4.13: Five-step WIC framework implementation approach

4.6 Chapter summary

This chapter provided an explanation of the WIC framework and implementation guidelines that wine bottling facilities and their supply chain partners can use to establish a collaborative relationship and to implement a collaborative initiative. This chapter first focuses on literature related to framework development and thereafter the purpose of the framework developed was established. This was translated into clear objectives of the framework after which the scope of the framework was set. The WIC framework was developed and consists of four phases, each with different steps for implementation. The framework aligns with Research Objective 3a, which aims to develop a framework for South African wine bottling facilities, their wine producing clients and dry goods suppliers that will enhance collaborative planning and execution of processes in this supply chain environment.

The chapter concluded with the formulation of implementation guidelines set to be achieved in Research Objective 3b. This completes the development of a collaborative framework and implementation guidelines that overlaps with the dimensions, challenges and benefits reported on in Chapter 2 and the collaborative opportunities identified during the explorative industry interviews reported on in Chapter 3. The validation of the framework and the implementation guidelines follows in Chapter 5 as the researcher conducts several SME interviews and a theoretical case study.

Chapter 5

Framework Validation, Case Study and Results

The bottling of products is a critical process for any wine producer. It immobilises a large amount of working capital in terms of the dry goods (bottles, labels, capsules and boxes) and the equipment used for bottling and labelling is expensive and labour intensive, which is why many wine producers use contract bottlers. Inefficient use of the bottling capacity can possibly cause delays in meeting customers' orders, which can lead to a loss of clients and decrease the overall profitability of specifically the South African wine industry. All of this makes the process of planning and execution of bottling important for the success of the industry.

The objective of this chapter is to validate the WIC framework and implementation guidelines developed through this research as it aims to assist industry stakeholders with improved decision-making capabilities ultimately aiming to be more responsive. It serves to verify that the WIC framework and the implementation guidelines adhere to the framework design requirements formulated in Chapter 3. Ideally, one would prefer to validate the framework through implementation of the complete framework within one collaborative group. This would be expensive and time-consuming and thus, from a research perspective, impractical.

This chapter discusses the validity of the WIC framework based on feedback received from various SMEs from a variety of industries. These inputs are evaluated and amendments considered to ensure that the framework achieves its intended objectives. This was used to develop the final WIC framework, whereafter the implementations guidelines, presented in Chapter 4, were formulated. This chapter concludes with a discussion of a theoretical case study proving the potential contribution that such a collaborative framework can make by exploring the value it can add to the daily operations at wine bottling facilities.

The content of this chapter answers the following research question (RQ) and the related research sub-questions highlighted in Table 1.3 (Section 1.3):

- RQ 5: Is the developed framework implementable within the intended supply chain environment and does it fulfil its intended purpose?

This specifically serves to verify and validate the proposed WIC framework and implementation guidelines to achieve RO 4 and its sub-objectives, leading to the formulation of the final WIC framework. A detailed explanation of the validation process and theoretical case study follows.

5.1 Framework validation

A group of SMEs validated the WIC framework prior to the completion of the case study. This validation process primarily serves to evaluate whether the framework has achieved the intended objectives as seen through the eyes and experience of industry role-players. Furthermore, it serves to explore the immediate benefits and shortcomings thereof. The validation process involved semi-structured interviews with numerous SMEs currently working in the South African wine industry or SMEs with prior experience in this industry.

As the validation serves as a tool to measure if the WIC framework has reached its objectives, the interviews allowed the researcher to gather feedback from industry experts based on the aspect described in Section 4.2.2 as depicted in Figure 5.1 below.

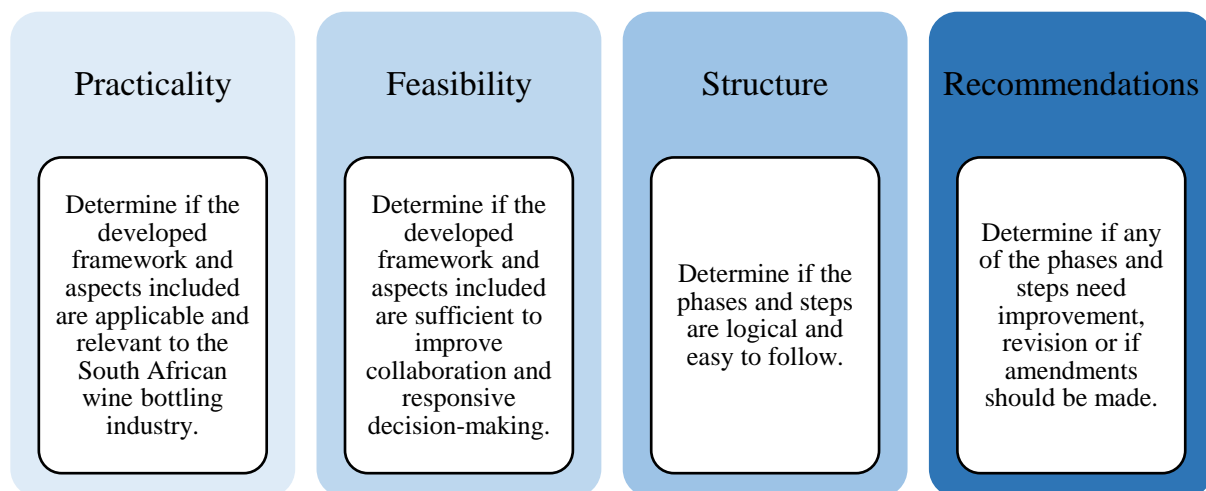


Figure 5.1: Aspects considered during the formulation of semi-structured SME interview questionnaire

5.1.1 Validation process and participants

The researcher constructed a summary document containing all the key elements of the proposed WIC framework (refer to Appendix G). This was distributed to the SMEs well in advance of the interview and each interviewee was encouraged to read

the document in advance. Before commencing with the interview, the researcher gave interviewees a quick overview of the framework and the relevant questions. Interviewees also had to complete a personal information form that can be found in Appendix G. The semi-structured interview involved a 60–90 minute interview with the relevant SME based on the set of questions given in Appendix G. Interviewees were encouraged to ask questions, make comments and to provide constructive feedback.

The participants were chosen based on the different roles they are fulfilling, have fulfilled in the wine industry or their involvement in the wine industry or relevant industry sectors. A summary of the participants and other relevant information is given in Table 5.1 below.

Table 5.1: Summary of validation participants

Participant (P)	Industry	Background/Qualification	Reason for inclusion
P1	Beverage manufacturing and distribution industry	Qualified MEng. Industrial engineer (>15 years involved in the wine industry) currently Group IT manager of one of SA's largest beverage companies. Previously involved in consulting work for Africa's leading beverage company.	Familiar with SAP implementation in multiple industries, supply chain planning, business process analysis and industry-related improvement projects.
P2	Wine supply chain logistics and distribution	Qualified BCom. Management Accountant with more than 20 years' experience in the wine industry. Currently employed as the <i>Information Systems and Operations Director</i> at a leading South African wine distributor.	Big focus on operations (distribution based on demand) and information systems. Good understanding of linking technical aspect of systems to the execution of operations.
P3	Supply chain consulting and information systems	Qualified MEng. Industrial engineer previously involved with initiation of a collaborative initiative between a contract wine bottling facility and a shareholding producer wine cellar.	Good understanding of supply chain mapping and integration of stakeholders using IT systems.
P4	Wine production and supply chain management	Assistant winemaker with qualifications in both MEng. Engineering Management & BScAgric (Oenology). Completed a MEng study focused on developing a demand-planning framework for SA wineries.	Good understanding and in-depth knowledge of the interaction between stakeholders as well as experience with the development of framework for the wine industry.

Chapter 5 - Framework Validation, Case Study and Results

Participant (P)	Industry	Background/Qualification	Reason for inclusion
P5	Manufacturing	As the Chief Operating Officer (COO) of a large printing company, the participant has 27 years' experience in the printing industry and 10 years' experience specifically printing packaging labels predominantly for the wine and spirits industry.	As the COO of a company printing 1.5 million labels daily, of which 95% contributes to the packaging of South African wines, the participant has a good understanding of the industry interaction and challenges.
P6	Wine and software development	The current CEO of a wine systems solution company and qualified Electrical engineer, with 15 years' experience in the wine industry.	A vast variety of knowledge and understanding surrounding the production and manufacturing processes involved to bring grapes from the farm up to wine bottling.
P7	Distribution	As a qualified industrial engineer and currently head of production and quality at a leading international cork distributor, the participant has 10 years' experience supplying corks to the wine and spirits industry, not only in SA but also in other international countries.	Currently the participant is looking at the possibility of driving a collaborative type of CRM initiative with their wine producing clients, having prior experience on how such initiatives can enhance supply chain operations.

Each of the participants included in the SME semi-structured interviews is involved in industries related to one or multiple of the following fields: wine, supply chain, operations, information systems, collaboration and manufacturing. As the participants' expertise covers multiple fields, it allowed the researcher to validate all aspects covered by the framework.

The validation questionnaire used to guide the semi-structured interview aimed to validate the practicality, feasibility, structure and overall value of such a framework based on the knowledge and experience of the respective SMEs. The questionnaire is divided into five sections. The first four sections validate one of the frameworks' phases and its dimensions while the last section validates the entirety of the framework. The questions are structured to allow participants to agree or disagree based on a Likert Scale rating system, with the exception of five of the questions that are of a descriptive nature.

A summary of the validation questions is given in Table 5.2 and the full questionnaire is provided in Appendix G. All of these questions are based on the information disclosed in the *Validation Summary Document* that is based on the proposed WIC framework (see Appendix D) and was provided to the participants prior and during the semi-structured interview. These questions were formulated based on the aspects referred to previously in Figure 5.1. The section that follows discusses the feedback and opinions of the SMEs.

Table 5.2: Summary of validation questionnaire

Aspect	Question	Summary of the question
Phase 1	1	Is partner selection, a mutually beneficial source and supply agreement and defining information sharing requirements sufficient to establish a collaborative agreement between stakeholders?
	2	Do you agree with the inclusion of joint goal setting and synchronised decision-making in the framework dimension <i>Joint Planning</i> ?
	3	Are the suggested technologies (RFID, bar codes and a shared or cloud-based platform) applicable in the supply chain setup and for its intended purposes?
	4	Is it feasible to deploy such a system in this industry?
	5	Are the given guidelines proposed by VICS sufficient to create a joint plan?
	6	Do you agree or disagree that the collaborative agreement should be revised annually as harvest seasons are on an annual basis?
Phase 2	7	Do you agree or disagree that the five activities proposed for <i>Supply & Demand Planning</i> are sufficient to generate an accurate demand forecast?
	8	Do you think it is realistic to develop a shared platform that will allow real-time information sharing between stakeholders?
	9	What are your main concerns with the development and implementation of such a platform, if any?
	10	Do you agree or disagree that if stakeholders collaborate according to the given guidelines, they will be able to improve preliminary planning, involving the identification of potential demand and supply constraints and/or exceptions?
Phase 3	11	Is it practically feasible to perform order generation and confirmation on a shared platform?
	12	Will real-time order generation and scheduling assist stakeholders to improve synchronisation of supply and demand?
	13	Will tracking and tracing components and finished products in the supply chain, information availability and visibility in this regard improve decision-making and exception management?
Phase 4	14	Will monitoring previous successes and failures allow stakeholders to improve decision-making in the future?
	15	Are the elements included in <i>Performance Measurement & Feedback</i> sufficient?

Aspect	Question	Summary of the question
High-level	16	Are Phase 1 to Phase 4 sufficient as the key phases for collaboration?
	17	Is the sequence of the phases in the framework logical?
	18	Do you know of such a framework or similar specifically for this industry?
	19	If “yes” in Q18, what are the similarities and what are the differences?
	20	Is the framework developed through this research easy to understand and logical?
	21	Can the stakeholders identified implement this framework?
	22	Will implementation of such an initiative improve the reliability and responsiveness of industry stakeholders?
	23	Are there any specific important aspects missing from this framework?
	24	Is this framework practical/ feasible?
	25	What are the main challenges for implementing such collaboration in the wine industry?
	26	Can the wine industry benefit from this framework?

5.1.2 SME validation feedback

The questions listed in Table 5.2 served as the primary guidelines for the semi-structured interviews conducted with the various SMEs. After conducting all the semi-structured interviews with the relevant participants, the researcher analysed the results and feedback obtained. The results of the Likert Scale questions were aggregated to give a representation of the congruence of SME opinions, as depicted in Figure 5.2. Based on the feedback received, the general level of congruence is in agreement with the phases and steps included in the proposed WIC framework presented to the SMEs.

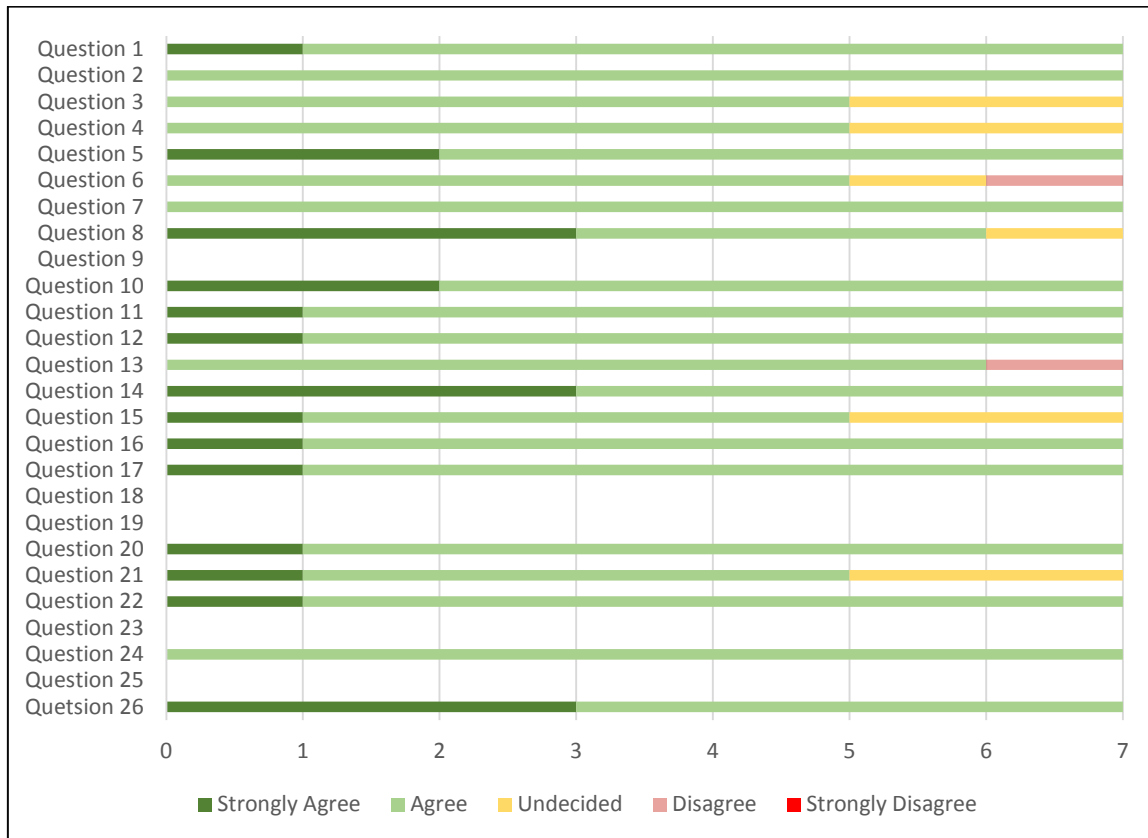


Figure 5.2: SME feedback based on Likert scale semi-structured interview questionnaire

This feedback was used to adjust the proposed WIC framework, which led to the development of the final WIC framework presented in Chapter 4. Based on the feedback obtained from the SMEs and the adjusted WIC framework (i.e. the final WIC framework presented in Chapter 4), the researcher developed implementation guidelines (also presented in Chapter 4). The implementation guidelines were used to validate the applicability of the framework given specific planning and scheduling scenarios that occurred at a wine bottling facility. The findings of this case study are presented in the section that follows.

The most important confirmation from the SMEs was the fact that the WIC framework has the potential to improve decision-making of the stakeholders and in return improve the reliability and responsiveness of the South African wine industry. The feedback given for question 22 (provided in Table 5.3) corroborates this statement as SMEs believe that the implementation of such an initiative will improve the reliability and responsiveness of industry stakeholders.

Table 5.3: SME feedback to semi-structured interview questionnaire

Aspect	No.	Participants' feedback and recommendations	Amendments/additions
Phase 1	1	When selecting partners, establishing a mutual beneficial sourcing and supply agreement and defining information sharing requirements it is very important to include T&Cs and an appropriate NDA (P1). P2 added that the benefits should be clearly stated while P3 considers rules of engagement to ensure restricted visibility, information availability and the security of the information shared between stakeholders also as important elements. P6 stresses the importance of including change management in this step as well as training all the stakeholders' employees involved.	Include training and ensure proper change management guidance. Output of this step should include T&Cs and appropriate NDAs. An important factor to include in the source and supply agreement includes T&Cs related to fluctuating exchange rates.
	2	All participants agreed that the inclusion of joint goal setting and synchronised decision-making are appropriate for Joint Planning. P6 mentions that joint plan should give typical context of lead times involved for each stakeholder and how this influences decision-making to enable synchronised decision-making. P7 states that joint goal setting relates to the performance measurement phase and mentioned that they have a measurement system in place with large clients based on KPIs such as on-time deliveries, responsiveness and quality. KPIs are predetermined, measured and feedback is given to enable improvement.	
	3	P2 validated the fact that a shared platform will allow for updated information flow and improved accuracy of information made available to the stakeholder if a shared platform and technology such as barcodes are implemented. However, P1 stated that RFID is too expensive whereas most other participants agreed in the interviews that followed. P3 mentioned having a cloud-based platform allows for central control and accessibility of such a system, which is preferable rather than an on-site server approach. P6 suggests that a shared platform could include a functionality for benchmarking. However, it is important to notice that P6 stresses that technology will not be the driving force of solution to the problem, but rather starting with change management of existing approaches, people and processes involved, then deploying a platform and lastly incorporating functionalities such as RFID, barcodes, QR codes, etc.	Based on suggested technologies (Barcodes, RFID and a shared platform), the utilisation of RFID is infeasible due to cost implications. QR Codes are an additional technology that can be useful for their intended purpose in this supply chain environment.

Aspect	No.	Participants' feedback and recommendations	Amendments/additions
	4	The majority of the participants agreed that the deployment of a collaborative system/platform is feasible, but not without its challenges. Two participants remained undecided. P7 doubts feasibility of deployment due to system integration and the cost implication of system development and implementation. P6 does agree that the overall feasibility of such a system exists; however, the participant is not convinced a system is necessarily required. P6 states that collaboration in this industry is much reliant on change management, where one should rather start training stakeholders and make them attentive about the importance of collaborating with one another whether it is using basic communication based on Excel. The participant believes this will contribute a lot to the industry, without requiring any integrated platform or system.	
	5	Participants were in accord that the collaboration guidelines proposed by VICS are sufficient to develop a joint plan, with two participants strongly agreeing.	
	6	One participant disagreed and one remain undecided regarding the aspect of annual revision of the collaborative agreement between stakeholders. Reason for disagreement by P6 is based on the assumption that this will primarily be a very unstable environment for the rollout and starting period of collaboration. Thus, it will have to be revised continuously. P3 agreed, but corroborated that during rollout quarterly revision is more appropriate. P7 remained undecided based on the reasoning that fluctuating exchange rates might influence business operation thus the agreement in terms of price might change every six months which means revision of the collaborative agreement.	During the rollout period of such an initiative, the stakeholders should revise the collaborative agreement continuously and on a regular basis as deemed necessary. Thereafter, annual revision of the agreement is appropriate, or the frequency agreed upon amongst the stakeholders.
Phase 2	7	All participants agreed that the five activities proposed as part of phase 2 was appropriate and sufficient. P1 suggests extending the time window for exchanging demand information from 3-6 months to a rolling period of 6-12 months . P7 highlighted that the inclusion of stock on hand levels, specifically for dry goods at either the supplier, their clients or the site of use will be beneficial for the stakeholders.	Change the time window for exchanging demand information from 3-6 months to a rolling period of 6-12 months. Include stock on hand levels to improve accuracy of planning production requirements.

Aspect	No.	Participants' feedback and recommendations	Amendments/additions
	8	Only one participant remained undecided regarding the reality of developing a shared platform that will facilitate information sharing and its visibility amongst the stakeholders, based on concerns regarding integration, cost, information accuracy as well as the accessibility of information that might reveal secure market-related information to competitors or others.	
	9	Based on feedback, the main concerns SMEs have regarding the development and implementation of a shared platform is information security and visibility (ensuring privacy), brand security and trust issues.	
	10	All participants was in accord that the guidelines given as part of phases 1 and 2 will allow stakeholders to improve preliminary planning based on identification of potential demand and supply constrains as well as exceptions.	
Phase 3	11	The participants agreed that it is practically feasible to perform order generation and confirmation on a shared platform based on the specific operations of this supply chain setup.	
	12	The participants were in agreement that real-time order generation and scheduling will assist stakeholders to improve synchronisation of supply and demand.	
	13	Having the capability of tracking and tracing components and finished products in the supply chain, information availability and visibility to help improve decision-making and exception management, are supported by six participants. P7 disagrees as they are of the opinion that stakeholders will not necessarily check the status of orders placed, orders received, orders shipped etc.	
Phase 4	14	Having an analysis phase is critical. Four participants agreed that monitoring previous successes and failures will allow stakeholders to improve decision-making in the future, while three strongly agreed.	
	15	The elements included in step 4.2 (Performance Measurement & Feedback) are rated sufficient by five of the participants, while P5 disagrees to some extent. The participant regards <i>training</i> step to be included after establishing an improvement plan.	Include element of training after the establishment of an improvement plan.

Aspect	No.	Participants' feedback and recommendations	Amendments/additions
High-level	16	General feedback constituted that the four phases proposed are sufficient key phases for the establishment and guidance of collaboration between stakeholders, given the inclusion of the amendments suggested.	
	17	The sequence of the phases and steps proposed seems to be logical and well understood by all the participants.	
	18	Participants are not aware of the existence of any similar framework or initiatives in the wine industry. P3 highlighted that fragmented systems are an obstacle in this industry, while P5 and P7 mentioned that larger industry players use established enterprise resource planning systems such as SAP to improve information availability and accuracy, but it is not integrated amongst supply chain partners.	
	19	As there are no similar frameworks to the knowledge of the participants, no comments were given based on similar aspects or differences.	
	20	All the participants agreed that the proposed framework is easy to understand and logical. This conclusion by the participants is based on the information presented to the participants prior to the semi-structured interview in the framework validation summary document.	
	21	While the majority of the participants agree that the stakeholders identified can benefit for the implementation of this framework (one strongly agreeing), P3 and P7 remained undecided. P3 stated that even though it is feasible, it will be a challenge to map all the supply chain processes, determine the costs, potential savings and the capacity of all the relevant stakeholders when implementing such a framework. The participant stressed the importance of rollout implementation should stakeholders look at implementation.	Recommendations can include research regarding the cost of implementation based on deployment of collaboration using existing systems vs. having a shared collaborative platform.
	22	The mutual feedback from the participants was that the implementation of such an initiative would improve the reliability and responsiveness of the industry and its stakeholders. P1 added that the efficiency or productivity of planning and operations should improve while P7 mentioned that such an initiative could help stakeholders to reach agreed service levels more easily.	

Aspect	No.	Participants' feedback and recommendations	Amendments/additions
23		As some components required for wine bottling are imported and prices are affected by exchange rates. P5 mentioned important aspects to consider when setting a collaborative agreement include laws, regulations and the volatility of exchange rates related to different international countries that have an effect on supply. Furthermore, P3 highlights the importance of specific guidelines regarding new product introduction. P7 suggests that sharing information regarding stock on hand levels can be beneficial for step 2.1 in the Supply & Demand Planning phase. Stakeholders should not only exchange demand information, both those responsible for supply and demand should share stock on hand information.	
24		All participants agreed that the collaboration described by the given guidelines is practical and feasible based on the current operations in the South African wine SC. P1 added that such a framework could be adapted/extended to include other industries performing contract bottling such as the spirits industry. Although P6 does agree, the practicality and feasibility is heavily reliant on change management and training of the stakeholders involved.	
25		P2 stressed that if such an initiative is driven by technology it will be challenging and is of the opinion that such an initiative will be heavily reliant on a centralised or web-based platform. P7 in addition stresses the challenge of integrating different systems. A challenge related to implementation also includes cost mentioned by P7, while P5 corroborated that the cost of deploying a system linking all the stakeholders can potentially be very costly, the security of information is a big concern and smaller stakeholders might be more vulnerable. P6 is of the strong opinion that such an initiative is not necessarily reliant on the deployment of an integrated system/platform, but the challenge will rather be to change the mindset of the stakeholders and equipping them with the relevant guidelines to streamline collaboration.	
26		P2, P3 and P7 strongly agreed that this framework is beneficial to the South African wine industry, while the remaining participants agreed. P7 stressed the enormity of the benefit for them as a supplier of dry goods, especially based on the inclusion of phase 3, Supply and Demand Planning.	

5.2 Theoretical case study

The theoretical case study serves to determine the possible value that the implementation of the WIC framework will add to the South African wine industry based on the validity of the implementation guidelines derived from the validated WIC framework. The applicability and validity of the framework and the corresponding implementation guidelines developed in Chapter 4 is determined by means of testing case examples at a wine bottling facility.

The objective of the case study is to determine how the use of the developed framework would change strategic, tactical and operational planning. It will also serve to test how the execution of processes at wine bottling facilities are influenced, if wine bottling facilities and their supply chain partners use the given implementation guidelines to facilitate collaboration. A proper industry-wide implementation validation, with involvement of several industry stakeholders, would have to be a part of future research projects.

5.2.1 Scope of the case study

The purpose of the case study is to determine the possible outcomes if wine bottling facilities and their supply chain partners were to implement the developed framework based on the implementation guidelines. This includes analysing multiple challenging scenarios faced by bottling facilities, the current outcome of these scenarios and the possible outcomes if the developed framework was implemented.

The implementation guidelines were tested at a case study wine bottling facility to evaluate whether a challenging scenario can be avoided or if the framework can enhance responsive decision-making of the bottling facility as well as other stakeholders. The researcher used the result to verify the obvious benefits the framework proposes.

In this case study, the researcher identified a small- to medium-sized contract wine bottling facility to validate the framework based on the derived implementation guidelines. The bottling facility was chosen based on the operating business model, the size of production and the variety of markets and customers they serve. Strategic, tactical and operational planning along with decision-making based on these three planning elements were the main aspects validated through this case study. The subject wine bottling facility will be referred to from here on as “*The Bottler*”.

5.2.2 The current state of *The Bottler*

The Bottler is a contract wine bottling facility, responsible for the bottling and packaging of several wine products as well as the owner's product range. The bottling activities at this wine cellar and wine bottling facility range from 3.5 million bottles to 4 million bottles annually. This equates to approximately 14 000 – 16 000 bottles and roughly 12 000 litres per day. This depends on seasonal harvests, demand patterns, line breakages causing downtime and bottling batch sizes, given that bigger batch sizes generally allow for increased throughput as change over time is minimised.

Their bottling facility consists of one bottling line, with all bottling and packaging operations executed in-line. In addition, one separate labelling line is on the premises and used in cases where clients only require labelling of pre-bottled wine or in some cases if labels are not available when in-line bottling and labelling takes place, the labelling is performed at a later stage on the separate labelling line. *The Bottler* also has an on-site laboratory for wine quality testing purposes and limited storage space, utilised for finished product and some dry goods materials. Dry goods are delivered to the bottling facility just in time for production, on average 2 days prior to bottling to minimise the storage required.

Given the current state of *The Bottler*, scheduling and rescheduling of bottling is much reliant on manual communication and inputs. Pre-planned scheduling is based on demand from wineries. The wineries decide how much wine of a specific type will be made and how much to bottle by a specific time. A bottling slot is subsequently requested at *The Bottler*, who then looks at available capacity versus demand requirements and schedules accordingly, mostly done on a longer planning horizon of 3 to 6 months, with additional runs being scheduled in between, as runs are requested and based on the availability of capacity.

Wineries in return are responsible for calculating the number of bottles, corks, screwcaps, capsules and labels required for the specific bottling run and negotiate with their suppliers to deliver the dry goods to the bottling facility at the correct time based on the agreed terms. The approximate fixed period of *The Bottler* ranges between six to eight weeks. Wineries inform *The Bottler* of the dry goods specifications and also the promised date of delivery and if orders do not arrive on the promised date, *The Bottler* calls the winery or in some cases the suppliers if time is limited. Wineries are responsible to investigate the causes of the delays and report to *The Bottler* if delivery

will be on time for the scheduled bottling run. If not, *The Bottler* evaluates the availability of materials of the subsequent bottling runs and tries to shift the schedule to avoid not utilising capacity. *The Bottler* rarely penalises clients if bottling runs are missed, but in some cases, it does occur. Rescheduling pre-planned bottling is a time-intensive exercise as it takes a lot of phone calls and emails between the relevant stakeholders to make queries, resolve the problems and to shift the schedule if possible.

The Bottler also usually tries to accommodate wineries who receive orders on short notice and then require a batch to be bottled. This requires a significant amount of coordination between the stakeholders to ensure that the schedule can be adjusted, that the wine is bottling ready, and all the dry goods delivered to *The Bottler* on time for the bottling run.

Even though *The Bottler* operates on an approximated fixed period of six to eight weeks, delivery delays of dry goods and unanticipated bottling order requests makes planning and scheduling complex. Exceptions are managed as best as possible to avoid unfulfilled orders or missed order opportunities for wineries, but in some cases losing bottling capacity, penalising clients or being unable to accommodate changes is unavoidable.

5.2.3 Case study process

The case study consisted of a semi-structured interview conducted by the researcher at *The Bottler*. Before commencing with the study, the researcher compiled a summary document (see Appendix H), explaining the proposed implementation guidelines. This served to provide the case study subject with the relevant background information to participate.

The case study interview comprised of an introductory overview of the WIC framework and the summary document of the implementation guidelines, whereafter *The Bottler* had the opportunity to clarify any uncertainties regarding the framework and its implementation. The researcher commenced with the scenario analysis, explaining each scenario presented in the summary document, asking *The Bottler* to explain how these scenarios currently affect operations.

Looking at the relevant implementation guidelines, the researcher along with *The Bottler* examined the proposed implementation guidelines and analysed the applicability of the steps to each scenario. As the interview progressed, *The Bottler*

gave insight as to the relevance of the steps, the anticipated outcomes if stakeholders engage in collaboration and follow the steps, as well as the benefits that it presents.

5.2.4 Scenario selection

Given the current state of the strategic, tactical and operational functioning of *The Bottler* and several other wine bottling facilities, the researcher formulated several scenarios to determine the cause-and-effect of improved collaborative capabilities and decision-making using the implementation guidelines formulated in Chapter 4.

The researcher developed three scenarios for the case study. These scenarios are based on typical problems experienced by stakeholders in the South African wine industry influencing daily operations. The researcher formulated the scenarios based on feedback given by stakeholders reported on in Chapter 3 and the feedback from SMEs presented in Chapter 5, which includes inputs from numerous stakeholders directly involved in winemaking, bottling and the supply of dry goods).

The three scenarios include activities that affect strategic, tactical and operational planning and their execution. This serves to validate that the implementation guidelines and inherently the WIC framework will be valuable to stakeholders in terms of all three planning horizons as well as the execution and performance management of operational activities.

5.2.5 Scenario 1 feedback and interpretation of results

The following subsections provide insight to the feedback given by the representative of *The Bottler*, given a specific challenging scenario. A short description of the scenario follows.

5.2.5.1 Scenario 1 description

Winery A bottles their entire range of product at *The Bottler*. In March, the winery submits an application for an international ‘tender wine’ order. The tender wine consists of a special blend Cabernet Sauvignon and Merlot and the label will have to be designed according to the clients’ specification if the tender is awarded to *Winery A*. Three months later, *Winery A* receives a call that they received the tender and that the shipment date is within the next three weeks. Bottling has to be scheduled and dry goods ordered.

The corresponding question probed is:

How will the implementation of the WIC framework help the stakeholders to address this challenge?

5.2.5.2 Scenario 1 analysis

Scenario 1 involves new product introduction, as tender wines are generally product batches customised for a specific order and are not necessarily produced again. *The Bottler* recognised this as a scenario that is similar or true to scenarios influencing planning and execution of bottling operations. Given the scenario, the wine certification and wine readiness should not be a problem if *Winery A* already has BG9 approval from SAWIS and only needs final BG11 approval. However, scheduling bottling and the availability of dry goods might pose some challenges. Based on the experience of *The Bottler* and current operations, the scheduling of this scenario will require a tremendous amount of effort. *Winery A* will be responsible to immediately contact the bottling facility and ask for an available bottling slot. Furthermore, they will have to communicate with the relevant suppliers via phone calls and/or emails to enquire about the availability of dry goods and if delivery of these dry goods will be possible on short notice.

This often results in a time-consuming exercise as *The Bottler* tries to accommodate all clients, to enable bottling of the ‘tender wine order’ on time for shipping while still adhering to their bottling commitment of other clients.

5.2.5.3 Phases affected and implementation guidelines utilised

Based on the presented implementation guidelines, *The Bottler* recognises the importance of the steps of Phase 3 and Phase 4 given this scenario (highlighted in Figure 5.3), especially if a shared platform is developed and used by industry stakeholders.

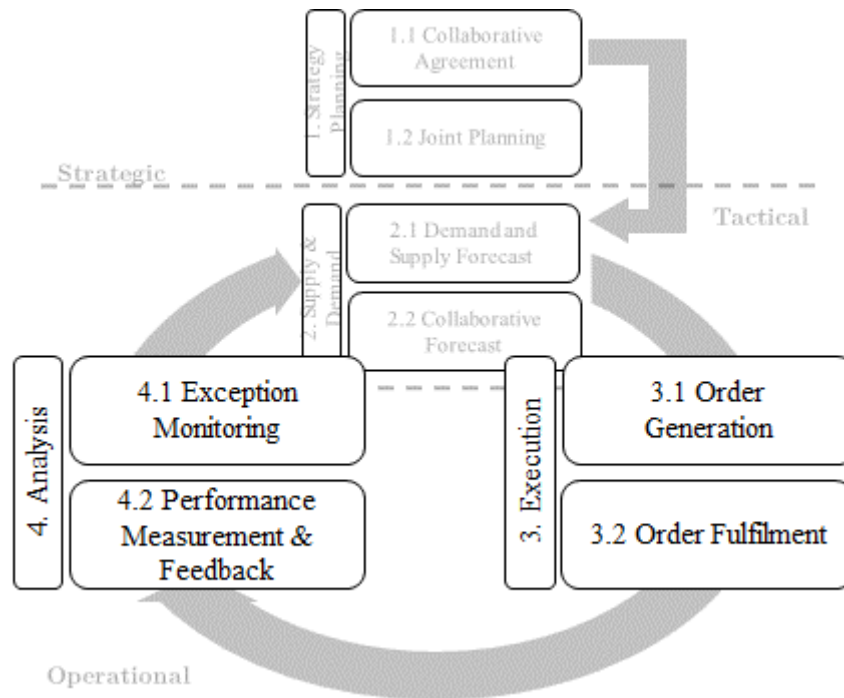


Figure 5.3: Key phases applicable to scenario 1

Winery A will have quick access to the ‘order generation capabilities’ of stakeholders based on the guidelines presented for step 3.1, having visible information regarding the capability of suppliers to supply dry goods and bottlers to accommodate bottling. *The Bottler* will also have information visibility portraying the current production execution of suppliers that influences their bottling operations and tracking order deliveries (step 3.2) to the facility to ensure that dry goods deliveries are on time and in full, not just for this order but orders in general. Having this information available, will assist *The Bottler* to identify any exceptions and also give an indication if any of their clients’ dry goods that are required for bottling in the near future will be available when required. *The Bottler* can use this information to improve decision-making concerning scheduling the bottling of the tender wine order.

5.2.5.4 Performance improvement expected

The Bottler emphasised the importance of having this extent of information availability and visibility as well as the importance of Phase 4 that follows, as Phase 4 will allow stakeholders to keep track of scenarios that influence planning and execution of supply chain processes. This can help the stakeholders to review the terms and conditions of collaboration agreed in Phase 1, to put measures in place that will help stakeholders to improve future planning and decision-making. *The Bottler* confirms that this is beneficial for strategic business planning and that the guidelines proposed

in Phase 1, step 1.1 and step 1.2, are appropriate and applicable to their business operations and will add value.

Furthermore, *The Bottler* highlights this as an important aspect that stakeholders should consider during Phase 2 implementation of the WIC framework. This will assist stakeholders to improve anticipated demand requirement and aid planning and decision-making regarding the scheduling and execution of production activities.

5.2.6 Scenario 2 feedback and interpretation of results

The researcher presented the second scenario to *The Bottler*. The feedback given and performance improvements possible based on the implementation of the WIC framework is presented in this section.

5.2.6.1 Scenario 2 description

The Bottler receives the majority of their bottling requests for the year during January, as per negotiation with their regular clients. These requests are based on estimated bottling quantities of a specific wine cultivar or cultivar blend with a specified BOM. *Winery B* wants to schedule a bottling slot at *The Bottler* for 15/08/2019. Several wineries use the same dry goods suppliers, even though they use different contract bottlers. Multiple other wineries (using other contract bottling services) as well as a large beverage manufacturer scheduled bottling slots for the same date and use the same supplier as *Winery B*. This might cause possible production and delivery constraints if not managed correctly. The resultant question being:

How will the implementation of the WIC framework based on the implementation guidelines help the stakeholders to identify the supply constraints and resolve this problem?

5.2.6.2 Scenario 2 analysis

The Bottler confirms that the identification of supply constraints and the resolution thereof will definitely be enhanced based on the given implementation guidelines. This will allow stakeholders to improve planning and decision-making of supply chain operations. In addition, the exchange of demand information, capacity availability and forecasting the requirements allows stakeholders to develop individual MPS and MRP schedules.

This will in return allow stakeholders to examine the possibility of any constraints, such as problems with the supply of glass bottles. *The Bottler* mentions that the timely exchange of this information and possibly having a platform where this is visible will enable the relevant parties to improve the planning and scheduling of production processes and also to minimise the risk of not being able to supply based on the collaborative forecast guidelines.

5.2.6.3 Phases affected and implementation guidelines utilised

Based on the given scenario, the stakeholders will all collaborate given the agreed collaborative agreement established in step 1.1 and have a vision of the joint goals they want to achieve. This scenario is more specifically applicable to Phase 2 (highlighted in Figure 5.4), which entails *demand & supply forecast* as well as *collaborative forecasting*. In addition, Phase 3 and Phase 4 is also important.

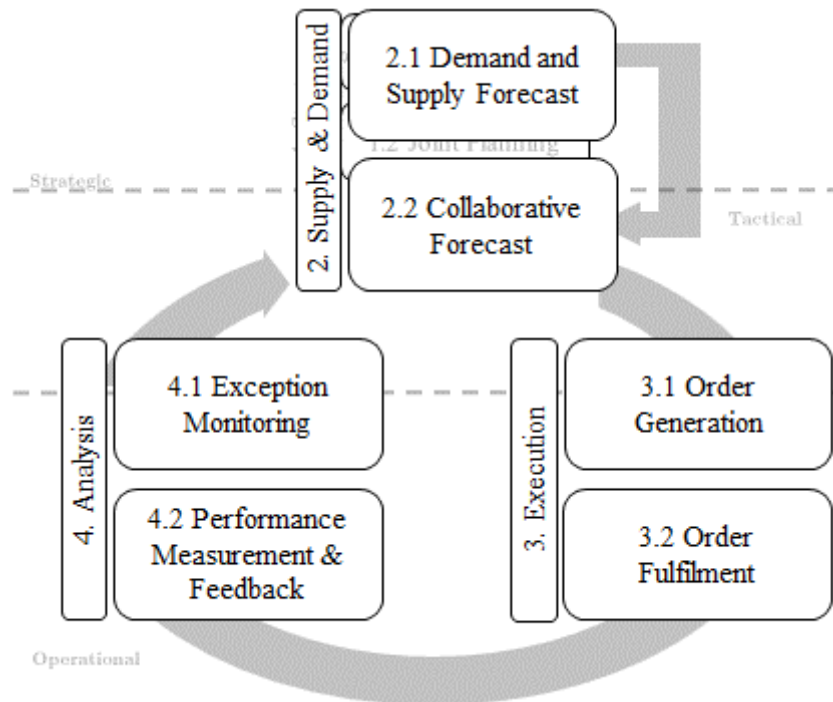


Figure 5.4: Key phases applicable to scenario 2

Exchanging information related to demand requirements such as the BOM and relevant quantities of each order batch, bottling slot availability and production capacities will create more supply chain transparency to equip stakeholders to enhance decision-making. *The Bottler* agrees that this information will help stakeholders with identifying constraints, manage these constraints among stakeholders and as a result be able to develop a collaborative MPS and MRP.

Thereafter, the guidelines of Phase 3 and Phase 4 will provide guidance to stakeholders to generate the orders more easily, keep track of order placements as well as tracking the execution of production and order deliveries along all the channels of the supply chain. Should any exceptions arise, *The Bottler* is of the opinion that the guidelines given are sufficient to resolve the exceptions and also use the framework to measure performance and formulate a sufficient performance improvement plan.

5.2.6.4 Performance improvement expected

Performance improvement factors are clear according to *The Bottler*. Given the scenario, the guidelines assist stakeholders with a stepwise approach to identify constraints earlier to resolve the constraint and as a result it is highly possible that bottling will be executed to deliver the order on time and in full.

Another possibility of improving performance arises as dry goods suppliers can plan well in advance to manufacture and combine deliveries for the same bottler based on planned bottling runs. So the supplier can plan and schedule delivery of, for example, labels for the week rather than delivering every day to the same bottler. This clearly illustrates how these implementation guidelines will help stakeholders to identify constraints and resolve problems.

5.2.7 Scenario 3 feedback and interpretation of results

The last scenario addresses the issue of wine readiness. Wine readiness along with dry goods availability are the two main factors that influence the wine bottling process. A short description of the case study finding follows.

5.2.7.1 Scenario 3 description

Winery C scheduled the bottling of their popular Red Lady wine blend on Wednesday 09/10/2019. They bottle this standard product range annually at *The Bottler* and it is a wine that is very high in demand. The bottling slot has already been scheduled end of January 2019 and along with the scheduling, the dry goods manager ensured that the orders for the bottles, labels, corks, boxes and dividers was placed. Two days prior to bottling, *Winery C* did some wine stability tests before sending the wine to *The Bottler*. This revealed a major problem – the batch of Red Lady has oxidised/chemical instability/microbial spoilage. Luckily, the winemaker will be able to stabilise the wine, but it will only be bottling ready on Monday 14/10/2019.

Unfortunately, stock levels of the Red Lady blend are critically low. If *The Bottler* is not able to rearrange the bottling schedule and shift the batch of Red Lady to one of Monday's bottling slots (which is already filled), the potential of out of stock situations at some demand points is very high. The question raised is:

How will the implementation of the WIC framework help stakeholders to reschedule bottling?

5.2.7.2 Scenario 3 analysis

When presented with this scenario, *The Bottler* stated that wine readiness is seldom a very big problem at their facility, although it does occur in exceptional cases. *Bottler* corroborates that in the cases of such a scenario, collaboration among stakeholders will be beneficial and value adding. Seeing that all the dry goods have been ordered, *The Bottler* can verify that the dry goods required for this order are en route using a shared collaborative platform if developed to confirm that bottling can take place from Monday 14/10/2019 and onwards. The production tracking as well as delivery status of other clients' dry goods and wine (especially those scheduled for Monday 14/10/2019) can also be verified to determine if those dry goods could potentially be delivered earlier to the wine bottling facility.

The Bottler highlighted this as a very important and helpful aspect of the collaboration proposed. This will allow *The Bottler* to make a better rescheduling decision by evaluating the possible options that exist for rescheduling based on dry goods availability and wine readiness of other clients, to cause the least disruption to the current planned bottling schedule.

5.2.7.3 Phases affected and implementation guidelines utilised

As this scenario focuses more on an operational planning level, step 3.2 and step 4.1 of the WIC framework is crucial (see Figure 5.5). This unforeseen problem is usually detected at short notice.

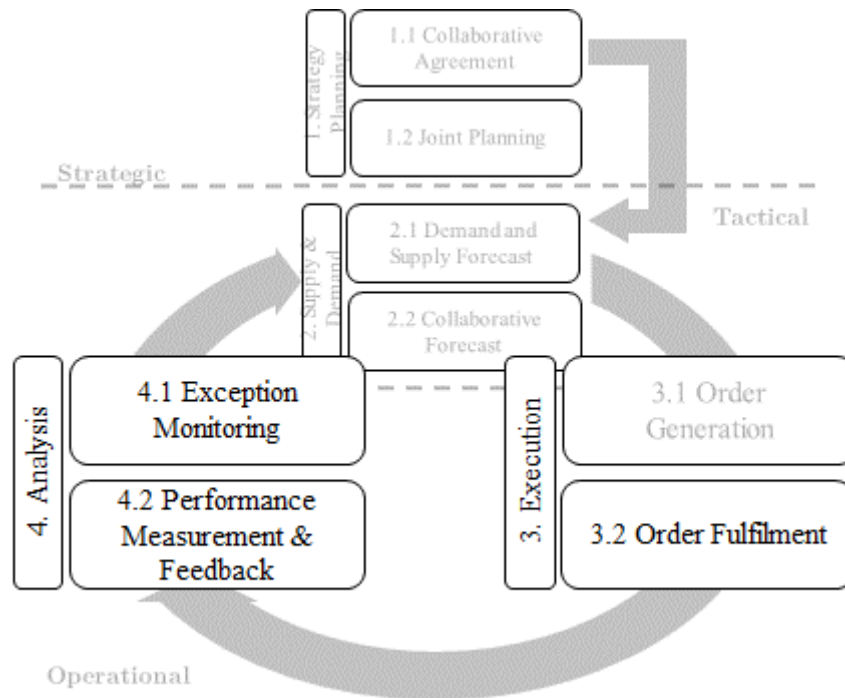


Figure 5.5: Key phases applicable to scenario 3

Given the information available regarding fulfilment of other orders as explained in Section 5.2.7.2, *The Bottler* will be equipped to make better decisions regarding shifting and shuffling the bottling schedule. As exceptions are recorded during the analysis phase, it will help stakeholders to keep track of the specifics related to the exception. Action can be taken to try to avoid reoccurrence or to help identify key management points that can assist with handling such a situation, ultimately aiming to cause the least possible disruptions.

5.2.7.4 Performance improvement expected

The Bottler states that given the WIC framework and the corresponding implementation guidelines, stakeholders will be able to reschedule bottling of the Red Lady Blend successfully and based on experience allow for on-time and in-full order fulfilment not only of the Red Lady Blend, but also other production orders scheduled. This will potentially help clients to avoid stock-outs and/or missed export opportunities.

5.2.8 General feedback and interpretation of results

During the case study session, *The Bottler* mentioned a few points of interest. Having such a collaborative initiative implemented in the wine industry will benefit the identified stakeholders and the use of a shared collaborative platform will definitely

ease implementation. The development of a shared collaborative platform will be of immense value for improved planning and decision-making as it will make information easily accessible and available to the relevant stakeholders. *The Bottler* emphasised the importance of data security and mentioned a concern regarding the compatibility of systems, should having a shared platform require system integration.

The Bottler concluded by saying:

“A system is only as good as the information that is in the system. Stakeholders will have to be willing and committed to share information. Even without having a shared collaborative platform to facilitate such a collaborative initiative, basic collaboration awareness among stakeholders that are based on the WIC framework and implementation guidelines developed will assist the wine industry with improved planning and decision-making.”

5.2.9 Reflection on the choice of case study

This section serves to evaluate the appropriateness of the case study choice and its limitations. In addition, the researcher aims to give recommendations for the improvement of future case studies related to this field of research.

A small- to medium-sized contract bottler, located in the Stellenbosch region in SA was chosen to participate in the case study. Management of this organisation was willing to participate and communicate information required to validate the implementation guidelines through semi-structured interviews hosted by the researcher, providing the researcher with valuable insight into their operations and to gain insight into the interaction with their supply chain partners. This bottling facility is one of the few contract-bottling facilities located in the Cape region, but is one of the smaller contract bottlers, with a limited number of clients and interacting with a vast variety of dry goods suppliers. *The Bottler* maintains a close relationship with clients and suppliers, but still experiences some scheduling challenges, which made *The Bottler* an appealing case study subject as the opportunity for collaboration seemingly exists.

The limitations of the case study include restricted time to understand the bottling operations and interaction between *The Bottler* and supply chain partners, as well as the subjectivity of the Management interviewed for the validation of the implementation guidelines. Even though the limitations are clear, the positive effects of

the framework and implementation guidelines as it is, were perceived to be valuable.

The ideal case study would have been to implement the WIC framework using multiple industry stakeholders related to the business operations of *The Bottler*. The effect of the implementation of the framework would be more apparent if a pilot implementation could take place and not only by testing implementation based on theoretical cases. Therefore, case studies fully implementing the framework to validate the framework in future would add value to the outcomes and benefits of the framework.

5.3 Chapter Summary

This chapter explained the feedback given by several SMEs about the validity and applicability of the WIC framework along with an overview of the contribution such a framework can make in the industry based on the finding of the theoretical case study at a wine bottling facility in Stellenbosch. This aligns with Research Objective 4 and its various research sub-objectives, that ultimately aim to verify and validate the proposed WIC framework based on SME interviews, followed by a theoretical case study to validate the developed implementation guidelines.

The chapter started out by explaining the SME validation process and the participants involved, followed by an overview of their feedback and the necessary amendments to the framework that are required after interpretation of the results. The theoretical case study subsequently validated the implementation guidelines and verified the anticipated advantages of the implementation of the WIC framework.

Given the feedback from the various SMEs and the theoretical case study, the researcher can conclude that the developed framework and its implementation guidelines are applicable to the South African wine industry and could potentially be of great value to the industry stakeholders. Based on the findings presented in this chapter, the researcher can conclude that the WIC framework and its implementation guidelines fulfils the set of design requirements compiled in Chapter 3 (refer to Table 3.9) to sufficiently address the challenges and opportunities currently presented to stakeholders in the South African wine industry.

By following the implementation guidelines, stakeholders are able establish a strategic collaborative relationship; subsequently fostering a collaborative culture. The extent of collaboration explained by the framework will allow stakeholders to improve strategic,

tactical and operational planning, align process execution, enhance information sharing, information visibility and ultimately supply chain transparency. Lastly, it will help them to track performance as well as improve desired performance measures. The final concluding comments and recommendations of this research project follow in the next chapter.

Chapter 6

Summary, Conclusions and Recommendations

The final chapter gives an overview of the research conducted and summarises the findings of the research study. It highlights the contributions of the Wine Industry Collaboration (WIC) framework at a wine bottling facility as well as contributions towards other stakeholders in the South African wine industry. The limitations of the research are discussed and recommendations for future research are explored. The chapter concludes with final remarks.

6.1 Overview of the research

This study started off in **Chapter 1** with an introduction to the wine industry of South Africa. It also provides background to the Wine Industry Strategic Exercise (WISE) aims and the current opportunities in the wine industry. The problem was introduced, followed by the research questions, the objectives and the approach for conducting the research. This included a brief overview of the research methodology whereafter the scope of the study and ethical consideration were discussed.

In **Chapter 2** the literature review explored all the elements used in developing the framework, especially elements of Collaborative Planning, Forecasting and Replenishment (CPFR). Several other factors related to CPFR such as the enablers, barriers, benefits and influence of technology were all part of the reviewed literature. Finally, supply chain digitalisation, the impact of Industry 4.0 and some possibilities associated with this revolution were briefly explored.

Chapter 3 gives an overview of the findings based on several semi-structured interviews with industry stakeholders. This includes interviews with SAWIS, wine bottling facilities, wineries and dry goods suppliers. The aim of the interviews was to explore the current operations and to identify the challenges experienced by all the individual stakeholders. This allowed the researcher to identify several opportunities for improvement and in essence – opportunities for collaboration. A set of design

requirements was subsequently compiled and served as the foundation for the development of the WIC framework to ensure that the framework constructed addressed the existing challenges and needs of the industry.

From the literature in Chapters 2 and the industry analysis in Chapter 3, a framework was proposed of which the final WIC framework is presented in **Chapter 4**. This incorporates all the necessary elements to facilitate collaboration between wine bottling facilities, wineries and dry goods suppliers. The purpose, objectives and scope of the framework are stated and then the framework is built in a step-by-step manner.

The validation of the proposed WIC framework was discussed in **Chapter 5**, along with the interpretation of the case study that evaluated the outcomes of case scenarios given that stakeholders follow the developed implementation guidelines. The applicability of the framework was then validated by means of structured interviews with several SMEs covering a wide range of subject matter areas. This led to the formulation of the final WIC framework, the implementation guidelines used for case study purposes and finally the five-step implementation approach, all presented in Chapter 4.

6.2 Research findings and conclusions

In Chapter 1, the researcher set out to answer a research question by completing a specific set of research objectives. The main research question the researcher aimed to answer is:

“How can wine bottling facilities and their supply chain partners improve their decision-making capabilities to increase the reliability and responsiveness of the wine supply chain, whilst keeping supply chain agility, costs and asset management to acceptable levels?”

The WIC framework and implementation guidelines developed in Chapter 4 and the validation thereof that followed in Chapter 5, enabled the researcher to answer the main research question. Based on the main research question, the research conducted in this study proved that wine bottling facilities and their supply chain partners could improve their decision-making capabilities through collaboration. It requires stakeholders to improve the availability and visibility of information amongst supply chain partners, aiming to improve the planning and execution of wine bottling activities. This entails the implementation of a WIC framework such as the one

developed in this research and even though the researcher acknowledges that fact that other frameworks could successfully facilitate collaboration in this supply chain environment, the aim of this study and main research objective, revisited here, was reached.

This research aims to develop a framework that will guide the establishment of a collaborative partnership, aid collaborative planning and allow responsive decision-making through improved information sharing and communication between wine bottling facilities and their direct supply chain partners. Additionally, the aim includes the formulation of generic guidelines towards the implementation of a collaborative partnership.

By developing the WIC framework, the researcher discovered that bottling facilities, wineries and dry goods suppliers in some instances neglect to share and communicate information necessary for planning and execution of wine bottling. This results in limited reliability and responsiveness of the overall wine supply chain. The framework developed firstly is a guideline for stakeholders to establish a collaborative partnership with one another and highlights the key aspects addressed by collaboration. This focuses on both tactical and operational planning, guiding the stakeholders to share information in a more structured way that will allow improved decision-making. In addition, the WIC framework provides guidelines that assist stakeholders with the execution of processes and managing any deviations, whereafter given performance measurement and feedback guidelines will enable them to avoid previous failures and repeat successes. These features are aligned with the set of framework design requirements listed by the researched based on the current challenges and opportunities existing in the South African wine industry. This can make a significant contribution to the South African wine industry and similar fields of research.

6.3 Research contributions

Current research in the South African wine industry focuses on performance measurement of the wine supply chain, while stressing the importance of collaboration between supply chain partners in order to successfully address the issues associated with performance factors (van Eeden *et al.*, 2014; Smit *et al.*, 2017; Palm & van Eeden, 2018). Due to the dynamic nature of ordering, production and delivery changes of dry goods needed for wine bottling, the ripple effect on the rest of the supply chain can have a detrimental influence on the reliability and responsiveness of bottling

facilities in specific situations. If changes are not communicated properly, optimal adjustment of schedules and processes will not be possible.

The WIC framework and implementation guidelines, together with the five-step implementation approach developed will enable wine bottling facilities, wineries and dry goods suppliers to address reliability and responsiveness issues by providing a guideline for the use of collaborative practices and technologies. It can be expanded to include other upstream or downstream partners. The focus will be on improving responsive decision-making to increase on-time order fulfilment and several other performance metrics that relate to reliability and responsiveness.

The research aims to contribute to research related to SCC tools such as CPFR specifically applicable to the agricultural and fast-moving consumer goods sectors. With a lack of implementation in these industries, this research aims to provide a framework and implementation guidelines to facilitate collaboration between wine bottling facilities and their respective supply chain partners. Furthermore, the evolving 4th industrial revolution is providing several new ways and means of communication platforms to enhance information flow. Very little research provides guidance on the applicability of these technological advancements to current South African supply chains with the aim to improve collaboration. The completion of this project will also contribute to facilitate the incorporation of concepts such as the IoT into an existing supply chain and enable the stakeholders involved to benefit, potentially gaining a competitive advantage. These contributions are summarised and compared to the research objectives in Table 6.1.

This study will serve as a reference for academics and researchers interested in this field of study and related areas. Related industries will also benefit from this research, as it will be a useful point of reference for the implementation of a collaborative initiative as well as integrated supply chain planning strategies and the coordination of the execution of processes. Furthermore, it will serve as a roadmap to improve the maturity of wine supply chains, as the WIC framework will guide participants towards the successful implementation of a collaborative strategy such as CPFR. It will allow more information visibility and availability throughout the SC, while aiding joint decision-making to improve aspects such as production scheduling and raw material movements. Finally, this will improve the overall reliability and responsiveness of the South African wine supply chain.

Chapter 6 - Summary, Conclusions and Recommendations

Table 6.1: Research objectives against the contributions made

Research Objectives:	Contributions:
RO 1. Understand supply chain collaboration initiatives, more specifically CPFR, and the influence of industry 4.0 on collaborative planning initiatives.	CPFR and Industry 4.0 related topics were covered in the literature review in Chapter 2. This served to investigate the dimensions, benefits and challenges related to CPFR and these elements were incorporated into the framework presented in Chapter 5. Additionally the review of Industry 4.0 provides an overview of how digitalisation can aid collaboration.
RO 2. Investigate the supply chain operations of wine bottling facilities and their direct supply chain partners	In Chapter 3 the exploration of the industry operations serves to equip the researcher with a thorough understanding of the industry, the relevant stakeholders, current challenges as well as the existing opportunities. This enabled the researcher to compile a set of design requirements that are used as the foundation for the development of the WIC framework.
RO 3. Develop a collaborative framework and implementation guidelines that overlaps with the dimensions, challenges and benefits from RO 1 and the identified opportunities from RO 2.	Given the current operations in the South African wine bottling industry, the researcher identified the need for guidelines to assist stakeholders with the implementation of improved collaborative practices. This led to the development of the WIC framework in Chapter 4, along with corresponding implementation guidelines and five-step implementation approach that provides industry stakeholders a foundation for the start of a collaborative partnership.
RO 4. Verify and validate the proposed collaborative framework by conducting subject matter expert (SME) interviews, followed by a theoretical case study to validate developed implementation guidelines.	Based on the feedback from several SMEs, covering a wide range of industry fields and expertise, the researcher was able to verify and validate that the WIC framework is relevant to this specific industry and its stakeholders. The theoretical case study showed good results that the implementation guidelines are applicable and valuable to aid collaborative planning, forecasting and replenishment, in return corroborating the value of the WIC framework. Through this validation process, it was then concluded that such a framework is valuable to the industry as it can aid decision-making and improve responsiveness and reliability to the greater wine industry.

This collaborative framework, when implemented successfully with the possibility of having a shared platform to facilitate such a collaborative initiative, can help wine bottling facilities, wineries and dry goods suppliers to improve planning of demand and supply, increase responsiveness towards packaged orders and allow reliable supply of packaged wine. In the end, the researcher can see this contributing to the shift towards

a bulk: packaged export ratio of 40:60 as well as a bigger and more promising market share abroad as Brand South Africa.

6.4 Research limitations and recommendations for further research

When implementing a new initiative in any industry not well known to all the stakeholders, change management and training employees are of the utmost importance. Even though these two elements are not directly included in the scope of this research, the researcher firmly believes that these are two crucial elements. Change management and training industry stakeholders to be more aware of collaboration and its impact on the performance of the South African wine industry need to be taken into account. This poses as an area for further research and highlighted as a key consideration that the industry should take note of, especially given that a proper industry wide implementation pilot project (also a possible area of future research) will be dependent on this factor.

The complete feasibility and cost implications of developing a shared platform based on the framework proposed is not considered in this research and is a definite area for future research. Collaboration will be dependent on stakeholder commitment and possibly largely reliant on the development and implementation of a shared collaborative platform, thus determining the potential cost implication, based on possible expenses and also cost savings, could be of interest. Furthermore, this research is limited to a selected number of stakeholders and based on the views of the participants interviewed. It does not directly include all types of bottling business model features such as that of mobile bottlers, but can easily be adjusted or extended if required.

A rich area of further research is how such a collaborative framework can be extended to include other stakeholders further upstream and downstream in the SC. The biggest potential is the integration of customer demand that could potentially improve the tactical and operational planning of wineries. Improved forecasting of demand can be translated into improving the tactical and operational planning of wine bottling facilities and dry goods suppliers, with the main aim of increasing the industry's capability to produce packaged wine for both local and international markets.

6.5 Final remarks

As the South African wine industry is aiming at transforming the operational business model of the industry from a production driven approach towards a market and value-driven approach, there are various supply chain and business issues to be addressed within the industry. This study is concerned with planning and execution of wine bottling, given that the industry aims to shift the bulk:packaged ratio to 40:60. In doing so, the WIC framework developed in this study proved to be valuable to stakeholders including wine producers, wine bottlers and dry goods suppliers by facilitating improved planning and execution of strategic, tactical and operational planning.

Improved planning could assist stakeholders to optimise production processes, avoid unnecessary costs, improve the reliability and responsiveness of the industry to increase on-time order fulfilment and ultimately increase profits (since value is created). These benefits will have to be validated by implementing the WIC framework at numerous wineries, wine bottling facilities and dry goods suppliers over a few years. However, this study is a starting point to introduce collaboration to stakeholders in the South African wine industry and to facilitate the establishment of collaborative partnerships between industry stakeholders.

References

Attaran, M. and Attaran, S. (2007) ‘Collaborative Supply Chain Management: The Most Promising Practice for Building Efficient and Sustainable Supply Chains’, *Business Process Management Journal*, 13(3), pp. 390–404. Available at: <https://pdfs.semanticscholar.org/af64/200c458070308d6703352e97aa73798027d5.pdf> (Accessed: 15 May 2018).

Audy, J. F. *et al.* (2012) ‘A framework for an efficient implementation of logistics collaborations’, *International Transactions in Operational Research*, 19(5), pp. 633–657. doi: 10.1111/j.1475-3995.2010.00799.x.

Augustyn, W. and Heyns, E. (2016) *The WISE way forward*, Wineland Media. Available at: <http://www.wineland.co.za/the-wise-way-forward/> (Accessed: 18 April 2018).

Barratt, M. (2004) ‘Understanding the meaning of collaboration in the supply chain’, *Supply Chain Management: An International Journal*, 9(1), pp. 30–42. doi: 10.1108/13598540410517566.

Barratt, M. and Oliveira, A. (2001) ‘Exploring the experiences of collaborative planning initiatives’, *International Journal of Physical Distribution & Logistics Management https An International Journal Industrial Management & Data Systems*, 31(1), pp. 266–289. Available at: <https://doi.org/10.1108/09600030110394932> (Accessed: 22 May 2018).

Barros, A. C. *et al.* (2008) ‘Decision Support Framework for Supply Chain Collaboration’, in *POMS 19th Annual Conference*. California. Available at: <https://pdfs.semanticscholar.org/4713/316fe70c7e76dcb6099f55a9c302f19c6cb2.pdf> (Accessed: 9 April 2018).

Ben-Daya, M., Hassini, E. and Bahroun, Z. (2017) ‘Internet of things and supply chain management: a literature review Internet of things and supply chain management: a literature review’, *International Journal of Production Research*. doi: 10.1080/00207543.2017.1402140org/10.1080/00207543.2017.1402140.

Bryman, A. and Bell, E. (2017) *Research Methodology: Business and Managemnet Contexts*. 7th edn. Edited by D. Wicomb. Oxford UNiversity Press South Africa.

- Caddy, I. N. and Helou, M. M. (2007) ‘Supply chains and their management: Application of general systems theory’, *Journal of Retailing and Consumer Services*, 14, pp. 319–327. doi: 10.1016/j.jretconser.2006.12.001.
- Cao, M. and Zhang, Q. (2011) ‘Supply chain collaboration: Impact on collaborative advantage and firm performance’, *Journal of Operations Management*. Elsevier B.V., 29(3), pp. 163–180. doi: 10.1016/j.jom.2010.12.008.
- Caridi, M., Cigolini, R. and De Marcoz, D. (2005) ‘Improving supply-chain collaboration by linking intelligent agents to CPFR’, *International Journal of Production Research*, 43(20), pp. 4191–4218. doi: 10.1080/00207540500142134.
- Chen, M.-C., Yang, T. and Li, H.-C. (2007) ‘Evaluating the supply chain performance of IT -based inter-enterprise collaboration’, *Information and Management*, 44(6), pp. 524–534.
- Chetty, P. (2015) *Developing conceptual framework in a research paper / Knowledge Tank, Project Guru*. Available at: <https://www.projectguru.in/publications/developing-conceptual-frameworkthesis-dissertation/> (Accessed: 20 September 2018).
- Danese, P. (2006) ‘Collaboration forms, information and communication technologies, and coordination mechanisms in CPFR’, *International Journal of Production Research*, 44(16), pp. 3207–3226. doi: 10.1080/00207540600557991.
- Danese, P. (2011) ‘Towards a contingency theory of collaborative planning initiatives in supply networks’, *International Journal of Production Research*, 49(4), pp. 1081–1103. doi: 10.1080/00207540903555510.
- DeMin, J. E. (no date) *Collaborative Planning , Forecasting and Replenishment (CPFR) and the Network — Cracking the Bullwhip !, BT infonet*.
- Du, X. F. *et al.* (2009) ‘Procurement of agricultural products using the CPFR approach’, *Supply Chain Management: An International Journal*, 14(2), pp. 253–258. Available at: <https://doi.org/10.1108/13598540910970081> (Accessed: 26 March 2018).
- van Eeden, J. *et al.* (2014) ‘Development of a Supply Chain Performance Measurement Framework for the South African Wine Industry’, *Third International Workshop on Food Supply Chains*, pp. 1–12.
- Enslow, B. (2007) *Global Supply Chain Excellence: New Best Practices to Master, Supply Chain Brain*. Available at: <https://www.supplychainbrain.com/articles/118-global-supply-chain-excellence-new-best-practices-to-master> (Accessed: 24 January

2019).

Fliedner, G. (2003) 'CPFR: an emerging supply chain tool', *Industrial Management & Data Systems*, 103(1), pp. 14–21. doi: 10.1108/02635570310456850.

Fliedner, G. (2006) 'Collaborative Supply Chain Forecasting: A Lean Framework', *Alliance Journal of Business Research*, 2(1), pp. 33–48. Available at: [http://www.ajbr.org/Archives/Collaborative Supply Chain Forecasting - A Lean Framework.pdf](http://www.ajbr.org/Archives/Collaborative%20Supply%20Chain%20Forecasting%20-%20A%20Lean%20Framework.pdf) (Accessed: 9 April 2018).

Gabriel, D. (2013) *Inductive and deductive approaches to research*. Available at: <http://deborahgabriel.com/2013/03/17/inductive-and-deductive-approaches-to-research/> (Accessed: 17 October 2018).

Garcia, F. A. *et al.* (2012) 'A framework for measuring logistics performance in the wine industry', *International Journal of Production Economics*, 135(1), pp. 284–298.

Gnimpieba Z, D. R. *et al.* (2015) 'Using Internet of Things technologies for a collaborative supply chain: Application to tracking of pallets and containers', *Procedia Computer Science*. Elsevier Masson SAS, 56(1), pp. 550–557. doi: 10.1016/j.procs.2015.07.251.

Hamister, J. W. (2012) 'Supply chain management practices in small retailers', *International Journal of Retail & Distribution Management*, 40(6), pp. 427–450. doi: 10.1108/09590551211230250.

Hauptfleisch, J. T. (2016) *The expected financial implications of establishment of a wine brand for a Swartland wine producer*. Stellenbosch University.

Hill, C. A., Zhang, G. P. and Miller, K. E. (2018) 'Collaborative planning, forecasting, and replenishment & firm performance: An empirical evaluation', *International Journal of Production Economics*, 196, pp. 12–23. doi: 10.1016/j.ijpe.2017.11.012.

Hollmann, R. L., Scavarda, L. F. and Thomé, A. M. T. (2014) 'Collaborative planning, forecasting and replenishment: a literature review', *International Journal of Productivity and Performance Management*, 64(6), pp. 971–993. Available at: <https://doi.org/10.1108/IJPPM-03-2014-0039> (Accessed: 12 March 2018).

Huo, Y. F. and Jiang, X. Y. (2007) 'Research on CPFR and warehousing management: A method to enhance supply chain visibility', *2007 International Conference on Wireless Communications, Networking and Mobile Computing, WiCOM 2007*, pp. 4640–4643. doi: 10.1109/WICOM.2007.1141.

Ireland, R. K. and Crum, C. (2005) *Supply Chain Collaboration: How to Implement CPFR and Other Best ... - Ronald K. Ireland, Colleen Crum - Google Books*. J. Ross Publishing. Available at:

https://books.google.co.za/books?hl=en&lr=&id=PGcRquCF0VAC&oi=fnd&pg=PR7&dq=cpfr+AND+collaborate***+AND+%22supply+chain%22&ots=goJIID8fI5&sig=nF278cozJS1Ws1xd4vUgU0kjPHI#v=onepage&q=cpfr AND collaborate*** AND %22supply chain%22&f=false (Accessed: 15 May 2018).

Jabareen, Y. (2009) 'Building a Conceptual Framework: Philosophy, Definitions, and Procedure', *International Journal of Qualitative Methods*. doi: 10.1177/160940690900800406.

Jooste, C. (2016) *Performance Measurement Framework for the South African Wine Supply Chain: An Investigation of Packaged Products in the Local Market*. Stellenbosch University.

Jooste, C., van Eeden, J. and van Dyk, E. (2015) 'South African Wine Supply Chain Performance Measurement Framework', (August).

Kamau, P. M. (2015) *SUPPLY CHAIN PLANNING AND PERFORMANCE OF WATER BOTTLING COMPANIES IN NAIROBI CITY COUNTY, KENYA*. University of Nairobi. Available at: http://erepository.uonbi.ac.ke/bitstream/handle/11295/93346/Kamau_Supply_chain_planning_and_performance.pdf?sequence=3 (Accessed: 9 April 2018).

Knoblauch, L. (2018) *A practical decision-making framework for improved demand planning in small to medium- sized wineries*. Stellenbosch University.

Knoblauch, L., van Eeden, J. and Edwards, R. (2016) 'RESPONSIVE STRATEGIES AND SUPPLY CHAIN DECISION-MAKING FOR THE SOUTH AFRICAN WINE INDUSTRY', in *Van Dyk L (ed.) 27th Annual Southern African Institute for Industrial Engineering Conference*. Parys, South Africa: SAIIE 2016: 151-161, pp. 1–11.

Koh, S. C. L. *et al.* (2007) 'The impact of supply chain management practices on performance of SMEs', *Industrial Management & Data Systems*. Emerald Group Publishing, 107(1), pp. 263–5577. doi: 10.1108/02635570710719089.

Kruger, P. and van Eeden, J. (2016) 'Identify major reasons for reliability issues in the packaged export segment of the South African wine industry', in *Mac Cawley A (ed.) Conference Proceedings: Fourth International Workshop on Food Supply Chains*. Stellenbosch, South Africa: International Food Supply Chain Council 2016: 1-15.

- Lee, C. W., Kwon, I.-W. G. and Severance, D. (2007) 'Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer', *Supply Chain Management: An International Journal*, 9(2), pp. 1–20. doi: 10.1108/13598540710826371.
- Lee, I. and Lee, K. (2015) 'The Internet of Things (IoT): Applications, investments, and challenges for enterprises', *Business Horizons*, 58, pp. 431–440. doi: 10.1016/j.bushor.2015.03.008.
- Li, S. *et al.* (2006) 'The impact of supply chain management practices on competitive advantage and organizational performance', *Omega*, 34, pp. 107–124. doi: 10.1016/j.omega.2004.08.002.
- Liu, X. and Sun, Y. (2012) 'Information Integration of CPFR in Inbound Logistics of Automotive Manufacturers Based on Internet of Things', *Journal of Computers*, 7(7), pp. 349–355. doi: 10.4304/jcp.7.2.349-355.
- Machado, H. and Shah, K. (2016) *Internet of Things (IoT) impacts on Supply Chain*. Available at: http://www.ijotjournal.nl/wp-content/uploads/2016/09/Machado__Internet_of_Things_impacts_on_Supply_Chain_in_Shah_Machado_Second_Place_Grad.pdf (Accessed: 26 March 2018).
- Márcio *et al.* (2014) 'Research synthesis in collaborative planning forecast and replenishment', *Industrial Management & Data Systems*, 114(6), pp. 949–965. doi: 10.1108/IMDS-03-2014-0085.
- Matopoulos, A. *et al.* (2007) 'A conceptual framework for supply chain collaboration: empirical evidence from the agri-food industry', *Supply Chain Management: An International Journal*, 12(3), pp. 177–186. doi: 10.1108/13598540710742491.
- De Mattos, C. A. and Laurindo, F. J. B. (2015) 'Collaborative Platforms for Supply Chain Integration: Trajectory, Assimilation of Platforms and Results', *Journal of Technology Management & Innovation*, 10(2). Available at: <http://www.jotmi.org> (Accessed: 21 May 2018).
- Milojevic, M. (2017) *Digital Industrial Transformation with the Internet of Things How can European companies benefit from IoT?* Available at: https://www.ge.com/uk/sites/www.ge.com.uk/files/2017_PAC_MCS_Digital_Industrial_IoT_Exec_Summary_GE_Digital%281%29.pdf (Accessed: 25 July 2018).
- Orlikowski, W. J. (1993) 'CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development', *Management Information*

Systems Quarterly, 17(3), pp. 309–340. doi: 10.2307/249774.

Palm, C. and van Eeden, J. (2018) ‘ANALYZING RESPONSIVENESS ISSUES IN THE PACKAGED EXPORT SEGMENT OF THE SOUTH AFRICAN WINE INDUSTRY’, in. Kolding, Denmark: NOFOMA.

Panahifar, F. *et al.* (2015) *A framework for Collaborative Planning, Forecasting and Replenishment (CPFR)*, *Journal of Enterprise Information Management*. doi: 10.1108/JEIM-09-2014-0092.

Petersen, K. J., Ragatz, G. L. and Monczka, R. M. (2005) ‘An Examination of Collaborative Planning Effectiveness and Supply Chain Performance’, *Journal of Supply Chain Management*, 41(2), pp. 14–25.

Pramatari, K. (2007) ‘The most promising practice for building efficient and sustainable supply chains’, *Supply Chain Management: An International Journal*, 12(3), pp. 210–220. Available at: <https://doi.org/10.1108/13598540710742527>. (Accessed: 15 May 2018).

du Preez, J. (2017) *Why SA wine exports must move from bulk to brands*, *Farmers Weekly*. Available at: <https://www.farmersweekly.co.za/agribusiness/agribusinesses/sa-wine-exports-must-move-bulk-brands/> (Accessed: 23 July 2018).

PWC (2015) ‘Can you see the trend? - The South African wine industry insights survey 2015’, *The South African wine industry insights survey - PwC*, (1), p. 68. doi: 10.1108/eb008758.

Ralston, P. M., Richey, R. G. and Grawe, S. J. (2017) ‘The past and future of supply chain collaboration: a literature synthesis and call for research’, *The International Journal of Logistics Management*, 28(2), pp. 508–530. doi: 10.1108/IJLM-09-2015-0175.

Ramanathan, U. (2014) ‘Performance of supply chain collaboration -A simulation study’, *Expert Systems with Applications: 21st Century Logistics and Supply Chain Management*, 41(1), pp. 201–220. Available at: http://irep.ntu.ac.uk/id/eprint/27374/1/PubSub4979_Ramanathan.pdf (Accessed: 15 February 2018).

Ramanathan, U. and Gunasekaran, A. (2014) ‘Supply chain collaboration: Impact of success in long-term partnerships’, *Intern. Journal of Production Economics*. Elsevier, 147, pp. 252–259. doi: 10.1016/j.ijpe.2012.06.002.

Ramdhani, M. A. and Ramdhani, A. (2014) ‘Verification of Research Logical

Framework Based on Literature Review’, *International Journal of Basic and Applied Sciences*, 3(2), pp. 1–9. Available at: https://www.researchgate.net/publication/311735508_Verification_of_Research_Logical_Framework_Based_on_Literature_Review (Accessed: 11 April 2019).

Sattar, T. H. (2012) *A CPFR Readiness Assessment Model*. Available at: <http://scholarworks.uark.edu/etd> (Accessed: 11 May 2018).

Saunders, M. N. *et al.* (2015) ‘Concepts and Theory Building’, in Anderson, L. *et al.* (eds) *A Guide to Professional Doctorates in Business and Management*. London: SAGE, pp. 35–56.

SAWIS (2017) *SA WINE INDUSTRY 2017 STATISTICS NR 42*. Available at: http://www.sawis.co.za/info/download/Book_2017_statistics_year_english_final.pdf (Accessed: 24 November 2018).

SAWIS (2018) *SA WINE INDUSTRY 2018 STATISTICS*. Paarl.

Seifert, D. (2003) *Collaborative planning, forecasting, and replenishment: How to create a supply chain advantage*. New York: AMACOM.

Sheffi, Y. (2002) ‘The value of CPFR’, in. Lisbon. Available at: <http://web.mit.edu/sheffi/www/documents/genMedia.theValueOfCPFR.pdf> (Accessed: 12 April 2018).

Simatupang, T. M. and Sridharan, R. (2003) ‘A Benchmarking Scheme for Supply Chain Collaboration’, *Benchmarking: An International Journal*, 9(6). Available at: <http://togarsim.tripod.com/publish/bench.pdf> (Accessed: 12 April 2018).

Simatupang, T. M. and Sridharan, R. (2005) ‘An integrative framework for supply chain collaboration’, *The International Journal of Logistics Management*, 16(2), pp. 257–274. doi: 10.1108/09574090510634548.

Singh, H., Garg, R. K. and Sachdeva, A. (2018) ‘Supply chain collaboration: A state-of-the-art literature review’, *Uncertain Supply Chain Management*, 6, pp. 149–180. doi: 10.5267/j.uscm.2017.8.002.

Skjoett-Larsen, T., Thernøe, C. and Andresen, C. (2003) ‘Supply chain collaboration’, *International Journal of Physical Distribution & Logistics Management*, 33(6), pp. 531–549. doi: 10.1108/09600030310492788.

Smit, J. B., van Eeden, J. and van Dyk, F. E. (2017) ‘A performance measurement framework for the South African bulk export wine supply chain’, *Journal of Transport*

and *Supply Chain Management*, 11, pp. 1–11. doi: 10.4102/jtscm.v11i0.318.

Sylvester, A., Tate, M. and Johnstone, D. (2013) ‘Beyond synthesis: Re-presenting heterogeneous research literature’, *Behaviour and Information Technology*, 32(12), pp. 1199–1215. doi: 10.1080/0144929X.2011.624633.

Szozda, N. (2017) ‘Industry 4.0 and its impact on the functioning of supply chains’, *Scientific Journal of Logistics*, 13(4), pp. 401–414. doi: 10.17270/J.LOG.2017.4.2.

Vanpoucke, E., Vereecke, A. and Muylle, S. (2017) ‘Leveraging the impact of supply chain integration through information technology’, *International Journal of Operations & Production Management*, 37(4), pp. 510–530. Available at: <http://dx.doi.org/10.1108/IJOPM-07-2015-0441> (Accessed: 15 May 2018).

Varsei, M. and Polyakovskiy, S. (2017) ‘Sustainable supply chain network design: A case of the wine industry in Australia’, *Omega (United Kingdom)*, 66(February 2018), pp. 236–247. doi: 10.1016/j.omega.2015.11.009.

VICS (2004) *Collaborative planning, forecasting, and replenishment*.

VICS (2010) *Linking CPFR and S&OP: A Roadmap to Integrated Business Planning*. Available at: https://www.gs1us.org/DesktopModules/Bring2mind/DMX/Download.aspx?command=core_download&entryid=433&language=en-US&PortalId=0&TabId=134 (Accessed: 12 April 2018).

Vinpro (2015) *A call to action*. Available at: <http://vinpro.co.za/a-call-to-action/> (Accessed: 18 April 2018).

Wakenshaw, S. *et al.* (2017) ‘An IoT-enabled Supply Chain Integration Framework: Empirical Case Studies’, in Gao, J., El Souri, M., and Keates, S. (eds) *15th International Conference on Manufacturing Research*. London, pp. 263–268. doi: 10.3233/978-1-61499.

Wang, P. *et al.* (2015) ‘Introduction: Advances in IoT research and applications’, *Information Systems Frontiers*, 17(2), pp. 239–241. doi: 10.1007/s10796-015-9549-2.

Whipple, J. M. and Russell, D. (2007) ‘Building supply chain collaboration: A typology of collaborative approaches’, *Article in The International Journal of Logistics Management*. doi: 10.1108/09574090710816922.

Willig, C. (2013) *Introducing qualitative research in psychology*. 3rd edn. Open University Press.

Xu, L. Da (2011) 'Information architecture for supply chain quality management', *International Journal of Production Research*, 49(1), pp. 183–198. doi: 10.1080/00207543.2010.508944.

Xu, L. Da, He, W. and Li, S. (2014) 'Internet of things in industries: A survey', *IEEE Transactions on Industrial Informatics*, 10(4), pp. 2233–2243. doi: 10.1109/TII.2014.2300753.

Appendix A - Industry exploration questionnaire

This appendix contains the questionnaire that the researcher used during the semi-structured interviews that served to explore the current level of collaboration between industry stakeholders. This questionnaire was used to gather all the information presented in Chapter 3 of this document.

Collaborative nature of wine bottling supply chain:

1. Who are currently your direct supply chain partners (this includes suppliers as well as clients)?

Suppliers	Clients

2. If there is any form of collaboration between your organisation and any of your direct supply chain partners, please answer the following questions in the table provided:

2.1. Who do you collaborate with?

2.2. How frequent is collaboration:

- 1-2 times per week

- 3-5 times per week
- More than 5 times per week

2.3. Shortly provide the reason(s) for current collaboration? And what are the goals to be achieved by these collaborative efforts?

2.4. What are the main elements of information/data shared with each collaborative partner?

2.5. Please provide a reason why each element is important.

2.6. Which of the following communication tools are used during collaboration with supply chain partners:

[1] Basic email and phone

[2] Internally linked email

[3] linked email and spreadsheets

[4] Enterprise class solutions (examples includes Electronic Data Interchange and SAP)

[5] Other: please specify

2.1 Collaborative partner	2.2 Frequency of collaboration	2.3 Reason(s) for collaboration	2.4 Information/data elements shared	2.5 Reason of importance of information/data	2.6 Means of communication

3. If there is currently no means of collaboration between your organisation and some of your direct supply chain partners, please answer the following questions in the table provided at the end of sub-questions:

3.1. Please provide the name of the supply chain partner and please indicate whether they are a supplier (S) or a client (C).

3.2. What is the reason(s) for not having an established collaborative relationship with the respective supply chain partners?

[1] Lack of trust

[2] Technical uncertainty

[3] Lack of knowledge regarding collaboration and the advantages associated with collaborative initiatives

[4] Unwillingness of partners

[5] Worried about information and data security

[6] Other: please specify

3.3. One of the major advantages associated with CPFR is the co-ordination of demand and supply planning (joint business planning). Will this be beneficial in the current SC configuration of your wine bottling plant to establish a collaborative partnership with each respective supply chain partner?

Yes

No

3.3.1. If yes, which demand and supply planning activities can be co-ordinated?

3.4. Would you be willing to enter a collaborative partnership given an appropriate framework is developed to facilitate successful implementation?

[1] Yes, 100%.

[2] Yes, but will require additional information (ex. resource requirement, financial investment, benefits, challenges etc.)

[3] No

3.1 Collaborative partner	3.2 Reason(s) for not collaborating	3.3 Will joint business planning be beneficial?	3.3.1 Activities that can be coordinated	3.4 Willingness to enter a collaborative partnership given a framework

4. Is there an opportunity to expand collaboration along the channels of the supply chain? If so, please explain shortly?
-
-

5. What do you regard as critical success factors to establish a well-defined collaborative partnership between your organisation and your respective supply chain partners?
-
-

6. What are the main opportunities and challenges (i.e. performance improvement, production scheduling etc.) that can be addressed by establishing a collaborative partnership given the current supply chain configuration?

7. Linked to the main opportunities and challenges mentioned in the previous question, which of the following benefits associated with successful CPFR implementation will be most beneficial for your company in general?

- Reduced inventory in the supply chain
- Improves sales and other operating and financial performance
- Faster order-response times
- Development of better products
- Improved production processes
- Improved dry goods and raw material availability
- Reduced forecasting error
- Reduced lead times
- Improved responsiveness
- Improved reliability
- Reduced purchase price
- Improved quality
- Cost reduction
- SC performance improvement

8. Is there currently any means of assessing suppliers/clients performances?

- Yes
- No

8.1. If yes, for which supplier(s)/client(s) and what are the specific performance metrics?

Supplier/Client	Performance Metrics

9. What are the main areas of measurable performance metrics improvement given the performance of your current supply chain partners and what would the desired improved state be (ex. reliability, responsiveness etc.)?

Improvement metrics	Desired state

10. Do you have a process of measuring the reliability and responsiveness of your suppliers?

- Yes
- No

10.1. If you answered yes in question 8, how do you measure these performance metrics?

10.2. If you answered no in question 8, why do you not have any measurement process in place?

11. In your opinion, will upstream or downstream collaboration (or both) be more beneficial in the case of a wine bottling plant setup? Please provide a reason.

- Upstream (supply points)
- Downstream (demand points)
- Both

Reason:

12. An important component of implementing CPFR involves having regular meetings with collaborative partners. Will you be willing to commit to these meetings, should you decide to implement CPFR at your institution? (This consist of monthly meetings which is mostly use to facilitate communication regarding the initiative and quarterly meetings used to review and address performance related issues.)

- Yes
- No

Current bottling scheduling procedure (planning, forecasting and replenishment):

13. What is the current process used to allocate bottling slots to your various clients?

14. What is the typical planning horizon according to which your organisation schedules bottling?

0 – 3 Weeks	0 – 3 Months	3 – 6 Months	6 – 12months	18-24 months
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15. Is there any means of forecasting anticipated bottling schedule in terms of variety and quantity of dry goods and raw materials needed for a specific point in time? If so, how is forecasting done?

16. What is the replenishment procedure of raw materials and dry goods needed for bottling?

Raw material/dry good	Procedure	Storage

17. What is the typical causes of deviations to the pre-planned bottling schedule (ranked 1-most occurring and 5-least occurring)?

- 1: _____
- 2: _____
- 3: _____
- 4: _____
- 5: _____

18. How do you manage exceptions/deviations of the pre-planned bottling schedule (ex. how is the involved/affected parties informed of changes)?

19. Is there currently any internal collaboration (inter-departmental collaboration) required/involved with the process of scheduling and executing bottling?

19.1. If yes, which departments?

19.2. What is the reason(s) for collaboration (i.e. which supply chain activities are coordinated by the collaboration)?

19.3. What are the information and/or data elements shared?

19.4. How is information shared?

Department	Reason(s) for collaboration	Information/data elements shared	Means of information/data sharing

Appendix B - Bottling facility forms

This appendix provides examples of two forms that are completed prior to bottling. Figure B.1 is the specification sheet that wineries have to complete when requesting a bottling slot and in return it is used by a bottling facility to pre-plan production scheduling. Figure B.2 is the dry goods checklist that is completed by an on-site employee of a bottling facility to ensure that all the dry goods required for a specific bottling run has been received and is as per the specification sheet.

BRC5-01-1 SPECIFICATION SHEET					
ALL fields marked with * MUST be completed					
CUSTOMER DETAILS					
Registered name at SAWIS		Tel.		Fax	
Contact person	*	E-mail	*		
Registered name at Wine-on-Line	*	Cell.	*		
PRODUCT DESCRIPTION					
Trademark & cultivar	*	Origin	*	Vintage	*
Quantity bulk litres	*	Bottle volume			
Tank number		Consigner			
WSB number		Label alcohol			
Seals application (customer / Koelenhof)		Seal application no.			
Sugar added (sweetened) / Semi-sweet	Yes / No	*			
* De-gas wine sample before lab analysis (Please indicate Yes / No)					
SERVICE REQUIRED (mark with X)					
Bottling & labelling (quantity)	*	Ozone sterilization	*		
Bottling only (quantity)		Sheet filtration (choose 30/70/110)	*		
Labelling only (quantity)	*	Membrane filtration	*		
Wine heating	*	Bar code	*		
Velcorin dosing (for sweetened / semi-sweet wine)	* Yes	No	* See condition 8		
DRY GOODS					
	<u>Type / Ref.</u>	<u>Quantity ordered</u>	<u>Supplier</u>	<u>Delivery date</u>	<u>Quantity delivered</u>
Bottles	*			*	
Corks	*			*	
Capsules	*			*	
Screw caps	*			*	
Front labels	*			*	
Back labels	*			*	
Cartons	* Upright: Layflat:			*	
Dividers	*			*	
Carton stickers	*			*	
Pallet / Bins	*			*	
PACKAGING SPECIFICATIONS					
Bottle volume	*	Filling height (eg 20c)		Lot.no. label	*
Bottle ref.no.	*	Front label height	*	Lot.no. position	*
Bottle colour	*	Back label height	*	Carton Lot.no.	*
Type of cork	*	Front label size		Carton bar code	*
Type of capsule	*	Back label size		Printing on carton	*
Capsule colour	*	Packing (6/12/bin)	*	# cartons / pallet	* Consol: /Export:
Screw cap colour	*	Type of divider	*	Pallet wrap (yes / no)	*
SPECIAL INSTRUCTIONS (e.g. quantities, different back labels etc.)					
CLIENT SIGNATURE			SERVICE PROVIDER SIGNATURE		
DATE			DATE		

Figure B. 1: Bottling specification sheet example

Pre Production Inspection on Issued Dry Goods				
<i>Below section to be completed by Bottling Manager</i>				
Production Date:		Bottling Line:	Lot no:	
Client Name:		Actual Liters Received:		
Product name, Cultivar and Vintage:				
<i>Below section to be completed by Certification Officer and Dry Goods Controller</i>				
Certification officer and Dry Goods Controller Check				
Wine of Origin				
Label Alcohol				
Signature:..... <i>Certification officer</i>		Signature:..... <i>Dry Goods Controller</i>		
<i>Quality Controller/Operator to check that the correct dry goods are handed over according the production Spec sheet.</i>				
Bottle number and Colour		YES	NO	Remarks
Cork type, Branded/ Non Branded		YES	NO	Remarks
Capsules colour, Branded/ Non Branded		YES	NO	Remarks
Screwcaps Colour , Branded/ Non Branded		YES	NO	Remarks
Labels Front & Back		YES	NO	Remarks
Cartons number,Upright/Layflat		YES	NO	Remarks
Divider type		YES	NO	Remarks
Carton sticker bacode, Cultivar, vintage		YES	NO	Remarks
Spray on Carton Cultivar, vintage, Lot no		YES	NO	Remarks
Pallet Type		YES	NO	Remarks
<i>Quality Controller and Operator hereby takes full responsibility, that the received dry goods are correct and ready for production.</i>				
Signature: <i>Dry Goods Controller</i>		Signature: <i>Quality Controller</i>		Signature: <i>Operator</i>
Quality Controller Please Tick ✓	Production	Complete	Production Incomplete	Reason Incomplete:

Figure B.2: Bottling dry goods checklist example

Appendix C - Proposed framework

In this appendix, the proposed collaborative framework is presented. This includes an explanation of all the phases and elements included in the collaborative framework developed for wine bottling facilities and their direct supply chain partners. The documentation presented in this appendix represents the collaborative framework developed by the researcher before validation took place.

Phase I: Strategy Planning

Strategy planning is the first phase in the establishment of a collaborative SC partnership. This phase consists of two steps: (1) Collaborative Agreement and (2) Joint Planning. These two steps concern the establishment of guidelines for driving a collaborative relationship. This phase incorporates the collaborative model proposed by

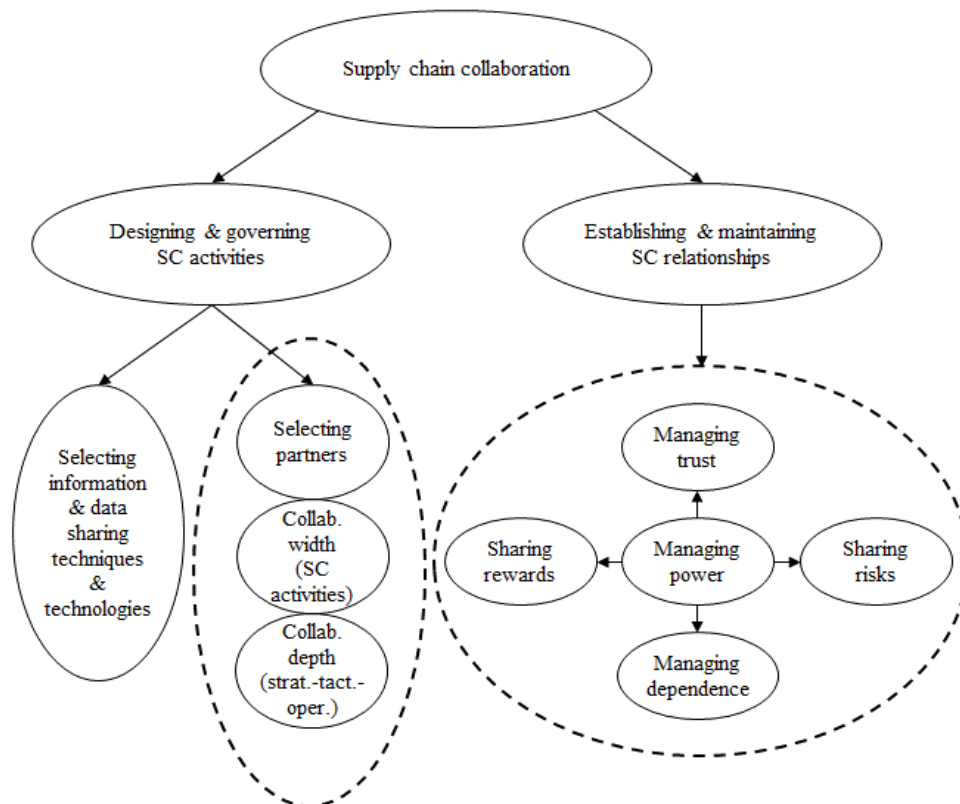


Figure C.1: Research framework for supply chain collaboration

Matopoulos *et al.*, (2007) depicted in Figure C.1.

Setting up the *Collaborative Agreement* starts with **partner selection** and collaborative partners must be willing to commit resources to implement and facilitate the initiative, which is an important step in this first phase of CPFR. Wine bottling facilities should focus on manifesting a close relationship with a selected number of partners, mostly focusing on collaboration with suppliers and in return, collaboration between suppliers and wineries will aid collaborative efforts of wine bottling facilities. Important decision factors in this case include the relationship between buyer and supplier, purchasing volume, LT and the risk of supply.

Partner selection will also be heavily reliant on trust between the stakeholders, management involvement and if stakeholders are willing to assign staff and train them adequately. These are key enablers of collaboration such as CPFR (Skjoett-Larsen, Thernøe and Andresen, 2003; Attaran and Attaran, 2007).

Hand in hand with partner selection runs the proposal of a **source and supply agreement**, which involves defining the collaboration width. This requires partners who enter the collaborative agreement to identify or specify the intended width of collaboration. Chapter 3 gives a detailed explanation of all the possible opportunities for collaboration explored by the researcher and this can be expanded should more stakeholders be included or if the stakeholders deem it necessary. Furthermore, the source and supply agreement involves setting the terms and conditions related to purchasing, often including price, quantity discount, quality, etc.

In Section 2.4.5.4 one of four collaborative SC strategies is suggested (depicted in Figure 2.13), guiding the selection and involvement of SC partners in a collaborative strategy. For the applicable SC configuration, an ‘information exchange’ combined with ‘synchronised supply’ SC collaboration configuration is suggested. Both of these SC strategies are focused on collaboration emphasising planning collaboration, while synchronised supply additionally has a focus on inventory collaboration.

Information about expected orders in the future and raw data for material planning are shared amongst the SC partners, but orders are still made independently. Forecasting is an integral element of information sharing added to this approach to

align it with CPFR. This calls for all SC partners involved to share a forecast³ by the agreed upon due date. Along with this approach, a synchronised supply approach entails a supplier concentrating supply and production planning using customer information, or in this case the information provided by wineries. This allows a certain degree of inventory collaboration, as suppliers' replenishment decisions are based on the visibility of production and material requirements planning of other stakeholders and vice versa.

Information exchange and its quality is considered as an important enabler of CPFR (Petersen, Ragatz and Monczka, 2005; Panahifar *et al.*, 2015; Singh, Garg and Sachdeva, 2018) and other enabling factors mentioned above need to be in place to ensure that stakeholders are willing to share the relevant information. It is crucial that stakeholders trust one another and feel that their information is confidential and secure (Fliedner, 2003; Audy *et al.*, 2012). Basic information sharing elements that will be required to facilitate collaboration are listed in Table C.1. This SC configuration focuses on planning collaboration as well as inventory collaboration and will be used to guide the supply and demand planning requirements.

Table C.1: Collaborative information sharing elements

Stakeholders	Information sharing inputs
Bottling facility	Bottling slots availability Pre-planned bottling schedule Dry goods BOM requirement planning (verify quantities and expected delivery of dry goods)
Winery	Wine readiness date (cultivar and expected completion) Bottling volume requirement Dry goods BOM Wine readiness traceability
Supplier	Production capacity Production planning and sequencing Dry goods availability Execution tracking of production processes Delivery tracking and traceability

³ Forecast in the context of this framework is not the demand of the consumer, but rather the operational demand originating at different stakeholders in the supply chain that is potentially based on consumer demand.

Finalising a collaborative agreement corresponds with *Joint Planning* which involves **joint goal setting** and **synchronised decision-making**. When setting goals, individual stakeholders must look at possible benefits of CPFR, identify which benefits they want to exploit and set performance targets along with related metrics. The goals set can be related to the possible benefits of CPFR, which might include mutual goals listed in Table C.2. When goals have been set, corresponding performance targets and related metrics must be set.

Table C.2: Mutual collaborative goals and related performance metrics

Joint goals	Performance metrics
Improved agility	Resource utilisation
Improve responsiveness	On-time order fulfilment
Increased reliability	Overall Perfect Order Fulfilment
Higher productive capacity	Capacity utilisation

Synchronised decision-making is an important factor to consider as it is recognised as a collaborative culture initiator (Ralston, Richey and Grawe, 2017) and enabler of CPFR (Simatupang and Sridharan, 2003; Ramanathan and Gunasekaran, 2014). Typical elements included are sales and order forecast, order multiples, minimum order sizes, lead times, the delivery lead times of orders and order placement deadlines (Simatupang and Sridharan, 2005). This aims to manage critical decision-making of each stakeholder who commits to the collaborative initiative to help optimise profitability by managing decisions at both planning and executional level.

Stakeholders should also consider the time frame of information sharing and joint planning to ensure that planning is dynamic. This includes reaching an agreement on a fixed period in order for planning to be accurate, not waste money or resources and enable stakeholders to make decisions and place orders within a reasonable time. Furthermore, *Joint Planning* also involves identifying appropriate **information sharing techniques and technologies**, another collaborative culture initiator identified by Ralston *et al.* (2017) and enabler of CPFR (Fliedner, 2006; Hollmann, Scavarda & Thomé, 2014; Singh, Garg & Sachdeva, 2018). VICS (2010) mentions that facilitating technological use is necessary to allow fast and accurate replanning and reconciliation. The integration of technology listed in Table C.3 and integrating CPFR with an IT system allows for easier documentation

Table C. 3: Proposed technologies for improved collaboration

Technology	Capabilities	Implementation phase
RFID and bar coding	Trace flow of goods and flow of information more accurately in the SC.	Phase III
Shared platform	Collaborative Planning and Schedule Platform: Automatic updates of purchase orders as they are accepted as well as tracking execution and use for detection of capacity or supply problems.	Phases II - IV

Literature reviewed in Section 2.4.5.1, focuses on the implementation of CPFR. A number of success elements are identified to assist organisations, with limited SC collaboration between trading partners, to move towards a strategically focused organisation that is able to pursue long range relationships with key SC partners. The most important elements for wine bottling facilities to focus on are listed below (VICS, 2010):

1. Developing a clear multi-year strategic plan consisting of key assumptions that are continuously reviewed for the planning horizon of each planning cycle. In this case, the *Strategic Planning* and *Joint Planning* steps are to guide the strategic plan and all the stakeholders involved should revise this on an annual basis.
2. Management must be the drivers of the collaborative strategy and its execution.
3. Link daily business execution to the strategic goals by implementing structured business reviews to clarify the roles, responsibilities and accountability of the participating members. These reviews can take place on a quarterly basis.
4. Building trust amongst the different trading partners by enforcing a discipline of getting things done and setting clear responsibilities. This will lead to improved work ethics, better performance and increase the competitive advantage.
5. Cross-functionality between collaborative teams across organisational boundaries to produce more efficient and effective work.
6. Driving group performance and responsiveness by having aligned incentives and shared risks and rewards.
7. Facilitating technology use to allow fast and accurate replanning and

reconciliation.

8. All strategic aligned partners following a single operating plan to ensure that the organisations stay strategically focused during collaborating activities.

It is important to note that the collaborative agreement and joint planning aspect are revised continuously. As these are strategic planning elements, an annual revision of the agreement is recommended based on harvest periods being annual, which is important for managing trust and dependence, as well as sharing risks and rewards which are important for establishing and managing SC relationships (Matopoulos et al., 2007). These are key enablers to avoid barriers associated with CPFR implementation such as a lack of common collaborative goals (Barratt & Oliveira, 2001; Skjoett-Larsen, Thernøe and Andresen, 2003) and stakeholder integration (Flidner, 2003, 2006; Ramanathan & Gunasekaran, 2014; Singh *et al.*, 2018).

Phase II: Supply and Demand Planning

This phase of the collaborative framework serves to estimate demand and order requirements for a specified planning horizon. This also includes planning replenishment requirements. This phase consists of two steps, (3) Demand and Supply Forecast and (4) Collaborative Forecast. The key focus of these steps is developing a forecast through collaborative information sharing and then aligning the forecast through collaborative decision-making. This phase relies on the development of a custom cloud-based platform that will allow stakeholders to have access to shared information and real-time updates.

During the Strategy Planning phase, information exchange and synchronised supply is identified as the best collaborative strategies for the SC environment relevant in this research. This SC configuration serves to guide *Demand and Supply Forecast* generation and *Collaborative Forecast* generation based on five key steps proposed by Barros *et al.* (2008). These steps focus on tactical planning.

Demand and Supply Forecast generation consists of:

1. Exchange demand information: this entails wineries to send appropriate approximation of bottling capacity requirements to wine bottling facilities and accordingly the anticipated demand of dry goods to suppliers. This information can also be distributed to SAWIS for relevant process planning purposes such as certification and tastings. This Master Production Schedule (MPS) type of information for an agreed time window of approximately 3–6 months.

2. Exchange ‘inventory on hand’ information.
3. Alignment of forecast for capacity and long-term planning: use exchanged demand information to pre-plan bottling and production schedules. This entails identifying the constraints and possible problems as well as the resolution thereof.

While *Collaborative Forecast* generation entails:

4. Collaborative forecasting: ensure that all information elements are shared in a timely manner to all the relevant stakeholders as per the collaborative agreement to create a collaborative forecast for each stakeholder.
5. Merge replenishment of wine bottling facilities with dry goods planning and production of the supplier: ensure incorporation of LT requirement of each individual component and JIT delivery according to forecasted bottling schedule.
6. Suppliers coordinate winery dry goods replenishment to wine bottling facilities and both parties, supplier and the wine bottling facility, use this visibility in planning own supply operations. Having visibility and updated information availability of the status of SC events allows for execution of forecasted plan or management of exceptions. The winery is also responsible for updating information regarding wine readiness to enable bottling facilities to keep track of wine required for scheduled bottling runs.

These key points form the foundation of the collaborative agreement, linked to the CPFR phases that follow. Step five is of particular importance as this information is transferred to the Execution phase that follows. Several inputs by various stakeholders are transformed to deliver the desired output.

The key responsibility lies with wineries, as these entities are responsible for planning demand for the year ahead (seeing that wine can essentially only be produced once a year when grapes are harvested for that specific season). Knoblauch (2018) developed a demand planning decision-making framework for small- medium-sized wineries that assists wineries with this aspect.

The framework proposed by Knoblauch (2018) can be used by wineries who enter a collaborative partnership with contract bottlers to aid demand planning and this can be translated into improved forecasted demand. Collaboration would include sharing

demand requirements over a rolling period to plan supply of dry goods and bottling for the year ahead. This can be applied to many scenarios of which a typical example is given.

Example: Several inputs are required from different stakeholders. A winery is responsible for planning different SKUs and requires the winery to compile a BOM for each SKU. From this, various “product families” can be created through the aggregation of SKUs, followed by gathering data related to harvest, expected yield, wine readiness prediction and bottling requirement from wineries.

The BOM specification along with the intended bottling date needs to be distributed to bottling facilities and supplier. This allows them to do aggregate planning based on SKU’s of different wineries, resulting in aggregation of SKUs to compile ‘product families’. A bottling facility will receive bottling requests based on expected bottling readiness of wine and align with available capacity. Suppliers receive SKU order quantities based on BOM and aggregate SKUs from different wineries into product family for capacity planning purposes.

This can be used for preliminary planning and allow stakeholders to identify potential demand and supply constraints and exception items due to potential before each individual stakeholder schedules production. In essence, each stakeholder can consolidate demand with supply capabilities and develop a collaborative ‘forecast’ for ‘replenishment’. Output consists of a collaborative agreement to consolidate bottling and supplier schedule or a collaborative forecasted bottling and dry goods schedule. This can be extended to include notification related to track-and-trace of execution of supply and delivery to manage potential problem arising with supply.

Phase III: Execution

During phase III, orders are placed, shipments are loaded and delivered, products are received, and sales transaction are recorded. Finally, payments are made if orders are received as planned. The two steps in this phase are (5) Order Generation and (6) Order Fulfilment.

The execution of production at both the bottling facility and the suppliers is heavily reliant on confirmation of order by wineries based on the forecasted order values. The activities involved in *Order Generation* include **order confirmation** and **demand requirement planning**. These two steps specifically require operational planning employees of the respective stakeholders to be involved, whether this be the winemaker

from the wine cellar or the dry goods and bottling managers at wine bottling facilities.

Order confirmation requires wineries to confirm the specific quantity of dry goods items and bottling capacity required for a specific SKU forecasted order. This order confirmation deadline will be based on LT requirements of individual SKU dry goods as per supplier agreement. An important factor is having order confirmation information availability and visibility along all channels of the SC, as each SC stakeholder is responsible for planning production and replenishment on their own, while still being synchronised with execution of processes of the other stakeholder. This ultimately aims to ensure that the right components are delivered in the right quantities, to the right place, at the right time and in the right condition.

Demand requirement planning follows directly after to achieve this aim. The final demand requirements (i.e., the final dry goods order quantities, the fixed bottling date and the final bottling capacity requirements) are generated to enable operational planning. A bottling facility will use this order confirmation, translate it into bottling capacity requirements and then do final scheduling. Table C.4 lists some typical operational planning elements performed by the various stakeholders. The order generation phase is translated into *Order Fulfilment*. This step of the Execution phase consists of **execution tracking** and **exception management**. These two steps concern monitoring the flow of goods in the SC.

Table C.4: Demand requirement operational planning elements for stakeholders involved

Stakeholders	Operational planning
1. Bottling facility	Bottling sequence, shifts, runs, number of employees, contract employees, wine readiness testing, dry goods order planning (if applicable), receiving dry goods, inspection of dry goods, bottling line setup and changeover, storage and distribution of finished product.
2. Winery	Wine blending and readiness, certification seal application, label design and proofing, wine sample testing, SAWIS BG9 and BG11 certification.
3. Supplier	Production planning capacity and sequence, shifts, import order planning, delivery schedules.
4. SAWIS	Inspections, certifications, tastings.

Execution tracking requires a certain degree of information availability and visibility. This enables tracking and tracing the flow of goods and execution of operations in the different SC channels. CPFR solutions often rely on internet based solutions (Seifert, 2003). Web-based collaboration allows information and process

sharing between multiple SC trading partners required in this SC setup.

This includes inventory plans, forecasts, promotional activities, distribution arrangements and changes to previous planning agreements. Information visibility and accessibility are important enablers of execution tracking as real-time events processing and notion of notification is required, which can be communicated using a collaborative web-portal. Such a collaborative web-portal could include the following elements:

- Order generation and confirmation notification: Easy accessibility to forecasted demand and generated orders to enable integrated planning and improved procurement leading up to wine bottling execution.
- Production scheduling and execution schedule: Visualisation of planned production operations (i.e., wine production, dry goods production and pre-planned bottling schedule), status updates regarding the execution of pre-planned schedule and notification if exceptions occurs which affect the operations of other stakeholders.
- Supplier delivery schedule: On-screen visualisation of schedules and automatic notification of new schedules or any schedule changes.

Exception management relies on the utilisation of information availability and accessibility enabled by a collaborative web-portal to allow for detection of deviations from the pre-planned planning and execution schedule. This typically includes the detection of a dry goods item not being available as planned and rescheduling bottling collaboratively as previously explained in Section 3.4.3. Improved exception management could potentially allow bottling facilities to increase the utilisation of existing bottling capacity to enable the shift from 40:60 packaged: bulk export to 60:40, without investing in additional bottling capacity.

Having accessibility to information related to order generation, order fulfilment and tracking their execution will allow traceability in this SC setup. This information can be useful in the Analysis phase that follows to analyse current SC processes, identify process deficiencies based on several performance measurements and in return help to determine causes of execution delays.

Phase IV: Analysis

The last phase serves to monitor the planning and execution phases (phase II and

phase III) for exceptions, whereafter results are aggregated and key performance metrics are calculated. The insight gained is shared between the partners and planning is adjusted to improve future SC operations. The two steps in this phase are (7) Exception Monitoring and (8) Performance Measurement & Feedback.

The execution of SC processes leading up to the execution of bottling is critical for the adherence to the planned bottling schedule. The management of exceptions is facilitated during phase III, whereas this phase aims to analyse the causes of exceptions to improve future SC operations. *Exception monitoring* involves gathering feedback from the execution phase. Having a web-based collaborative platform allows traceability to monitor exception notification and at the end of a review period, bottling facilities and their respective SC partners who form part of the collaborative relationship have the capability to trace root causes of delivery delays. This will allow stakeholders to revise process execution, providing feedback that can assist with avoiding a similar situation in the future or develop a course of action should such a problem arise again.

The second step of this phase is *Performance Measurement & Feedback*. This step aims to assist stakeholders with developing a collaborative performance system that consists of metrics that will help members of the SC to improve the overall performance. This consists of the following:

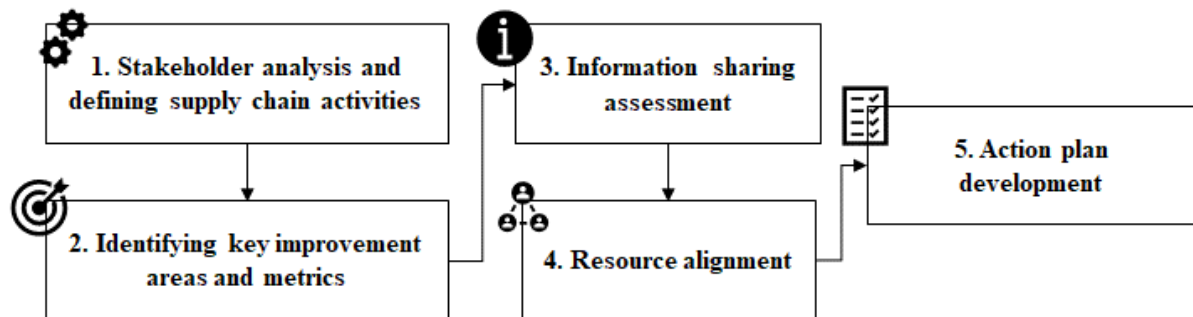
- Define Key Performance Indicators (KPIs) for each stakeholder.
- Define an appropriate performance rating system.
- Develop a performance evaluation and feedback system.
- Facilitate performance improvement plans based on evaluation and feedback.

Stakeholders can use already existing performance measurement frameworks and metrics, where Van Eeden *et al.* (2014), Jooste (2016) and Jooste *et al.* (2015) specifically researched performance measurement in the wine industry. This step can easily be facilitated using a web-based solution that allows tracking and reporting, enabling the generation of management reports by using the analysis of performance against the key indicators. Another important component of this step, as with any framework, is feedback, which is essential to keep track of success and failure situations in order to improve the next planning and implementation cycle.

Appendix D – Five-step implementation approach

This appendix presents the detailed five-step approach proposed to guide stakeholders towards implementing the WIC framework based on the give implementation guidelines.

Five-Step WIC Framework Implementation Approach



1. Stakeholder analysis and defining supply chain activities

This step involves identifying and understanding the influence of key partnering stakeholders on the supply chain operations. This includes understanding the key operating steps of each stakeholder as well as the needs and challenges existing in the current supply chain system. Relevant stakeholders should meet, discuss the extended supply

chain and agree on challenges and needs that will be addressed with implementation of the framework. Step 1 serves as the foundation of Phase 1 of the WIC framework which is to design and govern collaboration by establishing and maintaining supply chain relationships.

2. Identifying key improvement areas and metrics

Using the stakeholder analysis and supply chain definition compiled in step 1, the second step deals

with establishing the correct Key Performance Measurements (KPIs). This is important for *Joint Planning* (step 1.2 of the WIC framework) and will be measured and used for feedback relevant to Phase 4 of the framework. Stakeholders must ensure that individual performance measures are specific, measurable, attainable, relevant and time-based (SMART).

3. Information sharing assessment

Information availability and visibility plays an integral role in the success of collaboration. Thus, assessing different information sharing tools and techniques is of importance for the group of stakeholders involved. This could possibly involve implementing a supply chain management system such as SAP, Oracle or just developing a simple Microsoft Excel template that is distributed amongst stakeholders. The third step requires the stakeholders to assess their current information capturing and sharing methods to determine the most appropriate means of sharing information amongst the stakeholder group in real time, daily or weekly. This

step might involve developing appropriate information sharing templates documents, or platforms for ease of use when implementing the WIC framework.

4. Resource alignment

Based on the outputs of steps 1,2 and 3, which is identifying partnering stakeholders, defining the scope of collaboration, relevant KPIs and information sharing requirements, it is important to understand the impact of implementation and the corresponding resource requirement. The fourth step focuses on ensuring that the enabling factors of implementation, such as management involvement, resource commitment and trust is aligned to ensure successful collaboration. All resources that will be involved in the collaborative efforts should be gathered and briefed to ensure that the goals of collaboration and the benefit (i.e. improving supply chain operations in terms of reliability and responsiveness) are communicated clearly. This step will include training resources to use collaborative information sharing tools and ensuring the

information shared amongst stakeholders is accurate and shared in a timely manner.

5. Action plan development

Gather the stakeholder and finalise the group of stakeholders involved in the implementation of the WIC framework (exclude participants that choose not to participate based on outcomes of the first four steps of the implementation approach).

Develop a clear implementation timeline and expected deliverables.

This serves as the transition step towards the implementation of Phase 1: Strategy Planning and successive phases and steps of the WIC framework.

Appendix E – Framework validation summary document

The summary document presented in this appendix was compiled by the researcher and provides an overview of the proposed collaborative framework. This was given to SME who participated in the validation interviews prior to the interview and used by the researcher during the validation interviews to guide SMEs to answer the questions.

Framework Validation Summary Document

A Collaborative Framework for Wine Bottling Facilities and
their Supply Chain Partners

by

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1. Purpose of the document

This document serves to give sufficient background information to the participant to enable them to engage in the semi-structured interview for validation of the developed framework. The interview aims to validate the framework, its' applicability, reliability and to evaluate whether the framework has achieved the intended objectives. The documents gives a short description of the problem, the main research question and the objectives of the research study, followed by a short overview of some relevant literature. This is followed by a detailed explanation of each phase of the proposed collaborative framework and concludes with some key considerations.

2. Introduction and background to the research

South African wine cellars and their supply chain partners are placing more emphasis on efficient supply chain practices in order to keep up with dynamic demand, both locally and internationally. The reliability and responsiveness of wine bottling at bottling facilities are influenced by various other supply chain activities. This includes planning, forecasting and replenishment of materials and bulk wine needed during this step in the wine supply chain.

Pre-planned production schedules of bottling facilities also suffers significantly from the lack of collaboration and effective information sharing and visibility throughout the various supply chain channels. Notification of dry goods ordering, tracking and delivery between bottling facilities and their direct supply chain partners, suppliers and wine cellars, is a central aspect of the bottling scheduling process. Collaboration among parallel players in competing supply chains in upstream activities can assist these players to be more competitive collectively and separately.

2. Problem Statement and Main Research Question

The reliability and responsiveness of wine bottling facilities are influenced by various other supply chain activities, including planning, forecasting and replenishment of materials and bulk wine needed during this step in the wine production supply chain. In order to improve collaboration between the various parties involved, a large amount of information sharing and the visibility thereof is required. Furthermore, it requires the necessary technological input such as an appropriate platform that can visibly display the required information.

Problem statement

Limited information sharing and communication capabilities between South African wine bottling facilities and their direct supply chain partners, limits the capturing of information, tracking the progress of orders and schedule changes. This results in decreased on-time order fulfilment rates at South African wine bottling facilities.

Main Research Question

“How can the overall wine supply chain’s reliability and responsiveness be improved by the facilitation of collaborative information sharing and communication at wine bottling facilities”?

Main Research Objective

Develop a detailed framework that allows wine supply chain stakeholders involved in the bottling process to improve collaboration, aimed at increasing the reliability and responsiveness of the industry.

3. Important Terms and Definitions

Collaboration – Refers to the extent of information sharing, communication, joint planning and decision making amongst stakeholders.

CPFR – ‘Collaborative Forecasting and Replenishment’ is an interrelated set of processes whereby the various SC trading partners share information, risks, synchronised forecasts, cost and benefits with the goal of improving SC performance by means of joint planning and decision making.

Digitalisation – Implementation of digital technologies such as Internet of Things, cloud-based platforms and tracking technology to enable the availability of real-time information, including tracking, traceability and identification of goods in the supply chain.

VICS – The Voluntary Inter-industry Commence Standards first registered CPFR as a trademark in 1998.

Wine bottling facilities – A company that renders contract bottling as a service to wine producers.

Wine Supply Chain – In this document, ‘Wine Supply Chain’ only includes the supply chain interaction between wine producers, wine bottling facilities and dry goods suppliers.

4. Framework Explanation

The framework depicted in Figure D.1 at the end of the document, is designed using inputs from industry experts who helped to clarify the current challenges and existing needs. This along with literature concepts related to collaboration, CPFR, digitalisation and the implementation thereof provided all the information needed for the development of the framework. In this section, a detailed explanation of each phase, the steps of each phase and corresponding activities is given to provide you sufficient background of the content of the framework and how wine bottling facilities and their supply chain partners can implement it.

Phase 1: Strategy Planning

Strategy planning is the first phase in the establishment of a collaborative SC partnership. This phase consist of two steps, (1.1) *Collaborative Agreement* and (1.2) *Joint Planning* depicted in Table D.1. These two steps concerns the establishment of guidelines for driving a collaborative relationship.

Table D.1: Phase 1 steps and activities

Steps	Activities	Purpose
1.1. Collaborative Agreement	Partner selection	Identify collaborative partners who are willing to commit resources to implement and facilitate the initiative. This is an important step in this first phase of CPFR.
	Develop sourcing and supply agreement	Identify collaboration width (supply chain activities) and information sharing requirements. Furthermore, it serves to establish the terms and conditions related to purchasing, often including price, quantity discount, quality, etc.
1.2. Joint Planning	Joint goal setting	Individual stakeholders identify benefits related to collaboration and which benefits they want to exploit. This is followed by setting performance targets and related performance metrics.
	Synchronised decision-making	Typical elements included are sales and order forecast, order multiples, minimum order sizes, lead times, the delivery lead times of orders and order placement deadlines.
	ID Information sharing techniques and technologies	Facilitation of technological use to allow fast and accurate re-planning and reconciliation. Typical examples includes: <ul style="list-style-type: none"> • RFID and bar coding to track-and-trace inventory in SC.

Steps	Activities	Purpose
		<ul style="list-style-type: none"> • Shared platform for a collaborative planning and scheduling platform that can automate updates of purchase orders as they are accepted as well as tracking execution and use for detection of capacity or supply problems. This possibly includes cloud-based or web-based platforms.

The following guidelines were developed by VICS and aims to assist stakeholders with the development of a joint plan (see Table D.2). These are the most important elements for wine bottling facilities to focus on are to pursue long-range relationships with key SC partners.

Table D.2: VICS collaboration guidelines

VICS Collaboration Guidelines

1. Developing a clear multi-year strategic plan consisting of key assumptions that are continuously reviewed for the planning horizon of each planning cycle. In this case, the Strategic Planning and Joint Planning steps are to guide the strategic plan and all the stakeholders involved should revise this on an annual basis.
 2. Management must be the drivers of the collaborative strategy and execution thereof.
 3. Link daily business execution to the strategic goals by implementing structured business reviews to clarify the roles, responsibilities and accountability of the participating members. These reviews can take place on a quarterly basis.
 4. Building trust amongst the different trading partners by enforcing a discipline of getting things done and setting clear responsibilities. This will lead to improved work ethics, better performance and increase the competitive advantage.
 5. Cross functionality between collaborative teams across organisational boundaries to produce more efficient and effective work.
 6. Driving group performance and responsiveness by having aligned incentives and shared risks and rewards.
 7. Facilitating technological use to allow fast and accurate re-planning and reconciliation.
 8. All strategic aligned partners following a single operating plan to ensure that the organisations stay strategically focused during collaborating activities.
-

Phase 2: Supply & Demand Planning

This phase of the collaborative framework serves to estimate demand and order requirements for a specified planning horizon. This also includes planning shipment requirement. This phase consists of two steps, (2.1) *Demand and Supply Forecast* and

(2.2) *Collaborative Forecast* (see Table D.3). The key focus of the two steps are developing a forecast through collaborative information sharing and then aligning the forecast through collaborative decision-making, relying on the utilisation of digital technology.

Table D.3: Phase 2 steps and activities

Steps	Activities	Purpose
2.1. Demand & Supply Forecast	Exchange demand information	This entails wineries to send appropriate approximation of bottling capacity requirement (volume and schedule) to wine bottling facilities and accordingly the anticipated demand of dry goods to suppliers. This Master Production Schedule (MPS) type of information for an agreed time window of approximately 3-6 months.
	Forecast alignment	This step is for capacity and long-term planning purposes, and use exchanged demand information to pre-plan bottling and production schedules. This means that bottling facilities and suppliers could request schedule or volume adjustments to accommodate capacity restrictions across all their customers.
2.2. Collaborative Forecast	Collaborative forecasting	Information elements are shared in a timely manner to all the relevant stakeholders as per the collaborative agreement to create a collaborative forecast for each stakeholder.
	Merge replenishment	Ensure incorporation of lead-time requirements of each individual component and JIT delivery according to forecasted bottling schedule dry goods planning and production of the supplier. This results in Material Requirement Planning(MRP) across supplier tiers.
	Coordination	Visible and updated information availability of the status of SC events allows for execution of forecasted plan or management of exceptions.

Phase 3: Execution

During phase III, orders are placed, shipments are loaded and delivered, products are received, and sales transaction are recorded. Finally, payments are made if orders are received as planned. The two steps in this phase are (3.1) *Order Generation* and (3.2) *Order Fulfilment* presented in Table D.4.

Table D.4: Phase 3 steps and activities

Steps	Activities	Purpose
3.1. Order Generation	Order confirmation	Requires wineries to confirm the specific quantity dry goods items and bottling capacity required for a specific SKU forecasted order.
	Demand requirement planning	The final demand requirements (i.e. the final dry goods order quantities, the fixed bottling date and the final bottling capacity requirements) are generated to enable operational planning. A bottling facility will use this order confirmation, translate it into bottling capacity requirement and then do final day-to-day scheduling.
3.2. Order Fulfilment	Execution tracking	This enables tracking and tracing the flow of goods and execution of operations in the different SC channels, for example tracing supplier production order completion and delivery.
	Exception management	The utilization of information availability and accessibility enabled by a collaborative web-portal to allow for early detection of deviations from the pre-planned planning and execution schedule.

Phase 4: Performance Measurement & Review

The last phase serves to monitor the planning and execution phases (phase 2 and phase 3) for exceptions, where after results are aggregated and key performance metrics are calculated. The insight gained is shared between the partners and planning is adjusted to improve future SC operations. The two steps (shown in Table D.5) in this phase are (4.1) *Exception Monitoring* and (4.2) *Performance Measurement & Feedback*.

Table D.5: Phase 4 steps and activities

Steps	Activities	Purpose
4.1. Exception Monitoring	-	Having a shared collaborative platform allows traceability to monitor exception notification and at the end of a review period, bottling facilities and their partners who forms part of the collaborative relationship have the capability to trace root causes of delivery delays and planning deviations.
4.2. Performance Measurement & Feedback	-	This step aims to assist stakeholders with developing a collaborative performance system that consists of metrics that will help members of the supply chain to improve the overall performance and addresses the following:

Steps	Activities	Purpose
		<ul style="list-style-type: none"> • Define Key Performance Indicators (KPI's) for each stakeholder. • Define an appropriate performance rating system. • Develop a performance evaluation and feedback system. • Facilitate performance improvement plan based on evaluation and feedback.

5. Key Considerations

- It is important to notice that *Phase 1* focus on strategic elements and long term views that is only revised on a pre-determined time horizon, *Phase 2* focus on tactical decisions typically reviewed for each harvest season, while the remainder of the framework is a continuous process executed for each bottling order generated.
- The technicalities surrounding implementation of such an initiative is not fully incorporated into the framework, it only serves as guidance on the applicability and the dimensions of relevance when considering a CPFR approach for this supply chain configuration.
- The collaborative framework and suggested technologies has not been implemented.
- After this SME validation, the proposed framework will be amended and improved based on feedback. The improved framework will be validated using an illustrative case study at a wine bottling facility.

THANK YOU FOR YOUR TIME AND PARTICIPATION!

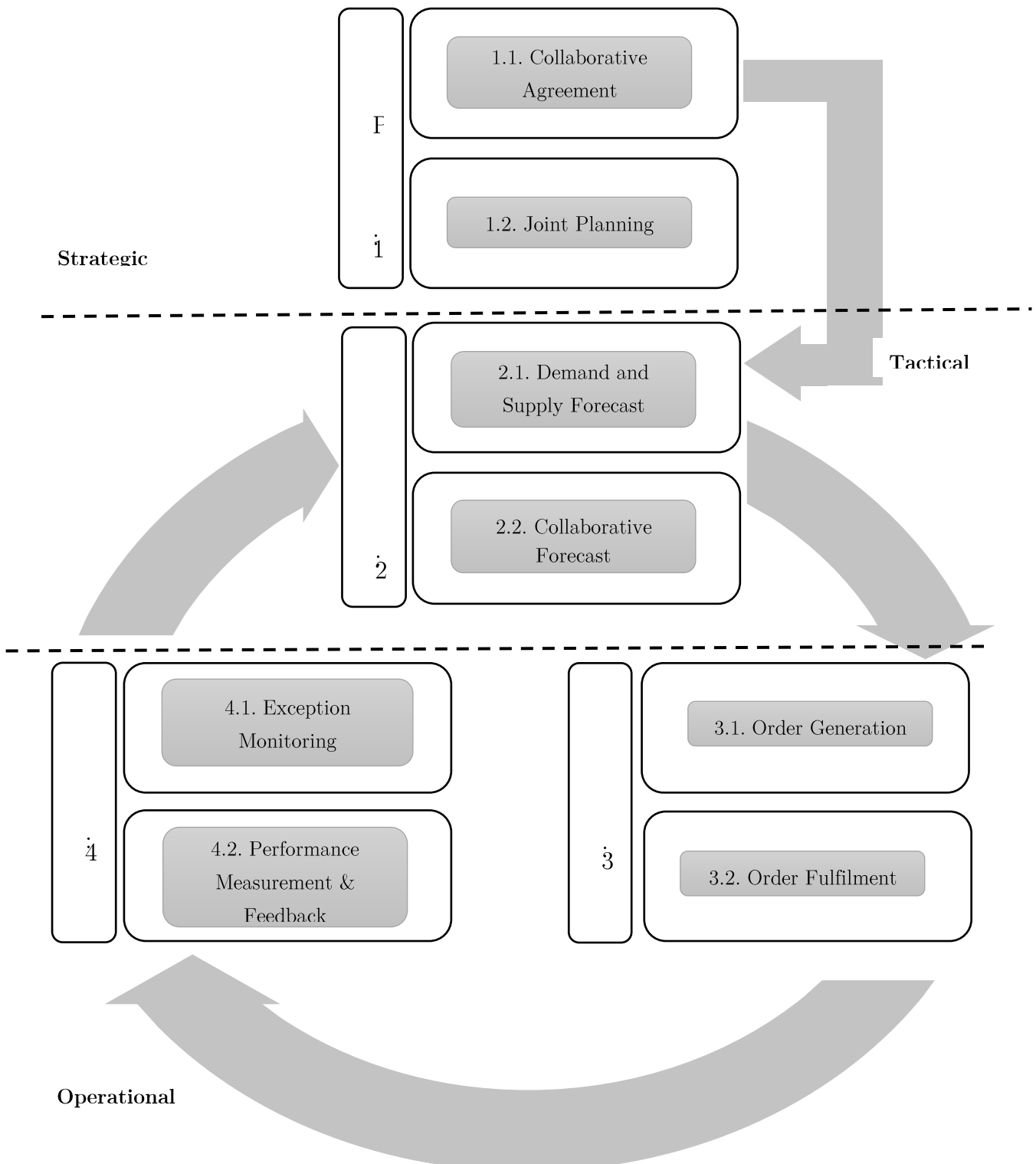


Figure D. 1: Proposed collaborative framework

Appendix F - SME information form

This appendix presents the form used to gather the personal information from SME that participated in the framework validation interviews reported on in Chapter 5.

This section aims to obtain personal details and background of the participant for verification purposes.

The information provided will remain confidential and participants will remain

Please provide you name & surname below

1. What is you qualification(s)?

2. What is your current job description/title?

3. What is the principle industry of your organisation?

4. Please list industry related experience and specify years of involvement.

5. Which of the following best describes your current job level?

- Owner/Executive
- Senior Management
- Middle Management
- Entry Level
- Other: _____

Appendix G - Framework validation questionnaire

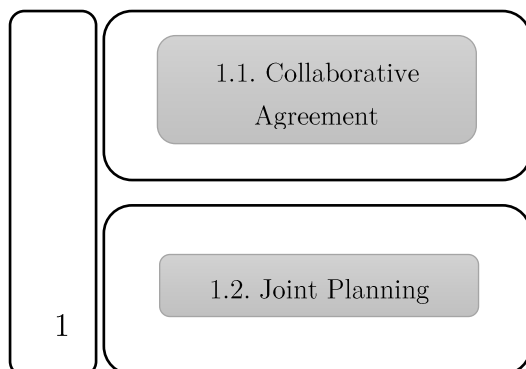
Appendix G contains the questionnaire that the researcher used to guide the semi-structured interviews with SMEs to validate the proposed WIC framework. The feedback obtained from the SMEs is presented in Chapter 5 of this document.

This validation questionnaire aims to validate the feasibility, comprehensibility and need for the developed framework based on your knowledge and experience. You are encouraged to ask questions, make comments and to give constructive feedback. The questions are based on the summary document provided.

The researcher, Marianca Koegelenberg, hosts the semi-structured interview and it is divided into five sections. It will be based on this questionnaire. If you do feel you cannot provide an informed answer for any of the questions, there is no obligation to provide an answer.

The first four sections of this questionnaire validates each of the frameworks' phases and its dimensions while the last phase validates the entirety of the framework. The questions are structured to allow you to agree, contest and suggest amendments according to your knowledge. If you disagree with any of the statements, please give a detailed motivation/explanation. Also, suggest possible improvements as you deem necessary.

Section 1: Phase 1 Validation



Phase 1 of the framework deals with the strategic element of establishing a collaborative partnership between the SC stakeholders involved in the process. This entails partner selection, defining information sharing requirement, set joint and individual goals and to identify and agree on appropriate technologies to use.

1. Do you agree or disagree that partner selection, establishing a mutual beneficial source and supply agreement and defining information sharing requirements are sufficient to establish a collaboration agreement between stakeholders? Please elaborate.

Strongly Disagree <input type="radio"/> Disagree <input type="radio"/> Undecided <input type="radio"/> Agree <input type="radio"/> Strongly Agree <input type="radio"/>

2. The framework dimension *Joint Planning* involves joint goals setting and synchronized decision-making. Do you agree with the inclusion of these two elements? If not, please elaborate.

Strongly Disagree <input type="radio"/> Disagree <input type="radio"/> Undecided <input type="radio"/> Agree <input type="radio"/> Strongly Agree <input type="radio"/>

3. Do you agree or disagree that the suggested technologies (RFID, bar codes and a shared platform) are applicable and can it be realistically utilized in the supply chain setup?

Strongly Disagree <input type="radio"/> Disagree <input type="radio"/> Undecided <input type="radio"/> Agree <input type="radio"/> Strongly Agree <input type="radio"/>

4. For a systems perspective, do you agree or disagree that it is feasible to deploy such a system in this industry. What are your concerns, if any?

Strongly Disagree Disagree Undecided Agree Strongly Agree

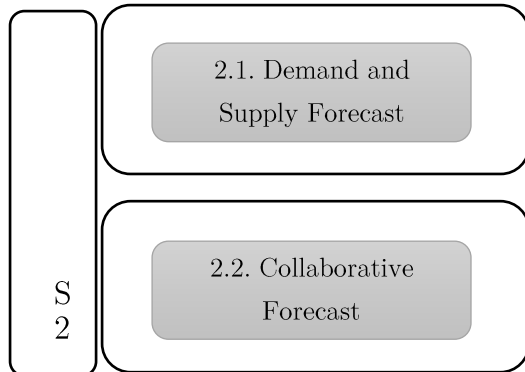
5. Under *Joint Planning*, eight guidelines are given as proposed by VICS. Do you agree or disagree that these guidelines are sufficient to develop a joint plan?

Strongly Disagree Disagree Undecided Agree Strongly Agree

6. It is advised that the collaborative agreement between stakeholders is revised on a pre-determined basis. Do you agree or disagree that this should be revised annually as harvest seasons are on an annual basis?

Strongly Disagree Disagree Undecided Agree Strongly Agree

Section 2: Phase 2 Validation



Phase 2 of the framework concerns Supply and Demand Planning. This phase assist stakeholders to estimate demand and order requirements for a specified planning horizon.

7. Do you agree or disagree that the five activities (*refer to activities of steps 2.1 and 2.2*) proposed in this phase is appropriate and sufficient to generate accurate demand forecast?

Strongly Disagree Disagree Undecided Agree Strongly Agree

8. Do you think it is realistic to develop a shared platform that will allow real-time information sharing between stakeholders?

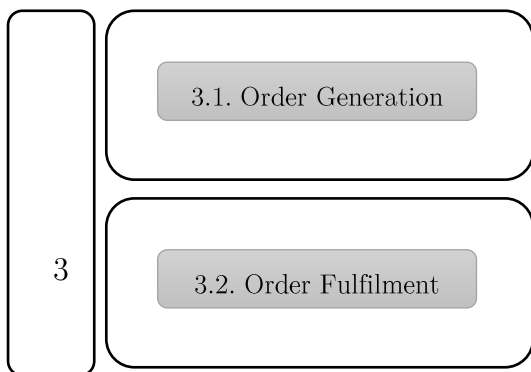
Strongly Disagree Disagree Undecided Agree Strongly Agree

9. What are your main concerns with the development and implementation of such a platform, if any?

10. Do you agree or disagree that if stakeholders collaborate according to the given guidelines, they will be able to improve preliminary planning, involving the identification of potential demand and supply constraints and/or exceptions?

Strongly Disagree Disagree Undecided Agree Strongly Agree

Section 3: Phase 3 Validation



Phase 3 involves order generation and the fulfilment thereof. This is an important aspect to ensure short term dry goods availability and wine readiness when needed for bottling.

11. According to your knowledge, do you agree or disagree that it is practically feasible to perform order generation and confirmation on a shared platform if available?

Strongly Disagree Disagree Undecided Agree Strongly Agree

12. Do you agree or disagree that real-time order generation and scheduling will assist stakeholders to improve synchronization of supply and demand?

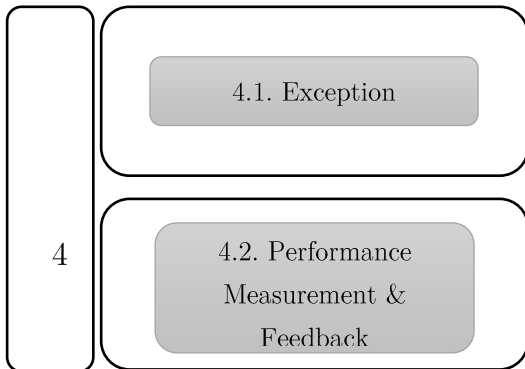
Strongly Disagree <input type="radio"/> Disagree <input type="radio"/> Undecided <input type="radio"/> Agree <input type="radio"/> Strongly Agree <input type="radio"/>

13. Do you agree or disagree that tracking and tracing components and finished products in the supply chain, information availability and visibility in this regard can improve decision making and exception management?

Strongly Disagree <input type="radio"/> Disagree <input type="radio"/> Undecided <input type="radio"/> Agree <input type="radio"/> Strongly Agree <input type="radio"/>

Section 4: Phase 4 Validation

Phase 4 of the framework involves performance measurement to ensure that stakeholders can establish problem areas and improve on these in the future.



14. Do you agree or disagree that monitoring previous successes and failures will allow stakeholders to improve decision-making in the future?

Strongly Disagree Disagree Undecided Agree Strongly Agree

15. Do you agree or disagree with the elements included in Performance Measurement & Feedback? *refer to step 4.2 of Phase 4 in the summary document.

Strongly Disagree Disagree Undecided Agree Strongly Agree

Section 5: High-Level Framework Validation

16. Do you agree or disagree that Phase 1 to Phase 4 are sufficient as the key phases for collaboration?

Strongly Disagree Disagree Undecided Agree Strongly Agree

17. Do you agree or disagree with the logical sequence of the phases of the developed framework?

Strongly Disagree Disagree Undecided Agree Strongly Agree

18. Do you know of any existing collaborative framework specifically for the wine industry?

19. If “yes”, what are the similarities and what are the differences?

20. Do you agree or disagree that the framework developed through this research is easy to understand and logical?

Strongly Disagree Disagree Undecided Agree Strongly Agree

21. Do agree or disagree that the stakeholders identified can implement this framework?

Strongly Disagree Disagree Undecided Agree Strongly Agree

22. Do you agree or disagree that implementing such an initiative can improve the reliability and responsiveness of industry stakeholders?

Strongly Disagree Disagree Undecided Agree Strongly Agree

23. Are there any specific aspect you regard as important that is missing from this framework? If yes, please elaborate.

24. Do you agree or disagree that such collaboration as described by this framework is practical/ feasible in the wine industry? Please motivate/ explain your answer.

Strongly Disagree Disagree Undecided Agree Strongly Agree

25. What do you believe are the main challenges for implementing such a collaboration within the wine industry?

26. Do agree or disagree that the wine industry can benefit from this framework?

Strongly Disagree <input type="radio"/>	Disagree <input type="radio"/>	Undecided <input type="radio"/>	Agree <input type="radio"/>	Strongly Agree <input type="radio"/>
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Appendix H - Implementation guidelines summary document

This appendix contains the implementation guidelines summary document that the researcher used for case study purposes. It was distributed to the case study subject prior to the semi-structured interview the researcher hosted to conduct the theoretical case study. It serves to provide background information about the researcher project, more specifically the implementation guidelines as well as the scenarios used for the case study.

Implementation Guidelines Summary Document

A Collaborative Framework for Wine Bottling Facilities and
their Supply Chain Partners

by

Marianca Koegelenberg

Department of Industrial Engineering, University of Stellenbosch

Supervisor: Dr. Joubert van Eeden

Co-Supervisor: Prof. Louis Louw

1. Purpose of the document

This document serves to give sufficient background information to the participant to enable them to engage in a semi-structured interview to determine the possible value of implementation of a collaborative initiative based on the implementation guidelines presented in this document. The interview aims to serve a further validation of the framework, its' applicability, reliability and to evaluate whether the framework has achieved the intended objectives. This will be tested based on given theoretical case examples formulated based on typical strategic, tactical and operational problems currently experienced by stakeholders in the wine supply chain. The document gives a short description of the problem, the main research question and the objectives of the research study. This is followed by a detailed explanation of the steps of implementation for each step of the collaborative framework, after which the theoretical case examples are given.

2. Introduction and background to the research

South African wine cellars and their supply chain partners are placing more emphasis on efficient supply chain practices in order to keep up with dynamic demand, both locally and internationally. The reliability and responsiveness of wine bottling at bottling facilities are influenced by various other supply chain activities. This includes planning, forecasting and replenishment of materials and bulk wine needed during this step in the wine supply chain.

Pre-planned production schedules of bottling facilities also suffers significantly from the lack of collaboration and effective information sharing and visibility throughout the various supply chain channels. Notification of dry goods ordering, tracking and delivery between bottling facilities and their direct supply chain partners, suppliers and wine cellars, is a central aspect of the bottling scheduling process. Collaboration among parallel players in competing supply chains in upstream activities can assist these players to be more competitive collectively and separately.

3. Problem statement and main research question

The reliability and responsiveness of wine bottling facilities are influenced by various other supply chain activities, including planning, forecasting and replenishment of materials and bulk wine needed during this step in the wine production supply chain. In order to improve collaboration between the various parties involved, a large amount of information sharing and the visibility thereof is required. Furthermore, it requires

the necessary technological input such as an appropriate platform that can visibly display the required information.

Problem statement

Limited information sharing and communication capabilities between South African wine bottling facilities and their direct supply chain partners, limits the capturing of information, tracking the progress of orders and schedule changes.

Main Research Question

“How can the overall wine supply chain’s reliability and responsiveness be improved by the facilitation of collaborative information sharing and communication at wine bottling facilities”?

Main Research Objective

Develop a detailed framework that allows wine supply chain stakeholders involved in the bottling process to improve collaboration, aimed at increasing the reliability and responsiveness of the industry.

4. Implementation guidelines

This research focus on the development of a collaborative framework. It is designed using inputs from industry experts who helped to clarify the current challenges and existing needs. This along with literature concepts related to collaboration, CPFR, digitalisation and the implementation thereof provided all the information needed for the development of the framework.

The implementation guidelines explained in this section is based on the corresponding steps of the developed framework and aims to assist industry stakeholders with implementing collaborative practices and process steps to improve existing operation. In this section, an overview of each phase, the steps of each phase and corresponding activities required for implementation each phase is given.

Phase 1 implementation

Phase 1 implementation aims to establish a collaborative partnership between stakeholders and help them to set the common goals to achieve. The first step of Phase 1: Strategy Planning is setting the *Collaborative Agreement*. This involves designing and governing SC activities as well as establishing and maintaining a SC partnership of a collaborative nature at the hand of the inputs and enablers listed in Figure G.1.

This step requires a stakeholder, such as a bottling facility, to gather information related to the inputs listed. Most important being a list of clients and supplier as this is the starting point of a collaborative partnership – partner selection. Partner selection is reliant on identifying current performance issues and major cost elements or contributions, as this will guide the stakeholders towards areas that will benefit most from collaboration. Other influencing factors also includes purchasing volumes and risk of supply as large purchasing volumes with a greater risk of supply can possibly have a detrimental effect on SC operations.

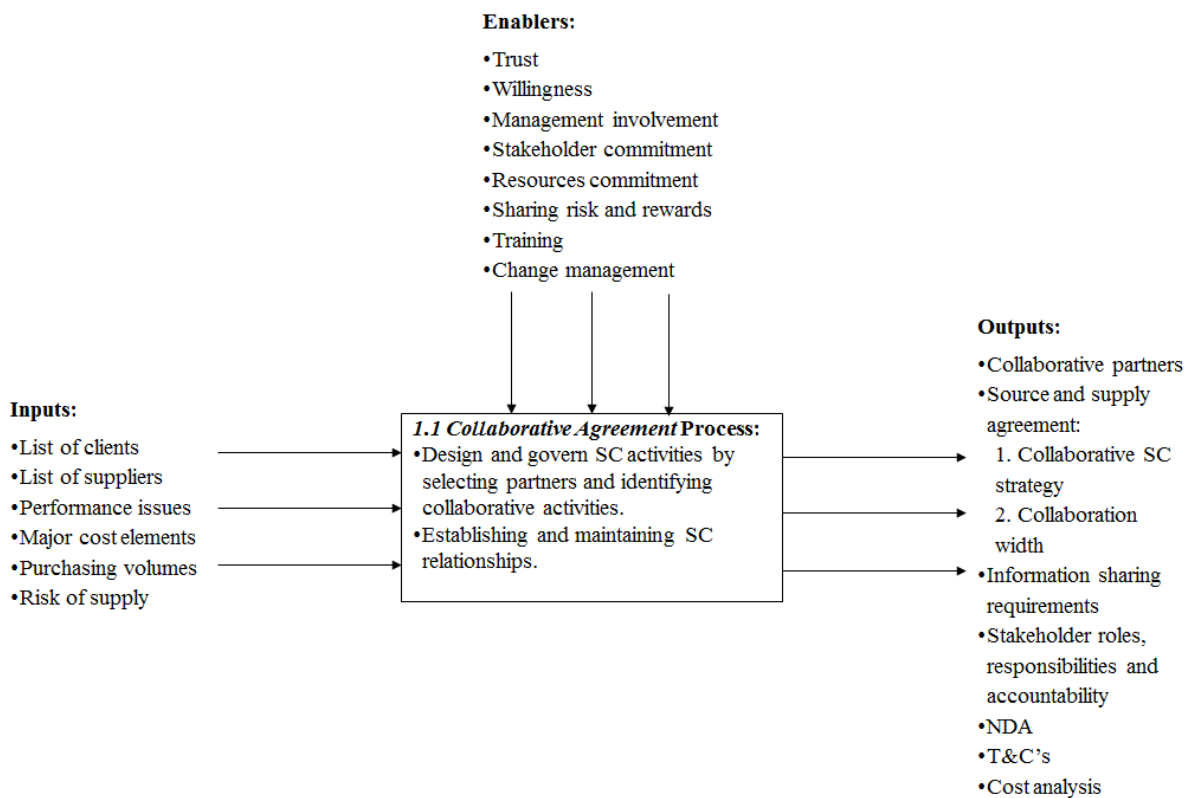


Figure G.1: Step 1.1 implementation guidelines

This information is subsequently used to formulate a collaborative agreement that constitutes several outputs listed in Figure G.1. These outputs form the foundation of any or multiple collaborative partnerships as it establishes and with proper revision on an annual term help stakeholders to maintain SC relationships. However, it is important to notice that the step is subject to several enablers. The design and government of collaborations and the appropriate SC relationship is heavily reliant on stakeholder involvement, trust and commitment, listed as the enablers of this step. In order to facilitate a collaborative initiative amongst the stakeholders will require the appropriate training and change management, as employees involved will have to

adjust their mind-set and approach. This is to ensure that the inputs required for the phases following can be sufficiently generated and translated to work towards the goals and benefits set to be achieved in the second step of this phase, which is *Joint Planning*.

Joint Planning primarily aims to allow stakeholders to get together and set joint goals, collaborative goals and clarifying the benefits for all the parties involved as depicted in Figure G.2. To enable synchronised decision-making, it is required to specify the terms related to the sales and order forecast, order multiples, minimum order sizes, delivery lead times and order deadlines. The terms set in this step will assist stakeholders with establishing the relevant terms (such as the frozen period for providing information for planning purposes) related to sharing information about bottling volume requirement, dry goods BOM, production capacity and scheduling which are information sharing requirement output criteria's generated in step 1.1.

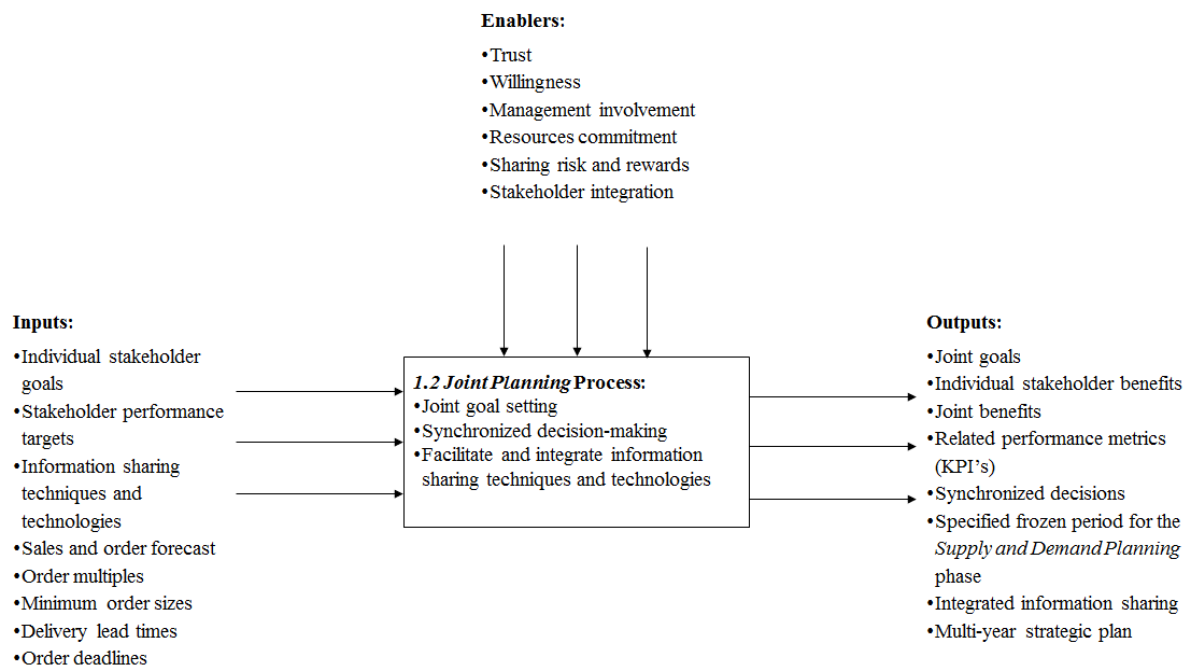


Figure G.2: Step 1.2 implementation guidelines

This step is reliant on enablers similar to those listed for step 1.1, but will especially require stakeholder integration. The extent of stakeholder integration is subject to training and change management highlighted as enablers of step 1.1, but is important to ensure integrated information sharing and help stakeholders to formulate a multi-year strategic plan. The training and change management will also account for the facilitation of using identified technologies to enable collaboration. Following these

implementation guidelines will allow stakeholders to design and govern collaborative SC activities as well as assist them with the establishment and maintenance of their collaborative partnerships. This is crucial for the governance of the phase following.

Phase 2 implementation

The collaborative agreement and joint plan set in Phase 1 aims to govern the generation of *Demand & Supply Forecast*. This process step entails the exchange of demand information, capacity requirements and availability, subsequently aligning the forecasts of multiple stakeholders to improve planning.

Figure G.3 highlights the key inputs and enablers of this process that is required to generate the appropriate outputs. Key inputs relates to sharing forecasted capacity requirements and distributing information regarding the availability of capacity. Stakeholder can use the approximated demand and supply specifications to develop MPS and MRP schedules for each individual stakeholder for a 6-12 months rolling period. The key focus of this is to allow stakeholders to improve planning and to identify constraints as early as possible to try and resolve potential problems of supply.

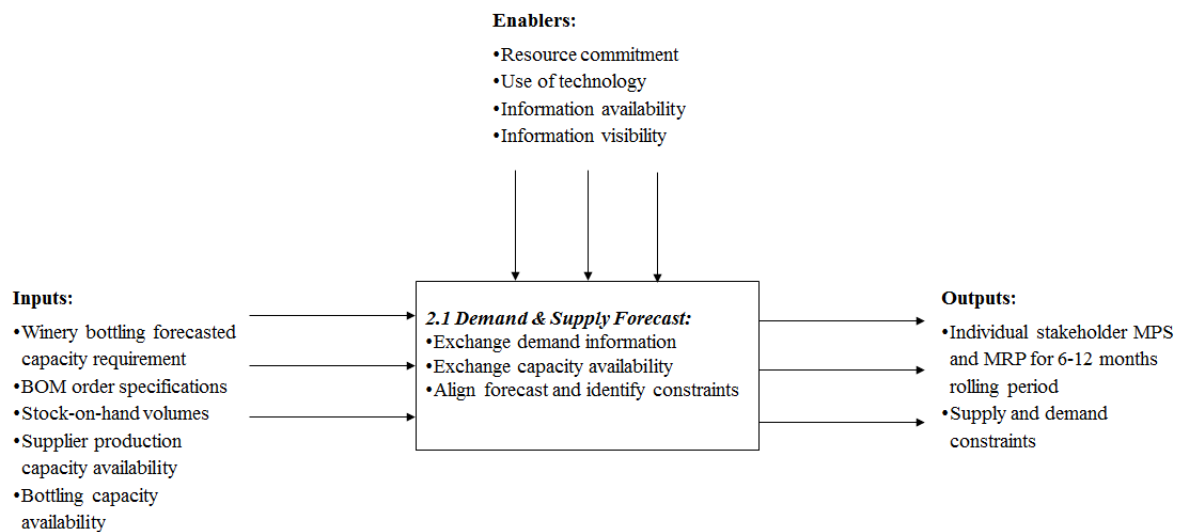


Figure G.3: Step 2.1 implementation guidelines

Training is listed as an enabler for step 1.1. The training of employees is of importance to this step as the resources committed to execute the *Demand & Supply Forecast* step will have to be proficient to use the appropriate technologies (where applicable), share the correct information and also ensure timely information sharing to allow for sufficient information availability.

After gathering the information for the demand and supply forecast step, the generation of a *Collaborative Forecast* follows (see Figure G.4). This entails merging demand, production and replenishment of individual stakeholders to minimize the occurrence of constraints and risk of supply. This collaborative forecast is generated under the assumptions that information will be available and visible to the relevant parties and that it will be shared amongst the stakeholders using the agreed upon technologies. The final output of this phase is a collaborative MPS and MRP for 6-12 months rolling period typically consisting of pre-planned bottling schedule, supplier production schedules, wine production schedules and basic replenishment schedules.

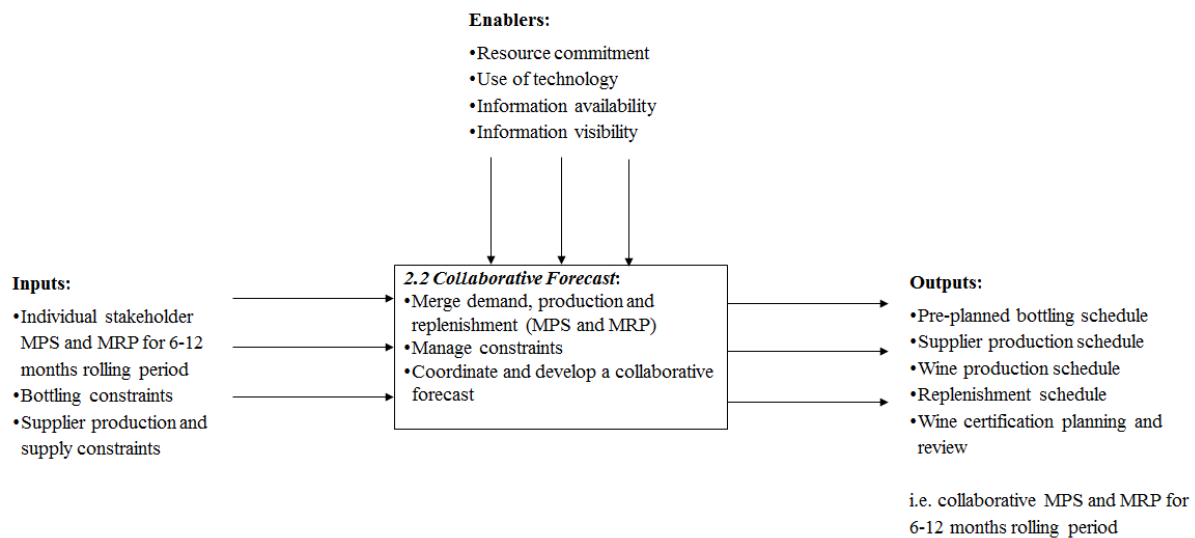


Figure G.4: Step 2.2 implementation guidelines

If stakeholders collaborate using the guidelines set in this phase, they should be able to generate an accurate demand forecast and use this information to improve preliminary planning. From this phase on forward, collaboration between the stakeholders can benefit from the implementation of a shared collaborative platform. However, it should be noted that such an initiative is not solely reliant on the utilization of this input. It could be beneficial for coordination purposes, as it will allow visible and updated information availability of the status of SC events related to the execution of forecasted plan or management of exceptions that can potentially cause deviations. The commitment of the resources involved and their understanding of collaboration will rather determine the success of collaboration.

Phase 3 implementation

Order Generation and *Order Fulfilment* focus on operational activities and requires the outputs of Phase 2 (i.e. the collaborative forecasted MPS and MRP generated in step 2.2). The implementation of this phase aims to allow stakeholders to keep better track of the generation and fulfilment of orders.

For wine bottling facilities to schedule bottling optimally, requires wineries not only to share the anticipated bottling quantities, but in addition the exact BOM for each order that is then translated into the supplier production schedule. Having a pre-planned bottling schedule allows wine production and certification processes to continue and ensure that wine is bottling ready when required. This will be determined by the outputs of this phase, which is the final bottling order (based on quantity and BOM specifications), the fixed bottling schedule, production schedules and accordingly replenishment schedules (for wine and dry goods) to the intended delivery destination. These elements are based on confirmed orders by the wineries and the final demand requirements planning performed by all the stakeholders involved as per the implementation guidelines for this steps depicted in Figure G.5.

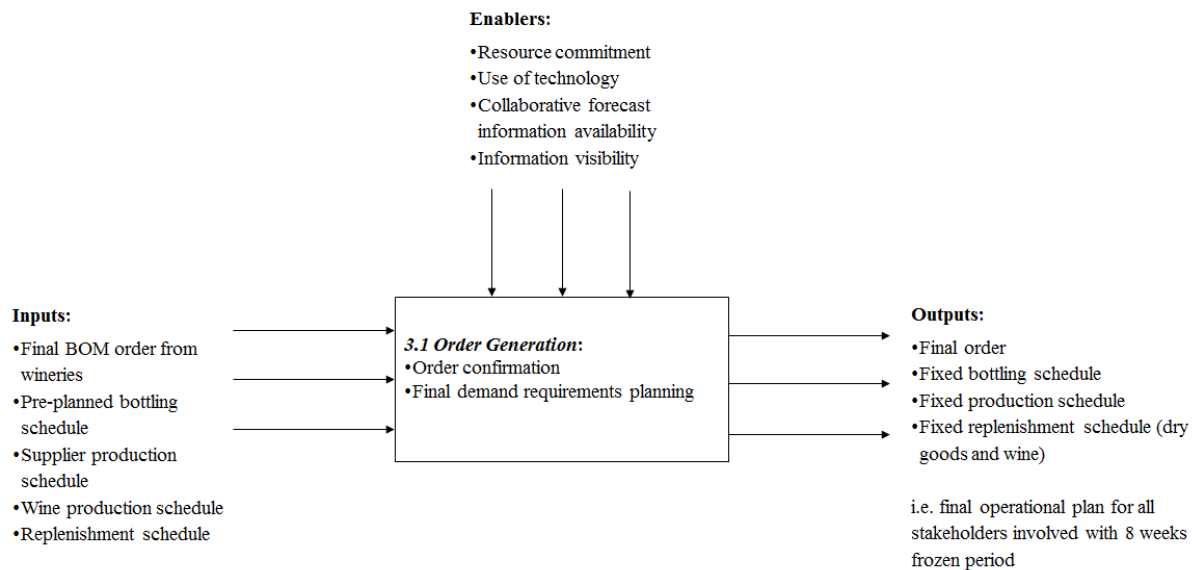


Figure G.5: Step 3.1 implementation guidelines

Having the final operational plan for all stakeholders involved with an approximate frozen period of 8 weeks enables stakeholders to continue with *Order Fulfilment* based on the guidelines presented in Figure G.6. The final order generated in step 3.1, is required to generate an order notification, which then has to be by the relevant stakeholder to generate a legally binding confirmed order. This is translated into an

order confirmation notification. Subsequently, the fixed operational plan is distributed and the execution thereof tracked to ensure that stakeholders are able to detect any exception that might cause deviations or delivery delays.

This enables tracking and tracing the flow of goods and execution of operations in the different SC channels for example keeping track of supplier production, order completion and delivery. If any deviations or delays are detected, stakeholders should have access to this information and be able to respond instantaneously in order to resolve the problem. This aims to improve information sharing to enable responsive decision-making and improve on-time order delivery.

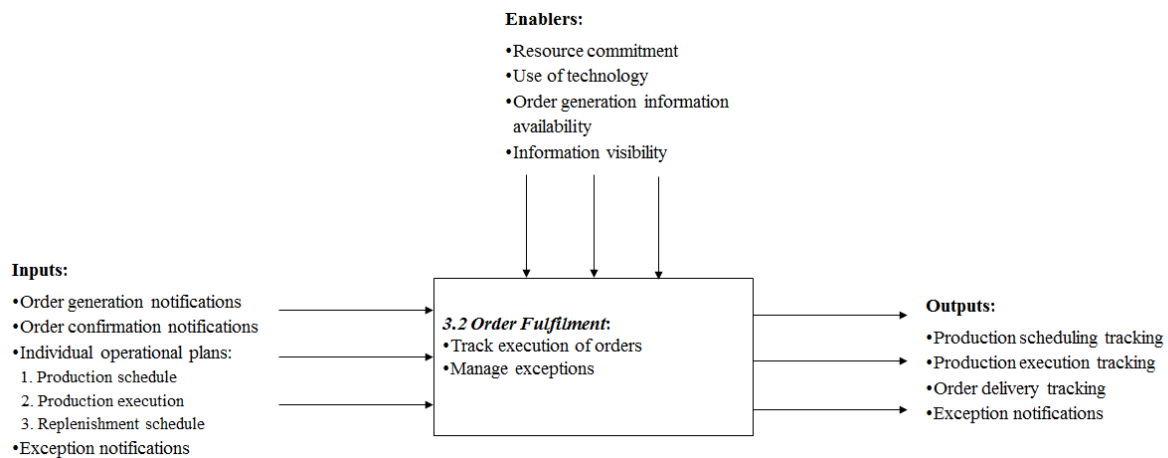


Figure G. 6: Step 3.2 implementation guidelines

Phase 4 implementation

The implementation guidelines of the last phase, Phase 4, serves to guide stakeholders towards improved performance measurement and feedback. This aims to monitor the planning and execution phases (phases 2 and 3) for exceptions, where after results are aggregated and key performance metrics are calculated.

Step 4.1, *Exception Monitoring*, focuses on monitoring previous successes and failures will allow stakeholders to improve decision-making in the future by following the implementation guidelines presented in Figure G.7. This will be applicable to each stakeholder involved in the collaboration, based on a combination of the agreed joint goals, individual stakeholder benefits, joint benefits and pre-determined key performance metrics (KPI's) as per the *Joint Planning* phase.

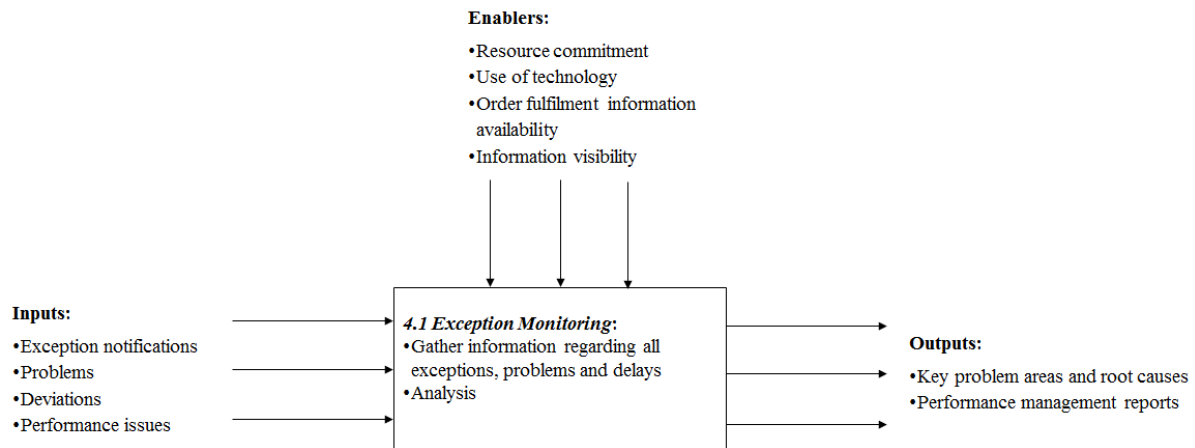


Figure G.7: Step 4.1 implementation guidelines

This step could be facilitated using a shared collaborative platform that allows notifications of exceptions, problems, deviations and performance issues that is monitored and reviewed at the agreed upon time by the stakeholders. Alternatively, stakeholders can evaluate other possible means of exception monitoring such as Excel, a tool currently deployed by some stakeholders in the industry. Having information available concerning the exceptions, problems and delays will allow stakeholders to identify key problem areas and the root causes by analysing cause-and-effect of each instance. This is subsequently translated into performance management reports that are required to continue to step 4.2, *Performance Measurement & Feedback* depicted in *Figure G.8*.

For the process of stakeholder performance measurement and the evaluation thereof, a certain set of inputs are required. This includes the KPI's and corresponding performance rating system of which all the stakeholders carry notice for the commencement of the measurement period as agreed upon in Step 1.2. Based on the problem areas and root causes identified, as well as the corresponding performance management reports generated as outputs of step 4.1, stakeholders can evaluate their collaborative partners' performance.

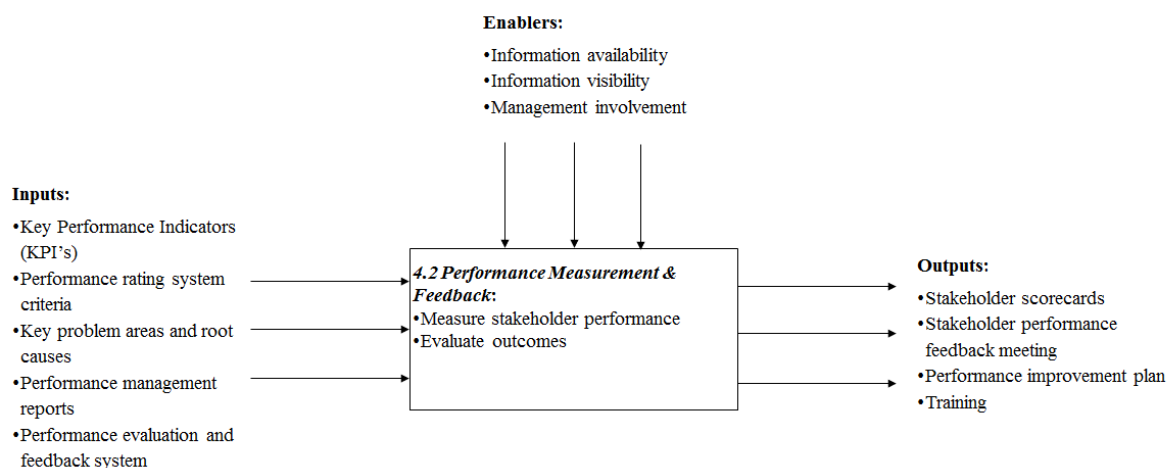


Figure G. 8: Step 4.2 implementation guidelines

The evaluation should ideally be translated in performance scorecards that is presented a performance feedback meeting, typically occurring every 3-6 months. Based on scorecards and feedback, a combined performance improvement plan is compiled and will focus on ensuring that joint goals, individual stakeholder benefits and joint benefits as per the joint plan is reached to the satisfaction of the stakeholders. Finally, the training of employees is crucial to align performance targets with process execution. The performance improvement plan serves to generate new individual stakeholder goals and performance targets required as inputs for Step 1.2 for the next planning cycle. Subsequently these goals and performance targets are incorporated into the next planning cycle completed from Step 2.1 and onwards.

5. Theoretical case examples

The purpose of the theoretical case examples are to determine the possible outcomes of these scenarios that typically occur in the South African wine industry, specifically at wine bottling facilities amongst other. The case study involves analysing case examples and obtain feedback from a bottling stakeholder based on the current outcome of these scenarios (given no collaboration in the current supply chain setup) and the possible outcomes if the developed framework is implemented. In these case examples, the stakeholder referred to as *The Bottler*, refers to the principle individual/organisation interviewed.

Scenario X (new product introduction):

Winery A bottles their entire range of product at *The Bottler*. In March, the winery submits an application for an international “tender wine” order. The tender wine consists of a special blend Cabernet Sauvignon Merlot and the label will have to be

designed according to the clients' specification if the tender is awarded to Winery A. Three months later, Winery A receives a call that they received the tender and that the shipment date is within the next three weeks. Bottling has to be scheduled and dry goods ordered. *How will the implementation of the collaborative framework help the stakeholders to address this challenge?*

Scenario Y (dry goods availability):

The Bottler receives the majority of their bottling requests for the year during January, as per negotiation with their regular clients. These requests are based on estimated bottling quantities of a specific wine cultivar or cultivar blend with a specified BOM. Winery B wants to schedule a bottling slot at *The Bottler* for 15/08/2019. Several wineries use the same dry goods suppliers, even though they use different contract bottlers. Multiple other wineries (using other contract bottling services) as well as a large beverage manufacturer scheduled bottling slots for the same date and uses the same supplier as Winery B. This might cause possible production and delivery constraints if not managed correctly. *How will the implementation of the collaborative framework based on the implementation guidelines help the stakeholders to identify the supply constrain and resolve this problem?*

Scenario Z (wine readiness):

Winery A scheduled the bottling of their popular Red Lady wine blend on Wednesday 09/10/2019. They bottle this standard product range annually at *The Bottler* and a wine that is very high in demand. The bottling slot has already been scheduled end of January 2019 and along with the scheduling, the dry goods manager ensured that the orders for the bottles, labels, corks, boxes and dividers was placed. Two days prior to bottling, Winery C did some wine stability tests before sending the wine to *The Bottler*. This revealed a major problem – the batch of Red Lady has oxidized/chemical instability/microbial spoilage. Luckily, the winemaker will be able to stabilize the wine, but it will only be bottling ready on Monday 14/10/2019.

Unfortunately, stock levels of the Red Lady blend is critically low. If *The Bottler* is not able to rearrange the bottling schedule and shift the batch of Red Lady to one of Monday's bottling slots (which is already filled), the potential of out of stock situations at some demand points is very high. *How will the implementation of the collaborative framework help the stakeholders to reschedule the bottling of the Red Lady blend?*