

The challenges behind producing a bottle of wine: Supply chain risks



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Background: One-third of wine producers in South Africa are experiencing negative net farming revenues. The wine industry is close to the heart of South Africans and South Africa is known for its production of quality wine in the world. However, the wine-producing sector faces many difficulties that threaten its survival. Besides the possible impact of the land reform drive of the government, the industry is experiencing financial and operational pressures, which have been exacerbated by drought and high temperatures affecting the crops. These factors affect not only the wine producers but also the complete wine supply chain.

Objectives: This article provides insight into the supply chain risks of producing wine. The study was conducted among wine producers in the Stellenbosch region of the Western Cape province of South Africa.

Method: An exploratory, qualitative, case-study approach was adopted in this study. Data were collected through in-depth semi-structured interviews with 10 participants at five wine producers' sites selected on a non-probability convenience sample basis. Thematic analysis was used to process the data.

Results: The most critical supply chain risks factors identified through this study centre around the sourcing of dry goods, agricultural activities, wine-making activities and financial risks. It also came to light that the wine farmers do not formally analyse their risks.

Conclusion: Wine producers can put in a greater effort to improve the relationship with suppliers of dry goods and they will more efficiently mitigate some risks if they actively analyse and manage their risks on an ongoing basis.

Keywords: supply chain; risks; supply chain risks; South African wine industry; Supply Chain Operations Reference model/framework; risk evaluation; risk rating matrix; dry goods.

Introduction

Key focus

Current business trends are increasingly prone to complexity and uncertainty in the supply chain. Global competition is intensifying, and supply chains are becoming longer and more complex (Tummala & Schoenherr 2011:474). Consequently, risks of supply chain failures are increasing and can affect the future sustainability of businesses. Therefore, it is important that managers can analyse, control and mitigate risks (Heckmann, Comes & Nickel 2014:120). The risks involved in supply chains, including the severity of supply chain failures, particularly in the food and drink industry, are clear from the recent recalls of processed meats (polony) and the subsequent listeriosis class action in South Africa (Whitworth 2019:1). As wine producers struggle with a range of human, economic and natural threats to their survival, supply chain risk management has become a necessity.

Risks threaten to reduce productivity, increase costs and reduce profits (Michalski 2009:213). Therefore, risk management has become a necessary tool (Benton 2014:363). The field of supply chain risk management gained prominence arising from several catastrophic events and natural disasters, globalisation, intensified competition and the application of integrated production methods (Hoffmann, Schiele & Krabbendam 2012:1). Supply chain risks can be found in each of the main supply chain flows of products, information and funds (Tang & Musa 2011:8). Supply chain risk management can be defined as 'the management of risk through coordination or collaboration among the supply chain stakeholders so as to ensure profitability and sustainability' (Ho et al. 2015:5036).

Background

The South African wine industry started in the Cape Colony in 1655. It is the oldest industry in the country (Wines of South Africa [WOSA] 2017). Today, South Africa is recognised globally for the production of quality wines. The importance of the South African wine industry is evidenced by the amount of wine produced, which comprises 3.9% of global wine (Mordor Intelligence Business Report 2017) and is the eighth largest wine producer in the world (International Organisation of Vine and Wine [OIV] 2018:7). In 2013, the wine industry contributed over R36.1 billion or 1.2% of the gross domestic product (GDP) of South Africa (Smit, Van Eeden & Van Dyk 2017:1; Wesgro 2017:7) and employs 290 000 people.

The South African wine industry has benefited from a major increase in export volumes and improved revenues. However, for the last two decades, this revenue increase has been more than offset by industry-wide cost increases above the inflation level, particularly labour, transport and power costs and difficulty in being able to pass these cost increases on to the consumer (Price Waterhouse Coopers 2013:38; SA Wine Industry Information and Systems [SAWIS] 2015:2). One-third of the wine producers are experiencing negative net farming revenues, and in recent years, the industry has faced extreme weather conditions of drought and heat, which affected their grape yield (SAWIS 2015:3). The focus of this study is the growing of grapes and production of wine for the markets and the risks associated with it.

Problem statement

South African wine producers face financial and operational difficulties, which manifest as risks in their supply chains. This may negatively affect the future sustainability of their businesses. Within this context, the following problem statement was formulated:

There is a lack of information on supply chain risks faced by the Stellenbosch wine producers which may negatively affect the sustainability of their business, unless these risks are managed.

Accordingly, the following research objectives guided this study:

- to identify the supply chain risks experienced by wine producers in the Stellenbosch region
- to examine the strategies used by the Stellenbosch wine producers to manage the identified supply chain risks.

Contribution

The context of this study is the South African wine industry, particularly the supply chain risks it faces, and the strategies used to manage these risks. There has been an increase in the interest of academics and practitioners in the area of supply chain risk management globally (Meyer et al. 2019:2). However, there is a lack of research on supply chain risk management in developing countries, compared to research conducted in developed countries (Meyer et al.

2019:2; Nel, De Goede & Niemann 2018:2; Prakash, Soni & Rathore 2017:78).

Various research studies have been conducted in the wine industry in South Africa on areas such as climate change, wine and conservation (Van Leeuwen & Darriet 2016; Vink et al. 2010); governance in the value chain (Ponte 2007); and factors affecting the competitiveness of the South African wine industry (Esterhuizen & Van Rooyen 2017). However, no evidence of previous research conducted on supply chain risks faced by wine producers in South Africa was found.

Therefore, the findings of this article contribute to the body of knowledge in the wine industry and the field of supply chain management. In particular, the results could benefit other wine producers, as they may gain insights into the implications of the ineffective management of supply chain risks in wine production. Practical suggestions are made that could help wine producers to better manage their supply chain risks.

The next section deals with a summary of the literature review, followed by a description of research methodology. Then the findings are presented, followed by the practical implications of the research. Finally, the article then concludes with the research limitations and areas of future research.

Literature review: Risk and supply chain risks

Risk

All businesses operate in an environment of constant change, which gives rise to uncertainty, particularly future events and the impact that these events may have on the business. This uncertainty can manifest as risk, that the businesses will not operate as planned and that the financial results will deviate from what is anticipated (Hugo & Badenhorst-Weiss 2011:97). Risk is any exposure that poses a threat to the existence of a business (Simba et al. 2017:2). It is always linked to a certain occurrence that can result in a loss or damage (Naude & Chiweshe 2017:3). Thus, risk is based on the fear of losing an investment or the probability of events that result in a loss (Heckmann et al. 2014:119).

Risk can be explained in terms of three dimensions, namely, *uncertainty*, *probability* and *consequence* (Breakwell 2014:3). All human endeavours and operations carry some risk because of uncertainty (Olson & Wu 2010:694). There is a close correlation between risk and uncertainty. In whatever way the term 'risk' is used, there is always uncertainty about a future outcome (Tranchard 2018). The degree of uncertainty surrounding the event determines the level of risk. The more uncertain the decision-maker is of whether the event will take place and what the outcome will be, the greater the possible deviation of the actual result from the expected result (Botha & Badenhorst-Weiss 2019:2). Because of the role of uncertainty in risk, risk cannot be eliminated, but only can be mitigated with risk management strategies (Lockamy 2014:757).

The other two dimensions of risk are *probability* and *consequence* (McLaughlin 2015:39). Probability is the chance

that something will happen. It is the quantifying measure on which risk assessment can be based (McLaughlin 2015:40). Uncertainty in terms of risk exerts a *consequence* of risks within a range of different possible scenarios (Hopkin 2017:34; Simba et al. 2017:4). Elahi (2013:113) defines this consequence as a 'business outcome' that influences the organisation. Therefore, risk can be explained by the following formula of McLaughlin (2015:39):

$$\text{Risk} = \text{Probability} \times \text{Consequence} \quad [\text{Eqn 1}]$$

Risk cannot be avoided and will always exist. Regardless of the area of interest, risk is associated with an undesirable loss – a negative consequence and uncertainty (Tummala & Schoenherr 2011:474). Consequently, supply chain risk management has become a necessary strategic process to address supply chain-specific risks that may happen within a business' supply chain (Meyer et al. 2019:2).

Supply chain risks

Supply chain risk can be defined as 'any risk that disrupts or impedes the information, material and product flow from

original suppliers to the delivery of the final product to the ultimate end-user' (Heckmann et al. 2014:122). Supply chain risk is an event that adversely affects supply operations and consequently its desired performance measures and cost. It is the likelihood of a disruption that will affect the ability of the business to continuously supply products and services (Tummala & Schoenherr 2011:474). Supply chain risks threaten to reduce productivity, increase costs and liabilities and reduce profits, and thereby negatively affect the value added within the chain (Michalski 2009:213; Wisner, Tan & Leong 2016:7).

Table 1 provides a comprehensive list of possible supply chain risks, categorised into financial, operational, external, market and reputational risks.

The processes of risk management in supply chain management

There are several steps in the process of the management of supply chain risk (Monczka et al. 2016:259; Stevenson 2018:654). They are risk identification, risk analysis and assessment, risk response treatment and risk monitoring and evaluation.

TABLE 1: Supply chain risks.

Risk category	Risk description	Literature sources
1. Financial	The risk of cost overruns and/or poor financial performance; Liquidity risk and the risk of poor financial management; The risk of fluctuating or high interest rates; Foreign exchange risk; Price and cost risk; The risk of high or fluctuating freight and transportation costs on raw materials or on goods sold to the customer; The risk of the non-sustainability of key suppliers and customers; Legal risk relative to the business activities and to the product it supplies.	Wagner and Bode (2008) Hugo and Badenhorst-Weiss (2011) Tang and Musa (2011) Tummala and Schoenherr (2011) Kim and Vonortas (2014) Johnson and Flynn (2015) Chopra and Meindl (2016) Rahman et al. (2017) Jacobs and Chase (2018)
2. Operational	The risk of a shortage of a key material; The risk of supply problems by a supplier of goods and services (supplier fulfilment problems and/or shortages); Risk of poor quality of goods or materials supplied; The risk presented by the supplier's supplier; The risk of the physical management of inventory; The risk of transportation of inventory (logistics delays/damage); Risks caused by people (human resources), for example: <ul style="list-style-type: none"> human error or negligence inadequate training poor working culture industrial action loss of personnel and replacement with inexperienced staff unethical conduct and theft by employees ill-informed and unauthorised decision-making. Risks caused by processes, for example: <ul style="list-style-type: none"> poor process controls operational failure fail to be agile and flexible poor operational performance equipment and machinery failures damage to the environment occupational health and safety of employees. Risks caused by systems in the operational process, for example: <ul style="list-style-type: none"> system breakdowns system obsolescence implementation failures of new technology security or system access breaches by unauthorised individuals poor data integrity or corruption of data through hardware or software failures insufficient computer system capacity damage or loss to computer systems because of physical damage. 	Wagner and Bode (2008) Hugo and Badenhorst-Weiss (2011) Tang and Musa (2011) Tummala and Schoenherr (2011) Kim and Vonortas (2014) Jacobs and Chase (2018) Fawcett, Ellram and Ogden (2014) Heckmann et al. (2014) Johnson and Flynn (2015) Chopra and Meindl (2016) Pakhchanyan (2016) Hopkin 2017; Stevenson 2018
3. External	The risk of disruption to the supply of water and electricity; Security risks; External hazard risks; Risk of crime; Risk of external industrial action; The risk of delivery problems; Physical security risks; Risk faced by the business through legislation and regulation.	Wagner and Bode (2008) Hugo and Badenhorst-Weiss (2011) Tang and Musa (2011) Tummala and Schoenherr (2011) Johnson and Flynn (2015) Chopra and Meindl (2016) Hopkin 2017:2 Manners-Bell 2017: 22 Jacobs and Chase (2018)
4. Market	The demand side/planning risks; Capacity planning risks; The risk of loss of customers; The risk of delays of delivery to customers; The risk of a distortion of demand because of sales promotions and/or incentives.	Wagner and Bode (2008) Tummala and Schoenherr (2011) Kim and Vonortas (2014) Johnson and Flynn (2015) Chopra and Meindl (2016)
5. Reputational	Adverse publicity to do with poor product quality, improper disposal and environmental practices or relationships and dealings with unethical suppliers, including bribery and kickbacks, can have impact on the business and its brands	Johnson and Flynn (2015) Chopra and Meindl (2016)

Risk identification

The first step in the supply chain risk management process is the actual identification of the risk. This comprises systematically identifying the sources of any potential external and internal risk, starting with the interrogation of the supply chain to understand where risk might arise and what could trigger the risk (Hallikas & Lintukangas 2016:57; Zsidisin & Ritchie 2008:4). An important part of this identification process is to ensure that once the risks have been identified, they should be recorded and then monitored (Scarborough, Wilson & Zimmerman 2009:730).

Risk analysis and assessment

The second step in managing risk is the evaluation of the probability of the occurrence of a possible risk and the prediction or estimation of its impact (Zsidisin & Ritchie 2008:4). This stage, therefore, has two perspectives, namely, the likelihood that a risk will occur and the extent of the impact if the risk occurs (Ho et al. 2015:5032).

Risk response treatment

The third stage of supply chain risk management involves generating and considering alternate scenarios and/or solutions, assessing and judging the merits of these scenarios and solutions, arriving at appropriate solutions and following up by implementing these solutions (Zsidisin & Ritchie 2008:4). Broadly speaking, this process leads to arriving at mitigating strategies or actions to eliminate, reduce or counteract the risks (Hoffmann et al. 2012:4). Possible actions may include risk avoidance, risk assumption, risk elimination, risk reduction and risk transfer. Risk avoidance is the taking of steps or actions to avoid the risk. Risk assumption occurs when the party that is exposed to the risk merely accepts it and the losses that might arise. Risk reduction aims at reducing the likelihood of the occurrence of loss or reducing the severity of the loss should it occur. Risk transfer is the action of transferring the risk to another party (Hugo & Badenhorst-Weiss 2011:103).

Risk monitoring and evaluation

The fourth and final step in risk management involves monitoring, controlling and managing solutions, and assessing their impact on the area of a business or the business itself (Zsidisin & Ritchie 2008:4). It must be noted that risks change over time; therefore, risk management is a dynamic process. The severity of the impact of a risk can equally change over time. Risk management is therefore important (Chang, Xu & Song 2015:55).

The Supply Chain Operations Reference model perspective

This study was conducted from a Supply Chain Operations Reference (SCOR) model perspective. The SCOR model is organised around six major supply chain management processes: *plan*, *source*, *make*, *deliver*, *return* and *enable*; it is used as a tool for the management to address, improve and communicate supply chain decisions within a business with the customers and key suppliers of a business (American Production and Inventory Control Society [APICS] 2017:2). This model is used widely to understand the key activities

within the supply chain, including risk appraisal and risk management (Hugos 2018:42). The supply chain management processes of the SCOR model were utilised in this study to examine the supply chain risks experienced by Stellenbosch wine producers. It was deemed appropriate as the primary contributor for this study because it incorporates supply chain activities between suppliers and provides measurements for them. The process elements of the SCOR model are shown in Figure 1 and are described next.

Plan

This process of the SCOR model consists of the processes needed to operate a supply chain strategically (Hugos 2018:42; Jacobs & Chase 2018:7; Wisner et al. 2016:514). Supply chain planning processes use information from external and internal operations to balance supply and demand (Zhou et al. 2011:333). The plan process refers to all the operations needed to plan and organise the operations in the other components of source, make, deliver and return (Hugos 2018:42; Jacobs & Chase 2018:7; Wisner et al. 2016:514).

Source

The source process consists of the selection of suppliers that deliver the goods or services required to make the business' products. This requires a set of pricing, delivery and payment processes, and metrics or measures for monitoring and improving the relationship between the business and its suppliers (Hugos 2018:42; Jacobs & Chase 2018:7; Wisner et al. 2016:514). One important strategy in sourcing is to have fewer suppliers, long-term relationship with suppliers and a supplier development programme (Zhou et al. 2011:333).

Make

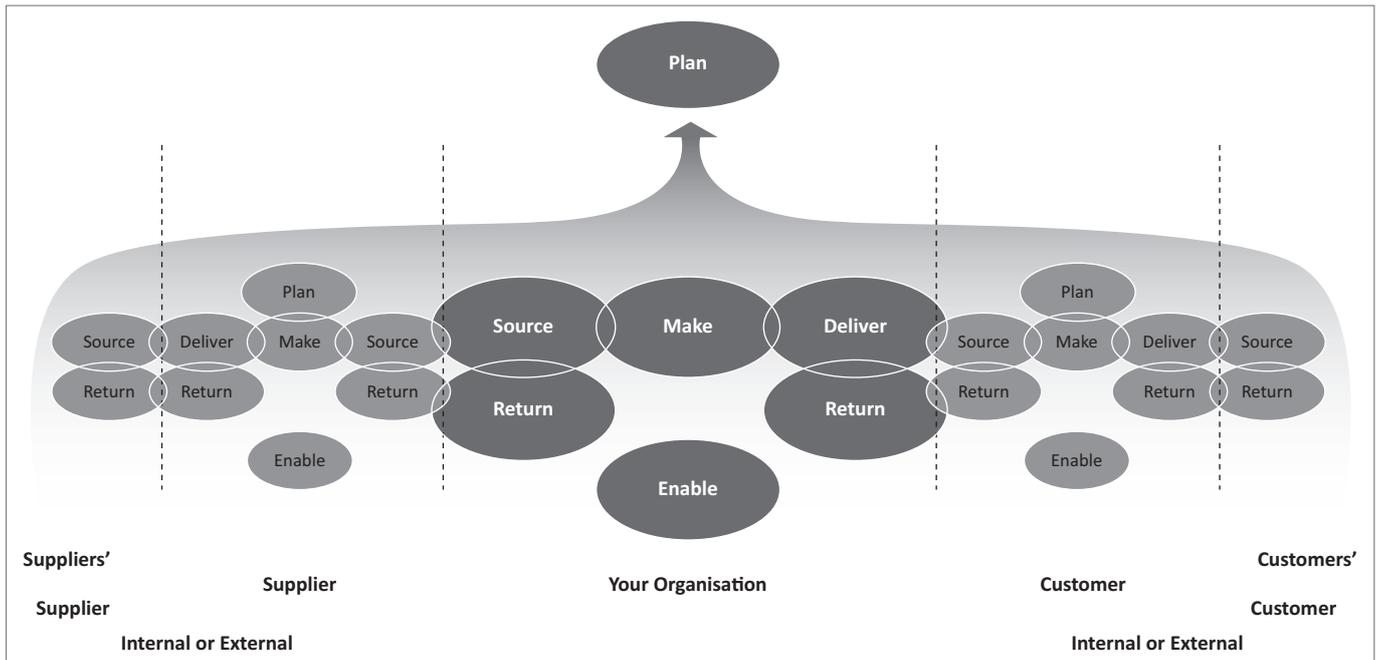
The *make* process consists of transforming raw materials into finished goods. This process includes the scheduling of processes for the workers and the coordination of the materials and other resources to support the producing of the product or the providing of the service (Hugos 2018:42; Jacobs & Chase 2018:7; Wisner et al. 2016:514). One important aspect of the make process is teamwork when transforming raw materials into finished good to meet supply and demand (Zhou et al. 2011:334).

Deliver

The *deliver* process is a critical link in the supply chain. Logistics companies are selected to move the finished products to storage warehouses and to customers, to coordinate and schedule the movement of information and products through the supply network, to develop and operate a network of warehouses and to run the information systems that manage the receipt of orders from customers (Hugos 2018:42; Jacobs & Chase 2018:7).

Return

The *return* process involves the receiving of defective products or excess products from customers. This process



Source: Supply Chain Council, 2012, *Supply chain operations reference model*, viewed 02 June 2017, from <http://docs.huihoo.com/scm/supply-chain-operations-reference-model-r11.0.pdf>

FIGURE 1: Six major supply chain management processes of Supply Chain Operations Reference.

includes support for customers who have problems with delivered products (Hugos 2018:42; Jacobs & Chase 2018:7).

Enable

The *enable* process involves supporting the design and management of the planning and execution processes of the supply chain. These processes are associated with managing activities like the planning component, and cover the whole supply chain and the other activities of source, make, deliver and return (APICS 2017:4; Wisner 2016:515).

As presented in the next section, the South African wine supply chain has been delineated and linked to the SCOR model through the key activities within the wine supply chain.

The wine supply chain

The wine supply chain consists of five stages, with risks arising within each stage of the supply chain (Petti et al. 2005:4). These stages are presented in Figure 2, which also illustrates the scope of this study in the wine supply chain.

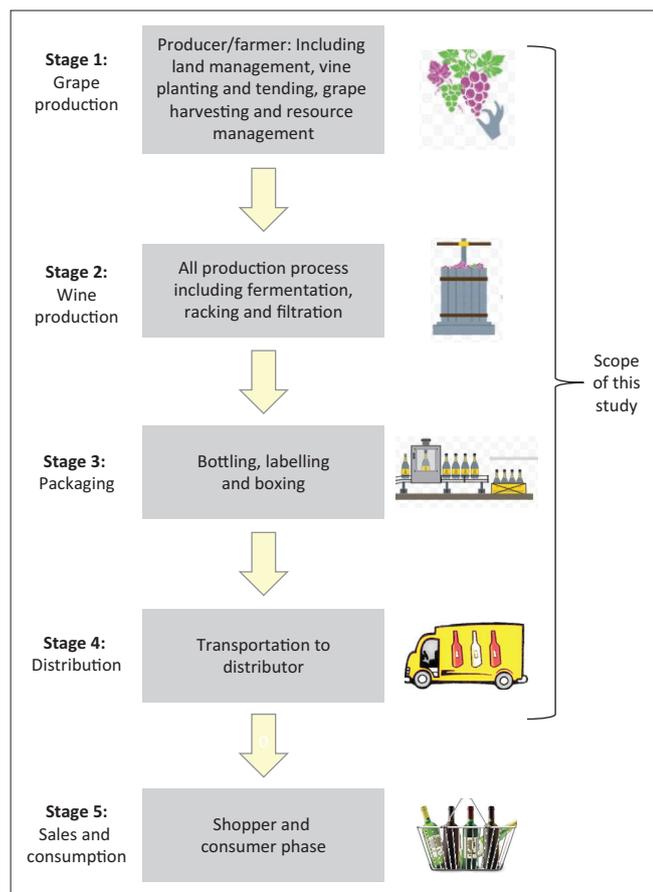
Table 2 links the five stages of the wine supply chain to the supply chain activities of plan, source, make, deliver, return and enable. These supply chain activities provided a framework against which supply chain risks were identified in this study.

Research methodology

This is an exploratory qualitative study, which aimed to identify wine producers' supply chain risks and the strategies they use to manage these risks. A case-study approach deemed appropriate for this, as it required the

TABLE 2: Activities in the South African wine supply chain.

Supply chain process	Supply chain stage	Description of the wine supply chain process
Planning	This incorporates all the planning activities of the supply chain stages: Stage 1: Grape production Stage 2: Wine production Stage 3: Packaging Stage 4: Distribution Stage 5: Sales and consumption	The planning process includes all aspects of planning of the business and its operational activities. This component covers planning for the business and its operation; farm and crop management; procurement; wine production, bottling and packaging; and sales or distribution of the wine.
Sourcing	This incorporates all the sourcing (procurement) activities of the wine supply chain stages: Stage 1: Grape production Stage 2: Wine Production Stage 3: Packaging Stage 4: Distribution	The sourcing process includes all aspects of sourcing for the business. This covers the procurement of materials, workforce, machinery and the services to enable the supply chain to operate and wine to be produced.
Making	This incorporates the making activities of the wine supply chain stages: Stage 1: Grape production Stage 2: Wine production Stage 3: Packaging	The making process includes all aspects of wine production. This component covers land management, vine management, crop management, harvesting and all steps of the wine production processes. It also includes the bottling and packaging activities of wine production.
Delivery	This incorporates the delivery activities of the wine supply chain: Stage 4: Distribution Stage 5: Sales and consumption	The delivery process includes all aspects of sales: customer invoicing; warehousing and sales transportation of the wine to the distributor; and after-sales service.
Return	This incorporates the returning (of product) process of the wine supply chain: Stage 5: Sales and consumption	The return process includes product return for any reason, such as quality problems, excess stock not required by the customer and account non-payment.
Enabling	This incorporates the enabling activities of the supply chain: Stage 1: Grape production Stage 2: Wine production Stage 3: Packaging Stage 4: Distribution Stage 5: Sales and consumption	The enabling process includes the support, design and management of the <i>planning and execution processes</i> of the supply chain.



Source: Adapted from Petti, L., Raggi, A., De Camillis, C., Matteucci, P., Sara, B. & Pagliuca, G., 2006, 'Life cycle approach in an organic wine making firm: An Italian case study', in *5th Australian Conference on LCA*, Melbourne, Australia, November 22–24, 2006, pp.155–168.

FIGURE 2: An illustration of the basic wine supply chain.

study to focus on current events (Yin 2014:5). Insights into the supply chain risks that wine producers face and how they manage these will have advantages not only for individual wine producers but also for other wineries as they may gain insights into similar supply chain risks and the management thereof.

Target population and sample

The target population is the entire population that a researcher is interested in researching (Sekaran & Bougie 2016:240). The target population for this study consisted of wine producers in the Stellenbosch region. Stellenbosch is the largest wine-producing region of South Africa. A total of 191 out of 546 (35%) South African wine producers are located in this area (SAWIS 2017:7). The Stellenbosch region contains five main wine-growing areas. These are the Greater Simonsberg area, the Stellenbosch Berg area, the Helderberg area, the Stellenbosch Valley area and the Bottelary Hills area (WOSA 2017).

A non-probability purposive sample technique was used in this study, as the owner of one of the wine-producing cellars acted as the gatekeeper. A gatekeeper is defined as a person who enables a researcher to gain access to a business to conduct research (Wagner, Kawulich & Garner 2012:64). The gatekeeper assisted the researcher in getting access to wine producers in

TABLE 3: Profiles of the study participants.

Participant pseudonym	Job title	Gender	Wine industry experience	Producer pseudonym
P1	Logistics Officer	F	< 5 years	W1
P2	CEO/Cellar Master	M	19 years	W1
P3	Owner/Sales & Marketing	F	19 years	W2
P4	Winemaker	F	< 5 years	W2
P5	Viticulturist	M	22 years	W2
P6	Owner/Cellar Master	M	21 years	W3
P7	Owner/Cellar Master	M	35 years	W4
P8	Winemaker	M	22 years	W4
P9	CEO/Financial Executive	M	5 years	W5
P10	Cellar Master	M	24 years	W5

M, male; F, female; CEO, chief executive officer.

the area. The sample size for this study comprised five wine producers, one from each wine-producing area; thus, there were five case studies, one from each Stellenbosch area.

At each participating winery, the chief executive officer (CEO) and/or owner and the winemaker were approached to participate in the study. At wine producer W3, only the owner or cellar master was available for interview. However, this individual, participant P6, had run the operation for over 21 years and had considerable knowledge of the wine supply chain in the producing estate. At wine producer W2, the owner, the viticulturist and the winemaker were interviewed. Therefore, a total of 10 interviews were conducted. Table 3 presents the profiles of the participants.

Research instrument

The research started with a comprehensive literature study to assist in the development of an interview guide, for the primary data collection through semi-structured interviews. The interview guide consisted of open-ended questions arranged under the supply chain activities of the SCOR model of plan, source, make, deliver, return and enable. In addition to the use of an interview guide, personal field notes were taken during the interviews, which were combined with direct observation. Personal field notes taken by the researcher during an interview add richness and context to the interview (Sekaran & Bougie 2016:124), while direct observation by the researcher about the participants and their activities offers a form of corroboration of the data obtained, also known as triangulation (Yin 2014:113).

The interview guide was checked for content validity by several academics during the ethical clearance process and was pre-tested by the gatekeeper. The purpose of this review was to refine the questions in order to confirm that the participants would be able to answer them without any difficulties, as well as to allow for assessment of the validity of the questions in order to give greater reliability to the data collected (Saunders, Lewis & Thornhill 2016:723).

Data collection

Data were collected through in-depth face-to-face semi-structured interviews conducted with 10 participants (using an

interview guide) at five wine producers' sites, and by means of personal field notes and observations. Data collection at each of the participating wine estates took place on an agreed date and time during June 2018. The interviews were conducted by one of the authors of this study and were voice-recorded.

Data analysis

The data were analysed using thematic analysis. Thematic analysis is a general approach for analysing qualitative data and it involves identifying themes and/or reporting patterns in the data (Wagner et al. 2012:231). The thematic analysis for this study was performed by following the six steps proposed by Braun and Clarke (2013:3). These steps include understanding the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report. The field notes added further context to the participants' answers in the transcription documents and were used to confirm comments made by the participants.

Validity and reliability

The validity of purposive research results or data depends on the level of their merit and worth, that is, their trustworthiness. The term 'trustworthiness' was used by Lincoln and Guba (1999:394–444) to describe the criteria involved in establishing the credibility, consistency, transferability and confirmability of data. Credibility was improved using the researcher's personal notes, which contained a brief review checklist of observations and were matched against the transcribed interviews. The questions in the interview guide were phrased in simple language to ensure that there was no ambiguity. The participants were given the opportunity to ask questions and seek clarity, if needed, before responding to the questions.

Therefore, consistency was maintained during the interviews, which contributed to the trustworthiness of the results of the study. In order to ensure conformity of the data, the interviews were recorded using 'Listen N Write Freeware' and transcribed verbatim using the same software. One of the authors carried out the transcription process and the transcribed data were reviewed and checked for accuracy twice by the authors.

Ethical considerations

The researcher complied with all ethical measures in communicating with the participants, in line with the formal application for ethical clearance at the University of South Africa Ethics Committee (Reference number: 2018_CEMS_ESTTL_005). This includes voluntary participation, anonymity, confidentiality and respect for the participants.

Findings and discussion

Key attributes of the participating wine producers

An overview of the key attributes of the five participating wine producers is presented in Table 4.

Findings and discussion

The 10 participants all demonstrated considerable in-depth knowledge of the wine supply chain and of their own wine-producing estates and the risks in their environment. The data gathered from the participants on certain themes did not differ much from one participant to another. Table 5 summarises the risk findings according to the thematic analysis of the interviews in the form of a thematic map comprising six themes, sub-themes and codes, which are discussed in more detail in the following sections.

TABLE 4: Key attributes of the participating wine producers.

Producer facts	Producer W1	Producer W2	Producer W3	Producer W4	Producer W5
Grape crop					
Locally grown grapes	50%	Buy out a small portion for specific wine types	95%	100%	90%
Bought-out grapes†	50%		5% buyout for specific wine types	Nil bought out	10% buyout for specific wine types
2018 yield versus prior year	Down between 10% and 30%	About the same as the previous year	Down 20%	About the same as the previous year	Down between 13% and 15%
Reason for lower yield	Drought	N/A	Drought	N/A	Drought
Producer water resources					
	Dam plus underground supply	Dam on farm not adequate – use Theewaterskloof Dam water supply	Dam/Water self-sufficient	Dam/stream Water self-sufficient	Dam/boreholes
	Use irrigation	Use irrigation	Use irrigation	Use irrigation	Use irrigation
Labour relations	High focus on labour relations	Good employee relations	High focus on labour relations	High focus on labour relations	Good worker relationships
Market					
Local	-	20%	35%	65%	70%
Export	-	80%	65%	35%	30%
Export sales terms	Mostly 60 days/FOB	90 days/FOB	Mostly 60 days/FOB	Mostly 90 days/FOB	Mostly 90 days/FOB
Export destinations	UK, Europe, US and Canada	US (98%) and Europe	US and Japan	UK and Europe	UK, Europe and US
Producer focus – as described by a participant	'Natural winemaker'	'Boutique winemaker'	'Natural winemaker – focus on professionalism'	'Precision viticulture'	'Sustainable viticulture'

FOB, free on board; N/A, not applicable; UK, United Kingdom; US, United States.

†, Many wine producers 'buy out' quantities of grapes from other farmers or producers, which are used together with their own grown grapes to produce their wines.

TABLE 5: Thematic analysis of the interviews.

Theme	Sub-themes	Code
Theme 1: Plan	Demand versus supply	Forecasting, planning
	Investment	New vineyards
Theme 2: Source	Bought-out grapes	Drought
	Dry goods	Costs, supply, quality
Theme 3: Make	Costs	Costs
	Nature	Drought, picking, disease, wind/hail/frost, pests
	Infrastructure	Irrigation and electricity
	In-process	Controls
	Human resources	Industrial relations, skills, safety, theft/damage
Theme 4: Deliver	Revenue	Sales revenue, costs
	Customers	Bad debts, demand
	Inventory	Damage, delays
Theme 5: Return	Nil	Nil
Theme 6: Enable	Financial	Profitability, cash-flow

Theme 1: Planning risks

The *plan* risk has two main sub-themes: demand versus supply and investment. This is in line with the literature (Hugos 2018:42; Jacobs & Chase 2018:7; Wisner et al. 2016:514) that states that the overall supply chain plan includes how demand will be met with available resources. The demand-and-supply sub-theme examined the risk faced by producers in managing and balancing product supply with customer demand to achieve optimum stock levels. The investment sub-theme involved the risk experienced by producers when investing in new vineyards. This comes from the uncertainty as to whether the wine consumer will buy the wine that comes from the investment, in view of the wine consumers' current and future tastes and desires.

Demand versus supply: Sales forecasting is the projection of customer demand for the various wine cultivars during a planning period. Four participants indicated that the matching of demand and supply is difficult and presents a risk. Customer demand is variable and, in many cases, does not follow a well-established pattern. The wine producers do not have a clear picture of the requirements of their customers, who might buy only small quantities of wine at any one time, but whose overall purchasing patterns are important to the wine producer. The larger wine-producing groups have an advantage in selling to wine distributors and have the resources to 'create demand' through promotions. This distorts the demand-and-supply picture.

There is also the lack of clarity regarding the short-term demand on the part of customers. Consequently, wine producers must vary their promotion strategies according to the shifting sales. This adds complexity and cost to the operations. The short-term demand-and-supply mismatches also affect the longer-term planning strategy. To add to this, the recent ongoing drought resulted in lower yields, and exacerbated the difficulty of matching demand and supply, as grapes availability was affected.

Four participants identified the planning for the facility and its processes as a risk. The wine supply chain is long,

beginning with vine planting, growing and moving through the harvesting and wine-making processes, to the maturation and storage stage of the finished wine. This is particularly true of the making and maturation of red wine, which takes several years to convert from a berry to a saleable wine. Planning and managing a vintage come with risk, and any changes to the plan and the timeframes may affect a producer and add additional risk, as evident in the following quote:

'You can plan what a vintage will give you. But now you have got two behind you, that's how we work. So, I have two in barrel. I have 2018 and 2017 behind me. I am going to 2019 now. When I am in 2019, I am going to bottle 2017. But, if 2017 isn't right, it might have to stay in barrel for another 6 months. Now it pushes me.' (Participant 3, female, 19 years experience)

Investment: The cost of a new vineyard is significant:

'You are planting over 3000 vines in a hectare. So, this little block here (pointing to a map) is a hectare. To plant a vineyard, it probably sets you back R250 000.' (Participant 7, male, 35 years experience)

The investment in planting a new vineyard, which will last many years, is a risk in view of the changing market and anticipated future customer tastes and demands.

'We are planning another vineyard now. While this vineyard is going to last 25 years, what is the demand going to be like in 25 years and what will the style be? How can I know that?' (Participant 6, male, 21 years experience)

Theme 2: Sourcing risks

The *source* risk includes all risks raised by the participants associated with sourcing of materials, manpower, machinery and services. This finding is in line with the observations of various authors (e.g. Hugos 2018:42; Jacobs & Chase 2018:7; Wisner et al. 2016:514) who identified that sourcing includes the ordering and receiving of goods and services and paying the suppliers for these goods and services. There are two risk sub-themes: the sourcing of 'bought-out' grapes and dry goods. Dry goods are materials used in the making of wine (e.g. yeast and oak wine barrels used for wine maturation), and the bottling process and packing of the wine (e.g. bottles, labels, boxes, capsuling, corks and pallets).

Bought-out grapes: The drought risk is found in the sourcing and making aspects of the wine supply chain. On the sourcing side, the drought created a shortage of grapes that needed to be bought in from third parties, and this increased the prices. This price increase is further exacerbated by overseas customers buying out South African bulk wine, owing to the South African prices being lower than those paid overseas for such bulk wine. This brought risk to South African winemakers, who buy out a significant portion of their grapes to make their wine.

Dry goods: Dry goods cover all the inventory items for the bottling and packing of the wine, and other items used in the

wine-making process. These include additives such as yeast and the oak wine barrels used for wine maturation. The packing items covered by this sub-category are bottles, labels, boxes, capsuling, corks and pallets. Three aspects of the risk related to these dry goods have been identified: the cost of the products; ordering and timely supply of these goods, including excess stockholding; and the possible poor quality of these items.

Costs: This risk involves the high and increasing cost of dry goods supplied by local suppliers and the increasing costs of imported dry goods. Each year, the local dry goods suppliers tend to put through inflation-linked price increases to their customers. Furthermore, all the participating wine producers used imported oak barrels in their wine-making process. These barrels are imported from France, with the cost of a barrel being high at 'between R13 000.00 to R18 000.00 per barrel' (Participant 3). The cost of the barrels is also increasing because of the depreciating Rand and the weak Euro exchange rate. The outlay cost for 150 barrels, at an average cost of R15 000.00 (at June 2018 exchange rates), is R2.25 million. The cost and continuous increase in the cost of these items present a significant risk, as identified by seven participants.

Supply: This risk covers issues relating to the on-time receipt of dry goods from local and foreign suppliers. The participants experienced long lead time between ordering and receiving dry good inventory from South African suppliers (between 6 and 8 weeks) and inefficiencies at local suppliers. Causes for the delays of inventory sourced from local suppliers include poor weather conditions, strikes and transport delays. The participants also experienced lead time delays in obtaining supplies from overseas because of, for example, the long distances and climate factors such as bad weather at sea.

Quality: This risk involves the poor quality of dry goods stocks, most notably bottles, boxes and labels. The poor quality of dry goods is a significant risk, as identified by seven participants. Issues included weak and flawed bottles that break and crack, labels that do not stick to bottles, colour variations on boxes, boxes that collapse and contaminated cork:

'The quality of the bottles is very poor. This is a major problem because the main supplier is ... [Consol] and they are not interested in the small guys. Beer is what keeps them ticking along and they are dreadful to work with. We've also had labels that don't stick on the bottles.' (Participant 7, male, 35 years experience)

Theme 3: Making risks

The *make* theme includes all risks raised by the participants associated with land management, vine management, crop management, harvesting and all steps of the wine production processes. It also includes the risks associated with the bottling and packaging activities. The make processes identified in this study are in line with those outlined in the literature (Hugos 2018:42; Jacobs & Chase 2018:7; Wisner et al. 2016:514). These

authors noted that the make process comprises the making or producing of the product. The five sub-themes are cost, nature, infrastructure, in-process and human resources risks.

Costs: The first risk sub-theme of costs was raised by four participants in relation to the high and increasing input costs of farming activities (land tending, planting, growing, vine tending and picking) and the wine-making process in the winery. These include the cost of labour and other inputs, such as water, electricity and wastewater treatment. Explaining the impact of costs increases, one participant commented:

'Yeah it's created pressure on the business. I mean obviously you can't keep paying more than inflation. Well it becomes the major inflation in your business. And it becomes a big component in the business. It's like 40% of our costs. The labour-related component flows all the way down the chain.' (Participant 6, male, 21 years experience)

Nature: Five individual codes were identified, namely, drought, picking, disease, wind/hail/frost, pests and fire. These risks or hazards are of an external nature and thus beyond the direct control of the producer.

Drought – A key risk issue that was raised by six participants was drought and its impact. The necessity for vines to receive enough moisture is a critical element of the Stellenbosch wine supply chain. Even though all the participating producers have dams, use irrigation and have other water resources (participating producers 1 and 4 have underground water resources and a stream, respectively), drought still impacted the wine crop, with three of the five producers noting that drought had negatively affected their crop yield. While the yield might be lower because of water issues, the producers noted that a smaller yield does not generally affect the quality of the grape berry or of the wine that is produced from it.

Picking – The next important risk was that of picking the grape crop at the wrong time (over- or under-ripened) and not at the best temperature conditions. The best temperature is generally when the ambient temperature is the coolest. The risk of getting this wrong can lead to a wine that does not meet the wine producer's requirements of a product that is consistent with previous vintages.

Ripe wine grapes are very perishable and are at their best for a few days. When to pick the grapes is such an important decision that most winemakers start sampling grapes several weeks before picking time and continue sampling with increasing frequency as harvest time approaches. There is the risk if the berries are not appropriately ripened and picked when the ambient temperature is the coolest. The importance of ripeness was explained as follows:

'It affects the whole style of the wine potentially. Over-ripe and we have a window where we [have] to pick it today and it's the middle of summer at 32 to 35 degrees and we get delayed by a week, then your sugar jumps and your alcohol will end up a lot higher than [you] intended it to be. That can happen, also you

lose quality, you are going beyond the point of ripening of where you want to be. You can lose market. Woolworths, for example, over 14% alcohol levels is a problem. Supermarkets won't stock it, won't shelve it if you have more than 14% alcohol level.' (Participant 8, male, 22 years experience)

While ripeness is key, the ambient temperature also plays a role:

'Well, temperature is important for the whites, but for the reds it's not so important. The coldest part of a Cape day is at dawn. The moment the sun sticks its head out is always the coolest part of the day. So, at 5:30 we will pick, we don't pick to a time, we pick to a temperature, we pick to 20 degrees Celsius. Then we stop. It could be 8, it could be 9, ja then we go back the next day. The first part of the harvest that's the way we do it. We pick for an hour or two or three. If it's cool and cloudy, we may pick the whole morning, but it depends on the temperature. We bring it in because again you have one opportunity in 12 months to get it right.' (Participant 10, male, 24 years experience)

Disease – High on the list of risks is the risk of disease, which was noted by five participants, because it affects the grape crop. This risk category includes two types of mildew, called powdery and downy mildew. Powdery mildew, also known to vine and grape growers as *Oidium*, is caused by the fungus *Uncinula necator*. Without necessarily causing obvious disease symptoms, the fungus may have a harmful effect on all facets of the vine and its products. Downy mildew is a highly destructive disease of grapevines and grapes, where a part of the young fruit bunches turns brown, wither and die rapidly (Wineland Media 2001).

Pests – Four participants noted the risk of damage to the vines caused by pests, most notably the mealybug, which damages the vines by passing on a virus to them. There is also the risk of the stemborer, which damages the vine trunks, eventually affecting the vigour of the vine and affecting bud burst. The snout beetle can cause serious feeding damage to emerging buds, sprouts and young shoot tips on the vines (Wineland Media 2013).

Wind, hail and frost – Five participants noted the impact of wind on the flowers and the vines. Hail and frost, while not a common occurrence in the Stellenbosch area, also constitute risk factors for the vines and the fruit.

Infrastructure: This risk sub-theme covers all risks relating to the infrastructure required for vine- and grape-growing and the wine-making operation, including irrigation and electricity.

All five participating wine producers noted that they use irrigation to water their vines, and that issues such as low water levels in dams have an impact on effective irrigation. Electricity is needed in a winery to run the equipment, and particularly to run the cooling machinery. Cooling of the wine juice is vital throughout the wine-making process. An interruption of electricity supply is a risk for the operation.

In-process risks: Six participants noted the risk of poor in-process controls and of not following systematic procedures. The science of wine making depends on the various controls and disciplines applied within the wine-making process and the impacts that occur if the process is not well managed or gets out of control. These controls, disciplines and procedures have various purposes:

- The winemaker follows practices, which lead to better wine quality and the elimination of wine faults. If the process is not well managed or gets out of control, it can lead to the wine being spoiled. The process involves checking, testing and managing the must (juice) to ensure that the correct chemical processes are taking place and that the wine develops correctly. Process control includes the need to measure, control and adjust (if necessary) the temperature, acid, quantitative measure of the acidity (pH), sugar, sulphur dioxide and malolactic acid. Three participants noted this risk.
- Maintaining production controls during the actual wine-making process ensures the production of a high-quality product that is consistent with previous vintages. This includes managing the overall taste or quality of the wine that is produced to ensure that the product matches previous vintages in flavour or style. Not controlling and managing these issues or not following previous historic practices presents as significant risk.

Human resources: Industrial relation is a key risk area, as a representative from each of the five participating wine producers noted the potential risk arising from industrial action in view of the legacy of the apartheid era, the historic perceptions of poor industrial relations in the industry and some current negative reports of unfair labour practices in the industry.

Another risk that was identified relates to the retention of the skills of the winemaker. Several participants noted that there are enough winemakers available in the employment market, owing to training programmes presented by various training bodies. However, while wine-making skills are not seen as unique, winemakers are having organisational knowledge in that they know the strategy, focus and methods of the wine producer where they are employed. The retention of the wine-making skills is important to ensure consistency in the process and a consistent end-product.

The safety of all personnel in the wine-making process is crucial. Employees need to be protected from risks such as carbon dioxide poisoning or perhaps falling from a height (off a tank).

Theme 4: Delivery risks

During the deliver process, transporters are selected to move the finished goods to the customers (Hugos 2018:42; Jacobs & Chase 2018:7; Wisner et al. 2016:514). The *deliver* risk theme includes risks associated with the selling and delivery

process, including warehousing of the finished wine, invoicing or sales of the wine, transportation of the wine to the distributor and after-sales service. These include risks affecting sales revenue (sales margin) and rising costs, market risks relating to bad debts and meeting customer demand, and inventory risks posed by damage to inventory or problems with on-time delivery to customers.

Revenue: Sales revenue is a key risk, as six of the participants identified several risk issues regarding sales revenue. There may be relatively low selling-price increases in the local market versus inflationary costs increases (margins under pressure). While the participants stated that they are increasing selling prices annually, these increases are generally at a level below the inflation level. Competition for wine is very strong in South Africa and the local wine consumers look for the best quality wine at the lowest price. There may be difficulty in moving the price point of wines upwards once the product and the price point on the product are established in the marketplace. The price point is the price of a wine product as determined and set against other competing wine products. When a price point is set for a wine, it is difficult to substantially move away from this price.

In the export market, most of the producers are selling in the currency of the customers, being the Euro and US dollar. In those markets it is extremely difficult to put through Euro or dollar price increases:

‘So once you have attained a level where your product is selling, what it is worth, what it is being sold for, then I think you are entitled to put your prices up by a certain amount every year. But then it (is) also market dependent. In SA we can put up our prices by 4,5% to 7% every year while you can't do that in the USA [United States of America] because it's like a 1% inflation environment. They are not used to a 4,5% increases.’ (Participant 2, male, 19 years experience)

Four participants noted the risk of high and increasing logistics and selling costs.

Market: Bad debts are a significant risk issue for all the participating producers. In the local South African market, some of the producers sell to bigger distributors such as Makro and Woolworths and sell directly to restaurants and other smaller customers. Restaurants and smaller customers increase the risk profile in the local market.

The demand risk category involves the risk of not achieving sales volumes in an environment of variable local demands, smaller orders and the emergence in the market of a demand for craft gins and beer as an alternative to wine. The variable local sales demand sometimes leads to stock runouts. This risk has a link to the forecasting risk noted under the planning risk theme.

Inventory: Damage and delays were identified as risks. Damage can occur in the warehouses or during shipment to

the customer and delays in delivering wine to the customer because of strikes, weather or road closures (including road closures brought about by community action in service delivery protests and demonstrations).

Theme 5: Return risks

The *return* theme includes all issues around product return for any reason, such as quality problems, excess stock not required by the customer and account non-payment. When asked probing questions about returns, the participants noted that such product returns rarely, if ever, occurred in their environment. Therefore, they did not consider that there was any risk in this area.

Theme 6: Enabling (management) risks

This section examines the risks identified by the participants under the *enable* theme, or the management of the business environment. This theme includes all risks within the support, design, planning and execution processes of the supply chain. These include the financial management aspects of the supply chain, with the two sub-categories of profitability and cash flow.

Whilst all the participating wine producers are profitable, three voiced concerns that profitability was not sustainable. They confirmed that many South African wine producers are experiencing various financial pressures. These include increasing costs above the inflation rate, declining yields, difficulties in increasing selling prices to offset the inflationary cost increases and a heavily traded market with competition from other wine brands and alternate alcoholic drinks. This is in line with the findings of the Price Waterhouse Coopers (2013:38) report:

‘I think return on investment [in the wine industry] or return on equity is marginal in SA [South Africa]. It's very low because most of the wine farms, you get your 15%, the other 85% survive basically. There is probably another 30% which just break even and are sometimes profitable, sometimes not, and so on.’ (Participant 9, male, 5 year experience)

Input costs are increasing annually, in line with or above the South African inflation level, with selling prices of wine under pressure, and this is placing pressure on profitability. Thus, protecting the profitability of the operation against this risk is vital.

Five participants noted that cash flow is a significant risk factor. With the length of the supply chain, an investment in 1 year could take 3–5 years to show a return. Therefore, considerable cash resources are absorbed by the supply chain, with cash flow returns only occurring when the debtor pays for his wine. This could be between 30 and 90 days after delivery. This means that wine producers need considerable cash resources injected through investment, and perhaps through short-term borrowings, such as overdrafts. The participants pointed out that financial institutions are very concerned about the wine industry and the extension of credit.

Summary of risks experienced by wine producers and how they manage these risks

It is clear from the discussion that supply chain risks threaten to reduce productivity, increase costs and reduce profits. These findings are in line with the observations by Michalski (2009:213) and Wisner et al. (2016:7) that supply chain risks threaten to increase costs and reduce profits and may affect the sustainability of the business.

The first objective of this study was to identify the supply chain risks experienced by the Stellenbosch wine producers. A summary of the risks is presented in Table 6. Four key risk groups identified by the individual participants are risks around the sourcing of dry goods, agricultural activities, the wine producing activities and sales revenue. There is a need to monitor and manage these areas as best as possible. The second objective of this study was to examine strategies that the participants use to manage the identified supply chain risks. The participant producers use certain management strategies to manage the risks as outlined in Table 6.

Practical implications

It was concluded that the sourcing of dry goods, drought, picking circumstances, in-process risks and sales revenue pose the highest risks for wine producers, and the management should particularly attend to these issues. Drought, picking circumstances and in-process risks fall outside the scope of business management and mitigation of these risks should be sought in insurance and the agricultural sciences. Thus, to remain within the scope of this article, suggestions are made regarding risk management in general and the sourcing of dry goods.

Although not part of the identification and management of the risks, which was the main focus of this study, some of the participants stated that many wine producers follow historic practices but do not formalise systems, which includes not formally assessing risks and having formal plans to manage the risks. They are of the opinion that a formal process could be beneficial to the wine producers.

Two key suggestions are proposed. The first recommendation is the introduction and use of a supplier development programme to improve the relationship between wine producers and their dry goods suppliers in order to improve the supply and quality of goods. The second recommendation is the implementation and use of a formal risk appraisal system to allow for a better and more formal management of risk. These suggestions are discussed in more detail below.

Supplier development

A theme raised by the participants was the poor service offered by their suppliers, especially dry goods suppliers. This occurred in all categories, but most notably boxes, labels and bottles. The poor service had two dimensions, namely, long order lead times and poor quality of the goods supplied.

This manifested in disruption of the supply chain and often led to the need to build in additional time for the order process. Both dimensions had negative cost implications for the wine producers. While all producers mentioned that they had engaged with their suppliers on the issue, they noted with concern a lack of understanding on the part of the suppliers of the impact of their poor service and quality issues. Therefore, it is suggested that producers should engage in supplier development initiatives. Lysons and Farrington (2016:599) define supplier development as an activity undertaken by a buying organisation to improve a supplier's performance and/or capabilities to meet the buying organisation's short- or long-term needs.

It is important to the success of this process for the producer to agree with the supplier that, if there are any problems, the wine producer will have open access to contact the senior manager at the supply company to explain the issues and to express concerns. The producer should seek a commitment from the supplier's management representative that the problems or issues will be addressed once he or she becomes aware of them.

Key to this could be supplier visits to the wine producer's site to understand first-hand the difficulties and costs to the operation that result from supply problems. There are two focus areas for this process: to build a relationship and trust between the producer and the supplier and to educate the supplier about the problems and their consequences.

While, initially, supplier development will take some time, the benefits would become evident in the long term.

A formal risk appraisal process

The importance of risk management and risk mitigation to the activities and processes of a wine producer was noted. Several participants in this study noted that the industry is inherently risky, as it is in the agricultural sector, and that a formal risk appraisal method is crucial:

'... And that's why wine making is all about mitigating your risks.' (Participant 6, male, 21 years experience)

From the responses of the participants, it can be concluded that the wine producers are aware of the risks that they face. All the participants were aware and honest about the risks in their supply chain and their negative effects. They also explained the steps they take to manage or mitigate these risks. However, it was found that they do not undertake a formal risk evaluation process. Their current informal risk management is based on past events and experiences, using knowledge of historical occurrences. The negative aspect of such an approach is that the wine producers do not take enough time to contemplate the future and the potential risks it might present. This is not unique to wine producers and the wine industry but applies to small and medium enterprises (SMEs) in general. In South Africa, SMEs do not view the management of risk as being important for

TABLE 6: Summary of risks and mitigation.

Theme	Risk	Risk item	Strategies participating wine producers use to manage risks
Theme 1: Plan	Demand versus supply	Forecasting	Undertaking as much forward planning as possible
		Planning	Knowing and understanding history and practices Having ready access to customers' sales history Managing the customers' expectations Manage stock supply to customers as best as possible. Creating customer loyalty Being flexible and adaptable enough to make changes
	Dry goods	Costs	Tough price increase negotiations with suppliers, and the negotiation of purchase contracts for bought-out grapes Import substitution to offset increasing costs on local goods
		Supply	Hold additional inventory of the item to mitigate delays (cost and space implications)
		Quality	Import substitution with better quality imports (e.g. imported bottles from China) Improved incoming dry goods controls
Theme 3: Make	Costs	Costs	The tight management/control of 'make costs', including controlling the size of the staff complement using contract labour sparingly.
	Nature	Drought	Conservation and recycling of water to protect their water resources and use irrigation to deliver water to the vines
		Picking	Constant ongoing testing of the grapes for sugar, pH and acidity. Visual inspection and a taste test
		Disease	Spray fungicides against mildew
		Wind/Hail	Not economically viable to insure against such risks
		Pests	'Cover' crops which attract other organisms to control the pests (ladybird beetles and parasitic wasps as a tool against the mealybug)
	Infrastructure	Irrigation	Use back-up generators
		Electricity	
	In-process	Controls	Continuous management of the wine-making processes and environment and through monitoring and testing key attributes within the process (adjusting and correcting when necessary)
	Human resources	Industry relations	Ensuring that employees are paid and treated fairly and equitably Ensuring good communication between management and employees
		Skills	Applying time and effort in training and developing employees
		Safety	To mitigate risk of injury to employees was to have safety protocols Training all employees on safety practices and methods.
Theft/damage		Vigilance	
Theme 4: Deliver	Revenue	Sales revenue	Can be increased through annual selling price increases Employing suitable experienced sales and marketing staff
		Costs	Monitoring managing logistics cost through control of consignment size Tight control of selling costs
	Customers	Bad debts	Tight debtors' control, and the producers having close relationships with their customers
		Demand	
	Inventory	Damage	Improve warehouse controls
	Delays		
Theme 5: Return	Nil	Nil	Nil
Theme 6: Enable	Financial	Profitability	Tight control of selling costs
		Cash flow	Tight management and control over cash resources

organisational success (Smit & Watkins 2012:4), despite evidence that businesses that adopt risk management strategies are more likely to survive and grow (Lockamy 2014:757). As noted by Meyer et al. (2019:2), supply chain risk management is a necessary strategic process to address risks that may happen within a business' supply chain.

A possible objection to undertake a formal risk assessment and risk management process could be the time needed to do this, as the management team at any wine-producing company is small. However, this process need not be onerous and could be handled in an annual 'one-day' risk review session.

Conclusion and areas of further study

The purpose of this study was to identify the risks experienced by wine producers in the Stellenbosch region

of the Western Cape province, South Africa. A qualitative case study was conducted. Data were collected through in-depth semi-structured interviews with 10 participants at five wine producers' sites from key wine-producing areas within the Stellenbosch region. The findings revealed that the main risk factors centred around the sourcing of dry goods; agricultural activities, including the drought and other external hazards; wine-making activities, including in-process controls; financial risks, including margin erosion because of inflationary costs not being matched by selling price increases; and human resource risks.

The main limitations of the study are the following:

- As this was an exploratory study, the study was limited to one wine producer within each of the five wine-route areas of the Stellenbosch wine-producing region. As a result, the findings of the study may not be representative

of the complete wine-producing region of Stellenbosch, and any conclusions and recommendations made in this study cannot be generalised to the whole Stellenbosch area or other wine-producing areas.

- While several risks were identified by the 10 participants in the Stellenbosch wine-producing area, it is possible that not all the risks have been identified.

It is recommended that wine producers implement and use a formal risk appraisal system and that they implement a supplier development process. This would allow for better and more formal management of these risks and could improve the relationship between wine producers and their dry goods suppliers.

While this study identified the risks faced by five wine producers within the Stellenbosch wine-producing area, a future study could be extended to all producers in the area, or to all South African wine producers. This would provide knowledge about the extent of the identified risks and additional supply chain risks under different circumstances and how wine producers could manage the identified risks.

There is a dearth of research into supply chain risks experienced by South African wine producers. Therefore, this research should be useful to understand the supply chain risks faced by wine producers. It is envisaged that the suggestions made will assist in reducing or minimising the impact of these risks.

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Authors' contributions

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