

Jooste, Corneli; van Eeden, Joubert; van Dyk, Esbeth

**Conference Paper**

## South African Wine Supply Chain Performance Measurement Framework

**Provided in Cooperation with:**

Hamburg University of Technology (TUHH), Institute of Business Logistics and General Management

*Suggested Citation:* Jooste, Corneli; van Eeden, Joubert; van Dyk, Esbeth (2015) : South African Wine Supply Chain Performance Measurement Framework, In: Kersten, Wolfgang Blecker, Thorsten Ringle, Christian M. 978-3-7375-4059-9 (Ed.): Innovations and Strategies for Logistics and Supply Chains: Technologies, Business Models and Risk Management. Proceedings of the Hamburg International Conference of Logistics (HICL), Vol. 20, epubli GmbH, Berlin, pp. 305-332

This Version is available at:

<https://hdl.handle.net/10419/209260>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<https://creativecommons.org/licenses/by-sa/4.0/>

**Corneli Jooste, Joubert van Eeden and  
Esbeth van Dyk**

# **South African Wine Supply Chain Performance Measurement Framework**



# South African Wine Supply Chain Performance Measurement Framework

*Corneli Jooste, Joubert van Eeden and Esbeth van Dyk*

Wine cellars in South Africa are looking for ways to improve profitability. Improving the performance of their supply chains may lead to increased profitability, and will definitely increase competitiveness. Performance measurement can be used as a tool to collect information for making supply chain decisions. Currently there is no performance measurement framework for the wine supply chains of South Africa. Private and producer cellars struggle to improve and manage supply chain activities due to the lack of useful information and benchmarks. The research method that is presented describes how an agile design methodology was used to develop a performance measurement framework and address the problem. Through a process of interviews, discussion groups and practical measurements, industry and academic feedback continuously influenced the design. The aim of the framework is to improve supply chain performance, provide strategic direction and enable decision making. In this paper, focus was placed on the distribution channels of packaged products to the local market. Metrics of the framework are categorised according to the attributes of the Supply Chain Operations Reference (SCOR) model. Supply chain segmentation can have a significant impact on the usefulness of metrics and benchmarking. The data of these measurements that will be received from industry can provide insight on the competitiveness and performance of the industry.

**Keywords:** Performance Measurement Framework, Packaged Wine Supply Chain, Supply Chain Metrics, Benchmarking

## 1 Introduction and Background

In today's global world it is often not organisations, but rather supply chains that are competing against each other (Martinez-Olvera & Shunk, 2005). The importance of supply chain wide management and alignment is therefore recognised by more and more industries. As part of a plan to improve the performance of the wine supply chain in South Africa, this study aims to initiate supply chain performance measurements that can be used to provide industry benchmarks.

South Africa is a major player in the global wine industry. As the 12th largest producer of wine, South Africa contributes 4% of the global production of wine (SAWIS, 2014). The wine industry also plays a significant role in the South African economy, by accounting for 1.2% of the national GDP in 2013. The industry is creating jobs and increased the income towards agriculture, tourism, manufacturing, trade and hospitality by 37.8% from 2008 to 2013 (VinPro, 2015).

Although the wine industry is one of the oldest industries in South Africa, the concept of a wine supply chain and the management thereof is still new. Interest in the field of supply chain thinking was delayed until the industry was deregulated in 1993. During the time that the industry was regulated, wine could only be exported through one channel. Deregulation opened exporting opportunities and forced cellars to create international and local market channels for their products for the first time.

The concept of the South African wine supply chain was mentioned in a publication for the first time in 2010 when Stellenbosch University conducted a survey, as part of the PWC annual financial benchmarking of wine cellars, to gather supply chain information (Stellenbosch University &

CSIR, 2010). The term is currently still uncommon to a large number of participants in the chain, but it is becoming more prevalent. Industry bodies are recognising the importance of investigating the topic and within the next decade, it will feature more often when discussing matters of the industry.

Due to the absence of previous research on the subject, the study was approached with a strong focus on supply chain principles from literature. Applying the principles to the wine industry of South Africa required an understanding of this supply chain. In a similar study on the agri-food supply chain, Aramyan (2007) confirmed that it is vital to consider the intricacies of the supply chain that is measured. The possible features that could distinguish one supply chain from another are comprehensive. It is these features that cause management of the wine supply chain to be different from the management of other supply chains (Ouyang, 2012). The metrics that are selected for performance measurement and improvement should capture the essence of organisational performance (Gunasekaran & Kobu, 2007). Several frameworks have been developed to explain these features since they are relevant for performance measurement and for developing a supply chain strategy.

## **1.1 The South African Wine Supply Chain**

To give background on the market and industry for which the performance measurement framework will be developed, some important characteristics of the South African wine supply chain are discussed. These relate to the various processes of the supply chain (source, make, plan, deliver) as well as the financial position of the industry.

Four supply chain segments have been identified through segmentation of the South African market. The four segments are: packaged wine for the local market, packaged wine for the export market, bulk wine for the local market and bulk wine for the export market. Bulk wine refers to large quantities of wine that has not been packaged yet.

Packaged wine for the local market, which is the focus of this framework, is mostly distributed to a variety of supermarkets and distributors (67.3%), but 30.2% is sold at restaurants or other on-trade events where the wine is consumed on the premises where it is bought (Marketline, 2014). Other markets such as online sales and wine clubs account for only 2.5% of the market volume.

Grapes are harvested once a year and this creates annual cycles and segments for inventory management of bulk and packaged wine. The implication for packaged inventory is that products are renewed and reviewed by customers every year. Bulk wine will be kept separate in the warehouse according to the year of harvest. Another natural classification of inventory is between red and white wine. This becomes less relevant from an inventory management perspective when the wine is packaged and distributed.

An illustration of the wine supply chain for local products can be seen in Figure 1.

Complexity of sourcing is relatively high due to long lead times of raw materials. Most raw materials are sourced locally from a variety of suppliers. Cellars usually source grapes from a specific group of grape producers and

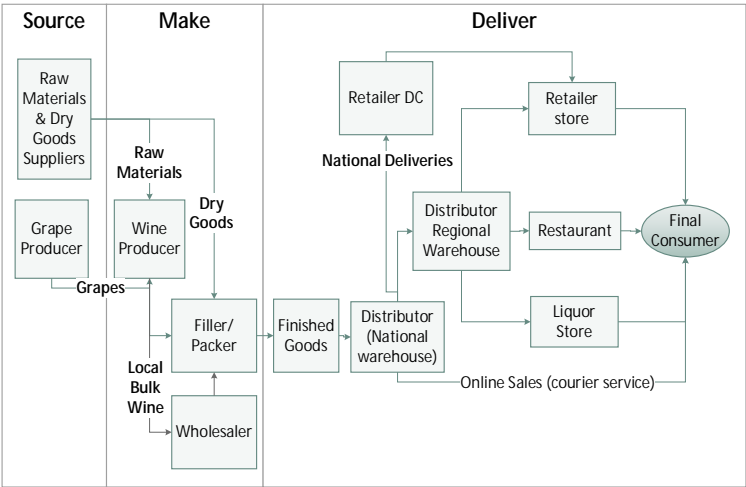


Figure 1 South African Local Wine Supply Chain (Internal project documentation)

have strategic, long term relationships. A lot of inventory is kept throughout the supply chain due to the long production process, distances from suppliers/markets and the importance of having the correct finished goods for orders. Inventory has to be financed, and this causes the wine industry to be very cash flow sensitive.

From discussions with industry, it is clear that cost is a main driver of the market. Transportation is a large cost component due to the long distances to most of the main local markets. Thus full truckloads are usually seen as compulsory for cost-effective distribution.

Before wine is bottled, it can be still be sold as a bulk or packaged product. However, once it is bottled and labeled, the options in terms of customers

are much fewer. Currently there is a surplus of wine in the South African market and customers therefore often have the buying power.

## 2 Methodology

In order to address the problem identified in the South African wine supply chain, a performance measurement framework was developed. Case studies and literature reviews played an important role in the development of the framework and benchmarks. The study commenced in 2014 and comprises of two work streams.

The first work stream performed case studies at 16 wine cellars to identify general issues in the supply chain. The second work stream developed a performance measurement framework and industry benchmarks for three of the four identified supply chains mentioned in section 1.1.

As part of the background study for the development of a performance measurement framework, initial measurements were collected from participating wine cellars in September 2014. The process of capturing information for the metrics introduced cellars to some important metrics. It also created awareness of the decisions involved in supply chain management. Feedback on the results created an opportunity to discuss future segmentation and the selection of metrics for the framework.

Parallel to the practical work, literature sources were consulted to investigate available solutions and methods. Subjects such as performance measurement, supply chain strategy, segmentation, performance measurement frameworks, strategic benchmarking and inventory management provided insight into the design process.



Developing a performance measurement framework for packaged wine in South Africa required an understanding of the business environment of every supply chain participant. Discussions with partners along the entire chain were conducted and included cellars, distributors and buyers at retailers.

The framework started as a selection of a few generic key performance indicators and developed into a balanced set of metrics that addresses the specific aims of the framework. This was achieved by following an agile and adaptable design process and incorporating the information that was gathered from industry and literature on a continual basis.

After an investigation of more than 15 supply chain frameworks, four relevant frameworks were identified. The selection criteria included the field of application, scope and recentness. Two of the frameworks apply to any supply chain, while the other two are developed for specific industries. Each metric of these four frameworks were considered, but only selected if its relevance in the local wine industry could be motivated and validated. The four frameworks are listed in Table 1 and their relevance is discussed below.

The first two frameworks in Table 1 are not industry specific and provide a wide range of metrics for any supply chain. SCOR provides a standard language for defining processes and metrics of any industry and supply chain. It is often seen as the industry standard for supply chain performance measurement and mapping (Stewart, 1997). Perez (2013) focused on the process of defining a supply chain strategy that is aligned with the business strategy. The framework was considered as a performance measurement framework since it provides metrics for each type of supply chain strategy.

Table 1   Relevant supply chain performance measurement frameworks

Framework	Application	Year
SCOR (Supply Chain Council, 2012)	Any supply chain	2011
Supply chain roadmap (Perez, 2013)	Any supply chain	2013
Measuring logistics performance in the wine industry (Garcia, et al., 2011)	Wine supply chain	2012
Measuring supply chain performance in the agri-food sector (Aramyan, 2007)	Agri-food supply chain	2007

Garcia et al. (2012) developed a framework for the wine industry in Argentina. The article identifies that there are different strategies and markets within the industry, but does not segment the industry. This framework assisted with providing metrics and especially definitions.

The research by Aramyan (2007) on the agri-food supply chain was considered due to the fact that a similar development process was followed to develop a framework. The wine industry forms part of the greater agri-food supply chain and therefore they have similar characteristics.

Most metrics were selected from the SCOR framework. The definitions of metrics were often adapted according to the industry specific frameworks. Adaptations were based on the specific characteristics seen in the wine industry and aim to increase the relevance of metrics.

Evaluation of the framework included feedback from academics and industry partners. An agile process was selected since the industry would have to be introduced to the metrics and start capturing some of the information that is not available.

### **3 Literature Review**

The literature review will discuss performance measurement, supply chain strategies, segmentation and benchmarking. Application to the wine industry is mentioned and indicates the relevance of the literature to the development of the measurement framework.

#### **3.1 Performance Measurement**

Performance measurement plays an important role in managing a business and achieving the desired goals (Langley, et al., 2008). The purpose of a performance measurement framework is to provide a set of metrics that can evaluate a complex process and measure the current level of performance. Supply chain processes are complex due to the fact that the cause and effect of supply chain decisions are often separated in time and location. Understanding the interdependencies of decisions enables management and

improvement of activities (Holmberg, 2000). Performance is defined differently for organisations and depends on the business environment and strategy.

A performance metric describes the definition of what is to be measured. They are used to quantify the performance of an organisation through a process of performance measurement (Gunasekaran & Kobu, 2007). The term measurements therefore refer to the values of the metrics. It is important to have a balanced view of the performance of an organisation and also to consider it on a strategic, managerial and operational level (Gunasekaran & Kobu, 2007).

### **3.2 Supply Chain Strategy**

A supply chain strategy is formulated to specify how the supply chain activities should be coordinated to achieve financial success. The motivation to select the correct strategy is driven by the competitive advantages and capabilities that can be achieved (Ambe, 2012). The differentiation in supply chain capability is defined by customer facing metrics as well as internal metrics. Customers experience a service and product based on the reliability (predictability), speed and agility that is presented to them. This experience of the customer is however enabled by a variety of internal capabilities that should be managed. The management of assets as well as the costs involved in creating the perceived value of the product and service should therefore be measured.

After involvement in more than 100 supply chain improvement projects, alignment was the characteristic that Bolstorff and Rosenbaum (2012) sin-

gled out as the key to supply chain success. Aligning the supply chain strategy with other components of the business and corporate strategy is of utmost importance (Perez, 2013).

The scope of a supply chain strategy should entail all the supply chain activities. Frazelle (2002) defines supply chain logistics as the flow of material, information and money from the suppliers' suppliers to the end consumer. The actual supply chain is the network of facilities, vehicles and logistic information systems. Some of the main activities that forms part of supply chain management are listed below.

- Warehousing and distribution centre operations
- Transportation
- Supply
- Inventory management
- Customer response

The goals and aims defined by the supply chain strategy should be translated into operational terms in order to make decisions and execute the strategy. This starts with an investigation process where the current activities are profiled, measured and benchmarked (Frazelle, 2002).

### **3.3 Segmentation**

Segmentation uses the characteristics that differentiate one supply chain from another to determine the appropriate supply chain strategy. When benchmarking, segmentation is required so that organisations are able to compare themselves to similar processes of other organisations.

There are several methods for segmenting. Some authors and frameworks have segmented according to the following characteristics:

- Product types/requirements
- Customer types/requirements
- Uncertainty of supply
- Uncertainty of demand
- Customer buying behaviour
- Relevance of assets in total cost
- Market mediation costs

A generic supply chain strategy and configuration is usually then described for each of the segments. The most common strategies include: efficient, responsive, agile or lean supply chains (Ambe, 2012).

It is important to identify the various supply chains within an organisation, since none of the strategies apply to all products (Hilletofth, 2009). Managing several supply chains within an organisation is advised rather than selecting a strategy with multiple objectives (Perez, 2013). Using a supply chain framework such as SCOR assists benchmarking since it creates a common language for processes and relates it to metrics.

It has been mentioned that SCOR focuses on providing a framework for mapping supply chain processes rather than measuring performance (Cagliano, et al., 2014). The metric section consists of five attributes with more than 200 metrics and each metric is linked to a set of processes. The framework as a whole is rather comprehensive and applying it to an industry requires a good understanding of the industry and the framework.

### 3.4 Benchmarking

Benchmarking is all about determining the performance of an organisation and then comparing it to the performance of competitors (Garcia, et al.,

2011). This concept and tool was made known by Xerox in the 1980's, when it was used to regain market share (Fong, et al., 1998). Supply chain benchmarking only received attention in the 1990's. At first benchmarking was discussed as part of the field of performance measurement. Wong & Wong (2008) identified the increased number of applications that were investigated, as the concept developed.

Supply chain benchmarking is more challenging than general performance benchmarking due to the complex level of collaborative joint decision making (Wong & Wong, 2008). The aim of supply chain benchmarking should therefore be to investigate the integration of performance measures. The lack of infrastructure and resources to support integration in organisations makes this difficult (Wong & Wong, 2008). Limited standardisation of supply chain measurements also creates challenges when benchmarking (Frazelle, 2002).

An important driver of successful benchmarking is a systematic process (Fong, et al., 1998). A systematic benchmarking process creates a framework through which the learning experiences seen from others can be explored (Kozak & Nield, 2001).

Benchmarking focuses on the creation of business knowledge. The transformation from data to information and then to knowledge is very important and benchmarking provides a structure that enables this. Comparing information can be used to create knowledge. Organisations therefore use the benchmarks to create business knowledge for their own organisation (Prasnikar, et al., 2005).

The process of benchmarking involves defining the supply chain strategy, measuring performance and performing the benchmark (Supply Chain

Council, 2012). The APICS SCC developed a 7 step process that can be used to complete a benchmarking study in this matter (Francis, 2012).

## 4 Performance Measurement Framework

The performance measurement framework is developed to assist wine cellars in South Africa in improving supply chain performance through performance measurement. The framework consists of a selection of metrics grouped according to the attributes of the Supply Chain Operations Reference (SCOR) model.

The wine industry share similarities with other industries, but several characteristics will be ignored if it is grouped together with other alcoholic beverages, retail products or agricultural products. Narrowing the scope of the framework to the wine industry, creates the opportunity for supply chain performance measurement to become part of the industry's management principles over the course of the next decade.

### 4.1 The Metrics

The framework is a balanced set of metrics that addresses three aims:

- Improving supply chain strategy formulation and execution
- Enabling decision making
- Indicating the diagnostic Key Performance Indicators (KPI's)

In order to formulate a supply chain strategy, information is required. This may differ from one industry to the next. The supply chain strategy is the starting point for most other supply chain decisions. Key performance indicators or diagnostic measures give an overview of the performance of the



organisation as a whole and industry benchmarks can be created more easily for these metrics. Segmentation is key when defining supply chain strategies. A cellar should define and implement a separate strategy for each identified supply chain.

It was important to develop a practical tool that could be understood and used by all participants. The metrics had to relate to the processes and practices currently seen in the industry, but also provide strategic guidance on how to approach supply chain management on a strategic, tactical and operational level.

Segmenting the wine industry made sense since it enables cellars to compare themselves to realistic benchmarks. It identified those characteristics that distinguish cellars from each other based on the significant industry specific characteristics. It could be useful to perform customer segmentation for the local industry, since the inventory policy (make-to-stock or make-to-order) is usually influenced by the customer's characteristics. The conclusion from the case studies of work stream one indicated that inventory is the major supply chain issue for wine cellars.

By keeping the number of metrics few, cellars are able to implement the framework easily and identify where additional metrics will be required to measure and compare internal performance. The set of metrics is balanced since it evaluates the plan, source, make and deliver activities of a cellar.

The metrics of the framework can be seen in Table 2. Level one metrics are diagnostic metrics. They evaluate the overall health of the cellar in terms of the attribute and indicate where lower level metrics should be implemented. Level two metrics focus on indicating where changes can be made

to the supply chain since they measure specific processes. In order to manage all supply chain activities with the necessary detail, level three, four and five metrics should be defined as part of the internal performance measurement system of the cellar. This can be done by first measuring the level one and two metrics and then adding metrics where problem areas occur or strategic value can be added.

Table 2   Performance Measurement Framework Metrics: Packaged Local

Attribute	Level 1	Level 2
Reliability	Overall Perfect Order Fulfilment	% On time deliveries
		% In full deliveries
		% Correct quality deliveries
		% Correct documentation deliveries
		Demand variation
	Order Accuracy - Dry goods suppliers	

Attribute	Level 1	Level 2
Respon- siveness	Total Order Cycle Time	Internal Order Cycle Time
	Sourcing Cycle Time - Dry Goods	
Agility	Average Resource Utilization	Resource utilization
Cost	Total Logistics Cost	Product Supply Cost
		Packaging Cost
		Transportation Cost Relevance
Assets	Cash-to-cash Cycle Time	Inventory Days of Supply - Finished Goods
		Inventory Days of Supply -Dry Goods
		Creditors Days
		Debtors Days

By measuring level one metrics of each of the attributes, a balanced view of a cellar can be represented on a scorecard. Cellars cannot excel in all of the attributes. It is therefore better to select two attributes for superior performance and have a defined strategy, than aiming to excel in all areas of performance (Perez, 2013). The five attributes will now be discussed individually to indicate their relevance in wine supply chain.

## 4.2 Reliability

Reliability is concerned with the experience of the customer (Supply Chain Council, 2012). A reliable organisation is able to consistently provide a predictable service and product. Perfect order fulfilment is the level one metric for reliability and provides information about how the customer experience the service of the organisation.

In the wine industry, a reliable service can create opportunities to form synergies and sell products to customers. Retailers demand orders to be perfect a certain percentage of the time and measure this continuously.

Product reliability and consistency is an important part of the end consumer's experience of the product (Louw, 2014).

Cellars are able to distinguish themselves from other competitors in the market based on the reliability of their service. Perfect orders create opportunities for close collaboration where mutual benefit can be experienced. If orders are not perfect, the problem may be caused by any of the activities preceding the final delivery. The first step towards identifying the root cause is to categorise the problems that occurred. The level two metrics for reliability are included in the framework for this purpose.

Demand variation and long lead times forces participants in the wine industry to carry inventory of dry goods and packaged finished goods. It is important to know how reliable dry goods suppliers are since additional uncertainty can arise in this section of the chain. The longest average lead time that was measured is 20 days. This is for the capsules used when bottling.

### **4.3 Responsiveness**

Responsiveness refers to the speed of execution and delivery of customer orders. It is an attribute that relates to customer orders and order fulfilment cycle time is the main metric. The relevance of speed in the wine supply chain is high during some of the fulfilment processes, but less relevant in others. Due to the surplus of wine in the industry, responsiveness is most relevant when an order is placed by a final customer. This could be a retailer, independent liquor store or restaurant.

The metrics for responsiveness (order fulfilment cycle time) are only measured at level one in the framework and not broken down into lower levels since responsiveness is not critical at the cellars. Cellars do not easily distinguish themselves based on their cycle time except if they deliver directly to the final customer. To keep selling wine in any market it is, however, necessary to be able to deliver within the lead time required by the customer. Responsive suppliers can enable a sourcing strategy where inventory of dry goods and finished goods are kept low at the cellar. The lack of dry goods inventory can easily cause customer orders to be late. Supplier responsiveness provides information that should influence the selection of suppliers for dry goods and raw materials.

Lead times have a significant influence on the wine industry. It is not uncommon for cellars to be far from the market and suppliers, since grapes are grown in specific regions. Longer lead times increases the amount of safety stock that should be kept. In an industry where cash flow is already a challenge, reduced amounts of inventory can provide financial benefits.

#### 4.4 Agility

The purpose of measuring agility is to quantify or measure the ability of a cellar to sustainably increase and decrease the number and volume of completed orders. Agility in the wine industry relates to the level of postponement that can be applied to finished goods. An agile cellar would be able to postpone its packaging process until an order is received, and still be responsive. This is usually enabled by having spare capacity on packaging machines. Other influencing factors include the speed of processing orders (documentation) and the speed of decision making.

Agility should take longer and shorter term capabilities into account. Longer term considerations for a cellar include the capacity of wine making equipment, bulk storage space, packaged storage space and the capacity of packaging equipment. Shorter term considerations include the amount of additional wine bought in, possibilities to outsource packaging, speed of decision making, dry goods availability and spare capacity of current packaging equipment.

The recommended supply chain metric from the SCOR model (Upside and downside demand flexibility) was not used in this framework since a standard and representative definition of what to include and exclude could not be reached yet. This measure is complex since the wine making process

takes months. It will take a much shorter time to upscale packaging and deliver processes.

An agile cellar is therefore one that can think creatively and make plans where capacity, inventory or any market related problems occur.

#### **4.5 Cost**

There are countless costs within a supply chain that are important. Measuring cost is definitely one of the most important sources of information for decision making and relevant data should be available. The framework only included cost that is linked to strategic decisions identified in the wine industry.

The total supply chain cost is usually defined as the sum of supply, production, inventory, warehousing, transportation and returns cost (Garcia, et al., 2011).

Financial information is always available in the form of income statements and balance sheets. Although these reports provide valuable information they are not created for the purpose of supply chain measurement.

Transportation cost is highly relevant for the South African wine industry due to the large distances travelled, high transportation costs and the lack of alternative methods to road transport. Full truckloads and reducing production costs are often more important than responsiveness due to low profit margins.

#### **4.6 Asset Management**

Asset management aims to measure how efficient the assets that an organisation owns is used (Supply Chain Council, 2012). Inventory strategies and

the decision to in-source or outsource are important considerations for this metric.

Cash-to-cash cycle time is the level 1 metric for asset management. Cash flow is a big concern to wine cellars due to the aging process that can take up to 24 months. Grape producers and other creditors must be paid much sooner. Cash flow constraints influence outsourcing and distribution decisions since outsourcing can create opportunities to reduce inventory or receive payments earlier.

Inventory management creates the most challenges for a cellar and reducing inventory will have a significant financial impact. The consequences of a stock out however have short and long term effects.

#### **4.7 Application and Implementation**

Implementing the framework requires that cellars should measure each of the metrics for their cellar. Industry benchmarks can then be provided by combining the information. Cellars can use benchmarking information to set performance goals and decide whether it would be feasible and profitable to enter a new market. The metrics also create a platform from which cellars should select more detailed supply chain metrics.

Definitions for each metric is provided, but cellars should understand their supply chains well to be able to apply the definitions to their operations, costs, customers and products. Segmentation and demographic information is used to add value to the results.

An example of relevant demographic data include the location of the cellar or the inventory policy. If one cellar uses a make-to stock policy for most inventory, their cycle time might be shorter, but inventory days of supply or



costs might not be as low and agility will decrease. All cellars will measure cycle time as the time from receipt of an order until delivery, but it would be useful to also compare those cellars using similar policies.

The framework has already been implemented partially in the wine industry through the first round of measurements. Six of the metrics were measured during this round and feedback was provided to the 16 cellars that participated in the study. Valuable information that was retrieved from the process is that segmentation should continue to be an important focus.

The results from the first measurements are shown in Table 3. The overall average refers to the average of all segments together. The difference between the two averages indicates the importance of segmentation and why cellars cannot be compared as a whole. The significant differences for order fulfilment cycle time and inventory days of supply are mostly due to differences between bulk and packaged products. Once the wine is packaged, it is stored for as short as possible.

Being able to view the performance of all five attributes simultaneously portrays the strategy of a cellar and provides a holistic view of performance, rather than simply indicating good and poor performance. This concept can be seen in Table 3, where the measurements for one specific cellar (cellar x) is shown next to the best performance of the packaged local segment.

The lower performance in order cycle time and order fulfilment rate may be understood when the superior performance of inventory days of supply is taken into account. Cellar x may be following a make-to-order strategy for

most products. High storage cost might be a concern since very little inventory is kept. Information on the type of storage that is used can help with root cause analysis.

Table 3   Results from first measurements

Metric	Overall average	Packaged local average	Best in class	Cellar x
Perfect order fulfilment	95%	94%	98 %	90 %
Order fulfilment cycle time	11.5 days	3 days	2 days	4 days
Upside supply chain flexibility	25 days	22 days	21 days	21 days
Storage cost	R0.07 per liter	R0.09 per liter	R 0.06 per liter	R 0.12 per liter
Transportation cost	R0.43 per liter	R1.43 per liter	R1.40 per liter	R1.40 per liter
Inventory days of supply	191 days	34 days	12 days	12 days

A second round of measurements is currently being collected. The number of measurements was increased from the first round. Representing a larger part of the industry and providing better definitions for the metrics are important in this round. Demographic data such as the type of storage that a cellar uses, will also be captured.

## 5 Conclusion

This article presented a performance measurement framework that can be used to quantify the performance of wine cellars in South Africa. By implementing the metrics and calculating industry benchmarks, information is provided that will assist with supply chain decision making and strategy formulation. The framework design process focused on applying literature to the local wine industry and recognising the features that differentiate the wine industry from other industries. These characteristics were identified through interviews with industry participants.

The framework should be implemented over a period of time. Through this process supply chain performance measurement and benchmarking will become a standard practice in the industry. The performance measurement framework has the potential to provide the building blocks that are necessary for the wine industry to achieve supply chain excellence within the next five to ten years.

## Financial Disclosure

Financial support for the project is provided by VinPro, Winetech and the National Research Foundation (NRF) for 2014, 2015 and 2016.

## References

- Ambe, I. M., 2012. Determining an optimal supply chain strategy, s.l.: University of South Africa (Unisa), Department of Business Management.
- Aramyan, L. H., 2007. Measuring Supply Chain Performance in the Agri-Food Sector, s.l.: Wageningen University.
- Bolstorff, P. & Rosenbaum, R. G., 2012. Supply Chain Excellence: a handbook for dramatic improvement using the SCOR model. New York: American Managment Association.
- Cagliano, A. C., Mustafa, M. S., Rafele, C. & Zenezini, G., 2014. Logistics Performance Measurement for Sustainability in the Fast Fashion Industry. In: HICL (Hamburg International Conference of Logistics), Next Generation Supply Chains - Trends and Opportunities. Hamburg, epubli GmbH, pp. pp.113-135.
- du Toit, D. & Vlok, P. J., 2014. Supply Chain Management: A framework of understanding. South African Journal of Industrial Engineering, pp. 25 - 38.
- Fong, S. W., Cheng, E. W. L. & Ho, D. C. K., 1998. Benchmarking: a general reading for management practitioners. Management Decision, pp. 407 - 418.
- Francis, J., 2012. AuthorStream: 7 Steps of a Benchmarking Program. [Online] Available at: <http://www.authorstream.com/Presentation/getsudhanshu-1401652-scor-benchmarking-presentation/> [Accessed 15 May 2015].
- Frazelle, E. H., 2002. Supply Chain Strategy. s.l.:McGraw-Hill.
- Garcia, F. A., Marchetta, M. G., Camargo, M. & Morel, L., 2011. A framework for measuring logistics performance in the wine industry. International Journal of Production Economics, p. 284–298.
- Gunasekaran, A. & Kobu, B., 2007. Performance measures and metrics in logistics and supply chain management: a review of recent literature (1995–2004) for research and applications. International Journal of Production Research, p. 2819–2840.
- Hilletofth, P., 2009. How to develop a differentiated supply chain strategy. Industrial Management & Data Systems, pp. 16-33.
- Holmberg, S., 2000. A Systems perspective on supply chain measurements. International Journal of Physical Distribution & Logistics Management, pp. 847-868.
- Kozak, M. & Nield, K., 2001. An Overview of Benchmarking Literature: Its Strengths and Weaknesses. Journal of Quality Assurance in Hospitality & Tourism, pp. 7 - 23.

- Langley, C. J. et al., 2008. *Managing Supply Chains*. s.l.:South-Western CENGAGE Learning.
- Louw, M., 2014. Interview. Rawsonville: s.n.
- Marketline, 2014. *MarketLine Industry Profile - Wine in South Africa*, s.l.: MarketLine.
- Martinez-Olvera, C. & Shunk, D., 2005. Comprehensive framework for the development of a supply chain strategy. *International Journal of Production Research*, pp. 4511-4528.
- Ouyang, H., 2012. *Supply Chain Performance Measurement - The integrated project of Shengda Market Chain and Lijin Agricultural Base*, Hämeenlinna: HAMK University of Applied Sciences.
- Perez, H. D., 2013. *Supply Chain Roadmap - Aligning supply chain with business strategy*. s.l.:David Perez.
- Prasnikar, J., Debeljak, Z. & Ahcan, A., 2005. Benchmarking as a tool of strategic management. *Total Quality Management & Business Excellence*, pp. 257 - 275.
- SAWIS, 2014. *Industry statistics*, Paarl: SAWIS.
- Stellenbosch University & CSIR, 2010. *The South African Wine Industry Insights Survey*, Stellenbosch: PWC.
- Stewart, G., 1997. Supply-chain operations reference model (SCOR): the first cross-industry framework for integrated supply-chain management. *Logistics Information Management*, pp. 62 - 67.
- Supply Chain Council, 2012. *Supply Chain Operations Reference Model*, United States of America: Supply Chain Council.
- VinPro, 2015. Press Releases. [Online]  
Available at: <http://vinpro.co.za/news/sa-wine-industry-raises-its-gdp-contribution-generates-more-jobs>
- Wong, W. P. & Wong, K. Y., 2008. A review on benchmarking of supply chain measures. *Benchmarking: An international journal*, pp. 25-51.