

LOGISTICS SERVICE PROVIDER PERFORMANCE MEASUREMENT: A CONCEPTUAL FRAMEWORK

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Introduction

According to Mentzer and Konrad (1991), the evaluation of performance is a vital managerial function. There are many reasons as to why firms measure their performance. Some examples found in the literature are to see progress, identify success, report performance, evaluate performance, confirm what is already known, reveal what is not known, understand operating processes, assist operational personnel, identify problems and bottlenecks, form new objectives and targets, determining future courses of action and to confirm priorities (Gunnasekaran et al. 2004; Holmberg, 2000; Kennerley and Neely, 2003).

The purpose of this paper is to provide a comprehensive and innovative performance measurement framework for a logistics service provider. The framework is supported in a thorough revision of the existing literature regarding performance indicators system, with particularly significant domain in the field of logistics and freight transport.

This paper is separated into 2 main sections. The first section will discuss the systematic review methodology of the logistics performance measurement literature for logistics service provider combined with a citation network analysis approach. Then, the findings of the review will be presented through the use of the Pajek software and conclusions will be derived. While the 2nd section, a conceptual theory building is used to develop a framework representing a theory of logistics service provider performance measurement.

The Systematic Review Methodology

This manuscript follows the guideline provided by Gopal and Thakkar (2012) as well as Hemingway and Brereton (2009). Figure 1 describes how the articles were selected, evaluated, analysed and interpreted.

The objective of this systematic review methodology will help identify the research streams related to performance measurement in the logistic and supply chain context. The first stage of the review process involved the identification of papers and research reports that were concerned with logistics and supply chain performance measurement. The authors identified electronic databases and websites that could provide potentially relevant articles. The following databases were searched: Emerald, Science Direct, Taylor & Francis, Springer, ABI/Inform, Scopus and Wiley Online Library. However, some journals are available in more than 1 database, such as IJPDLM which is published in Emerald but available in ABI/Inform. To ensure that there has no duplicated journals, ABI/Inform and Scopus were selected as the main database in this systematic review.

The period of publication of the journal articles is from 2005 to 2015. 2005 was chosen as the starting point for the review because it was the year that had the highest number of hits when keywords such as "Logistics" or "Supply Chain" or "Performance Measurement" were selected. Nonetheless, earlier literature was also included.

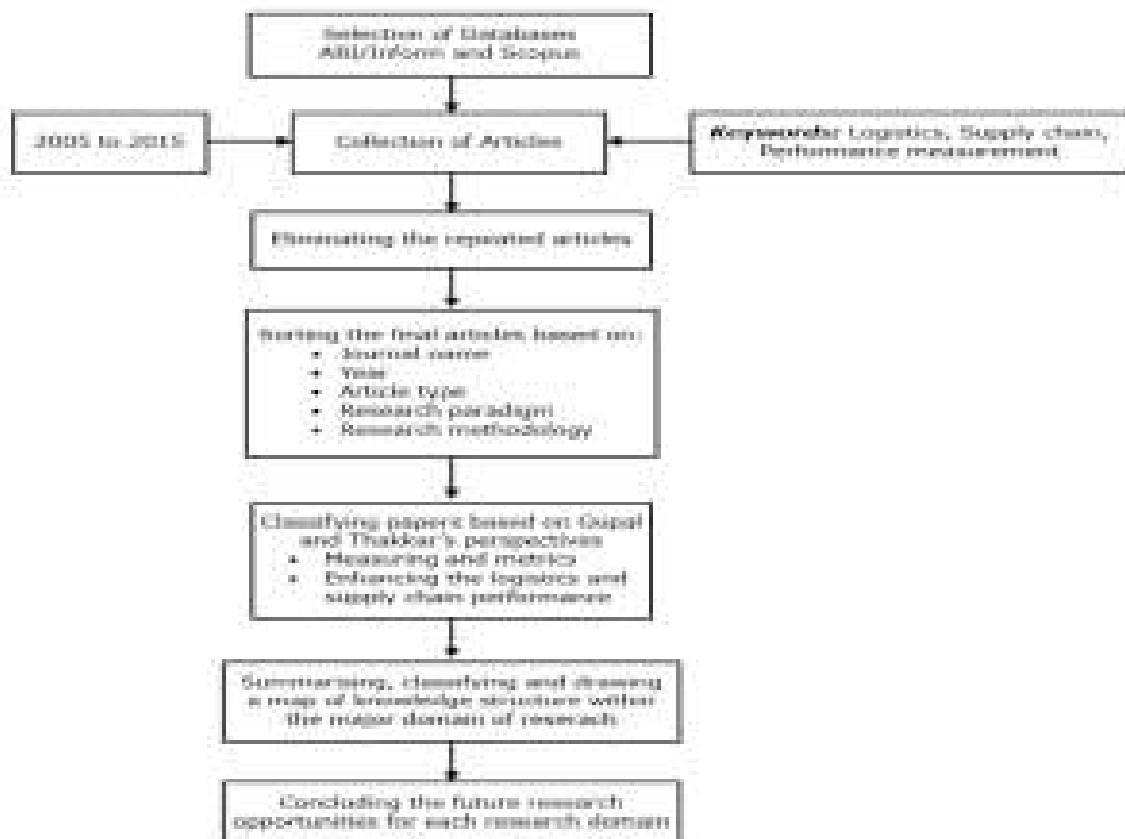


Figure 1: Review methodology

Source: adapted from Gopal and Thakkar (2012) & Hemingway and Brereton (2009)

There are three main keywords used in this review "logistics performance measurement", "supply chain performance measurement", "logistics and supply chain performance measurement" and equivalent keywords are also used for covering all the potential relevant papers. Table 1 summarises the keywords and the search results. This table shows the number of article identified.

Keywords	Equivalent keywords and search strings	Number of articles	
		ABI/Inform	Scopus
Logistics Performance Measurement	Logistics Performance Assessment; Logistics Performance Evaluation	269	2408
Supply Chain Performance Measurement	Supply Chain Logistics Performance Assessment; Supply Chain Logistics Performance Evaluation	530	948
Logistics and Supply Chain Performance Measurement	Logistics and Supply Chain Performance Assessment; Logistics and Supply Chain Performance Evaluation	76	132

Table 1: Search keywords and results (2005-2015)

Source: The Authors

22 papers looked into logistics and supply chain measure and metrics perspective (Gunasekaran et al. 2004; Neely et al., 1995; Beamon, 1999) which explored supply chain metrics as shown in figure 3.

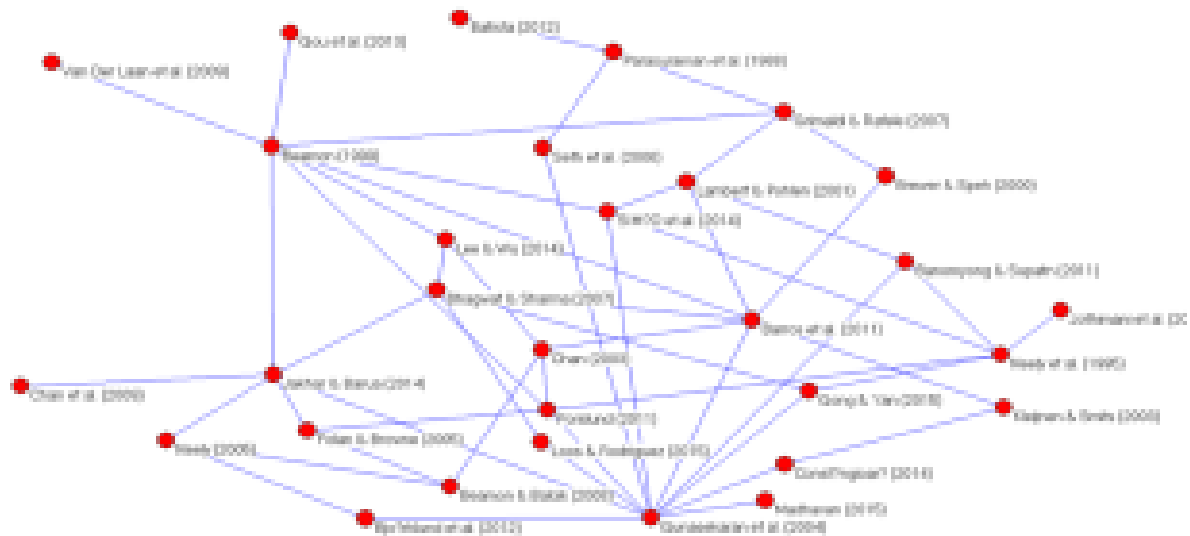


Figure 3: Citation network of supply chain metrics literature
Source: The Authors

Research Streams Path Analysis

Figure 2 and Figure 3 illustrated the structure of two research domains which are enhancing logistics and supply chain performance as well as supply chain metrics by following Main Path Analysis (MPA) approach (Colicchia and Strozzi, 2012), the authors used the citation network as the key to link each article with Pajek software 4.01 (De Nooye et al., 2005).

Reviewing supply chain performance enhancement

There are six research clusters within this domain. The first stream is related to the scope of performance measurement in logistics and supply chain which was proposed by Mentzer and Konrad (1991), Dreyer (2000), Zimmermann (2002), Gardner et al. (2005), Singh et al. (2006) and Wagner (2008). It is about the scope of performance measurement path. The second cluster is focused on total quality aspect which was proposed by Behara et al. (1995), Shokri et al. (2013) and Bejorklund and Forslund (2013) where they measured the probability of manufacturing a product or creating a service through the six sigma concept or zero defects to measure customer satisfaction. The next research cluster is an efficiency and efficacy in logistics and supply chain management proposed by Fawcett and Clinton (1996), Ho et al. (2006), Niemi and Hulskonen (2008) and Keebler and Plank in 2009.

The next cluster is related to KPIs in logistics and supply chain performance measurement which is proposed by D'Avanzo et al. (2003), Folmer and Browne (2005), Sharma and Bhagwat (2007) and Martin and Patterson (2009). The next identified cluster focused on methodology of performance measurement as proposed by Clarke and Gounin (1991), Koota and Takala (1998), Saad and Patel (2006) and Chia et al. (2009). The last stream is the impact of measurement system on firm's performance as discussed by Wong et al. (2014). The starting point of this cluster came from Winer and Fawcett (1991) who identified basic characteristics of world-class manufacturers.

Reviewing supply chain measure and metrics

This research domain presents only one cluster with three articles that have the most citations. The first article named "Measuring Supply Chain Performance" by Beamon (1999) who proposed a supply chain performance measurement stream. This article was used as a reference for developing the performance measurement system by many practitioners and scholars such as Grimakli & Rafale (2007), Van Der Laan et al. (2009), Barros et al. (2011), Forslund (2011), Gou et al. (2013), Jakhar & Barua (2014), Lee & Wu (2014) and SIMÃO et al. (2014).

The second most cited article entitled "A Framework for Supply Chain Performance Measurement" by Gunasekaran et al. (2004) who proposed a supply chain performance modelling/framework stream. This article was used as an important reference to assess performance by scholars such as Seth et al. (2006), Banomyong and Supatn (2011), Barros et al. (2011), Forslund (2011), Bjorklund et al. (2012), Constăncioară (2014), Jakhar and Barua (2014), SIMÃO et al. (2014), Madhavan (2015), Loos and Rodriguez (2015) and Gong and Yan (2015).

The last seminal paper is entitled "Performance measurement systems design: a literature review and research agenda" by Neely et al. (1995) who proposed a performance measurement framework. This paper was cited by academics and practitioners such as Banomyong and Supatn (2011), Forslund (2011), Jothimani et al. (2014), Simao et al. (2014) and Gong and Yan (2015) in their development framework.

Beside of using systematic review, the authors still perform the traditional review about LSP performance measurement and found that

- Knemeyer, et al. (2003) study the perspective of a customer. If the customer perceives that the LSP focuses on the interaction between the companies and is concerned with winning and keeping the customer, the relationship can be strengthened.
- Stank et al. (2003) examine how relational, operational and cost performance relate to customer satisfaction, loyalty and market share.
- The internal business perspective translates the customer perspective into what the company must do in order to meet its customer's expectations. But the targets for success keep changing; and thus innovation is needed. For LSP s innovations can include additional activities, regions, transport modes and communication systems e.g. RFID or WebServices (Chapman et al., 2003 , Lemoine et al., 2003).
- Financial indicators measure if the company's strategy, implementation and execution contribute to bottom-line improvement.

Proposed Conceptual Framework

The literature overview presented in the previous section supports the view that there are different points of view (both internal and external) on the company's performance. The internal point of view is represented by management and employees within the company. The external point of view shows the perspective of the customer and the society.

The authors introduce the concept of performance measurement – the integration of environmental, social, economic and others criteria that allow service providers to achieve long term sustainable viability – to the logistics literature. Then a proposed framework of logistics performance measurement and develop performance indices based on logistics service provider's perspective. The authors conclude by discussing managerial implications and future research directions, including the further development and testing of the framework.

Horizon \ Point of view	Internal		External	
	Management	Employees	Customer	Society
Long-term				
Short-term (operations)				

Table 2: LSPs performance measurement point-of-view
Source: The Authors

The vertical axis divides the performance indicators in long-term and short-term. This distinction has been previously used in other research (e.g. Gunasekaran et al, 2001) and is accepted as a meaningful division that the decision makers find applicable.

Horizon \ Point of view	Internal		External	
	Management	Employees	Customer	Society
Long-term				
Short-term (operations)				

Table 3: Performance indicators perspective
Source: The Authors

An extra extension has been added for the management point of view, the KPI schema has been further split in four categories: Effectiveness, Efficiency, Satisfaction, IT utilisation and innovation.

Horizon \ Point of view	Internal		External	
	Management	Employees	Customer	Society
Long-term				
Short-term (operations)				

Refinement of management point of view			
Effectiveness	Efficiency	Satisfaction	IT utilisation & innovation

Table 4: Management point-of-view
Source: The Authors

After that the KPIs for LSP performance measurement were listed as follow.

Internal perspective – Management point of view				
Efficiency Revenue ↑ Profit margin ↑ Capacity utilization ↑ Keep on day ↑ Labour productivity ↑ Price ↑ Turnover per lot ↑ Number of deliveries ↑ Receipt per delivery ↑ Time per period ↑ Perfect order fulfillment ↑			Total number of orders ↑ Number of customers ↑ Number of new customers ↑ Number of repeat customers ↑ Number of profitable customers ↑ Continuous improvement, rate ↑ Product range ↑ Fleet utilization ↑ Total loading capacity (for trucks) ↑ In-time delivery performance ↑	Long term plans availability / development ↑ Market share growth ↑ Number of markets that have been penetrated ↑ Successful contacts - % of successful deals out of the total offers ↑ % distribution of distribution planning schedule ↑ % of orders scheduled to customer request ↑ % of supplier contracts negotiated meeting target terms and conditions for quality, delivery, flexibility and cost ↑ Competitive advantage ↑
Agility Total distribution cost ↓ Labour utilization ↑ Overhead percentage ↓ Operating losses ↓ % of non-employees ↓ Subverts and benefits ↓ Controllable expenses ↓ Non-controllable expenses ↓ Customer service costs ↓ Order management costs ↓ In-warehouse ↓ Number of trade items ↑ Total delivery costs ↓			Average fuel consumption ↓ Average delivery re-planning time ↓ Marketing costs ↓ Failure costs ↓ Pre-claim costs ↓ Approved freight rate costs ↓ % of failed orders ↓ % of material lost out of planned lot ↑ Performance measurement costs ↓ Repair (rework) costs ↓ Variable asset costs ↓ Fixed asset costs ↓ Information system costs ↓	Operational management information systems ↓ Quality of delivery documentation per manufacturer ↑ Effectiveness of delivery invoice methods ↑ % orders / lines received with correct shipping documents ↑ % of product transferred without distribution errors ↑ Item Picking Time: decrease of time ↓ Order management costs ↓ Supply chain finance costs ↓ Total supply chain costs ↓ Total time to repair the trucks ↓ % rate of material orders vs. requested orders ↓ Average delivery planning time ↓
Supplier Address of drivers ↓ Movers, location of personnel ↑			In-time delivery performance ↑ Number of customer complaints ↓ Overall customer satisfaction ↑	% of orders scheduled to customer request ↑ On-time employee satisfaction ↑ Overall carrier satisfaction ↑
IT and innovation Information system costs ↓ Operational performance information availability ↑ Utilization of IT equipment ↑ IT training costs ↓			Number of new products in the range ↑ % of information exchange through IT ↑ % of employees with IT training ↑ Availability of IT equipment ↑	% of information management needs with particular needs ↑ % of service requests and problems generated via EDI ↑ Average time for new products development ↓ Average costs for new product development ↓
Internal perspective – Employee's point of view				
Km per trip ↓ Working conditions ↑	Weight in car load per labour hour ↓	Salaries and benefits ↑		
External perspective – Customer's point of view				
Transportation price ↓ Insurance price ↓ Primary services price ↓ Goods safety ↑ Product safety ↑ Responsiveness ↓	Transparency for a customer ↑ Possible types of communication ↑ Available types of goods insurance ↑ (order size flexibility) ↑ Timeliness of goods delivery ↑	Service variety ↑ Order configuration flexibility ↑ Possibility to change order details ↑ Additional services price (priority transportation) ↓ Contact points (number of people in contact) ↓		
External perspective – Society's point of view				
Level of CO ₂ emission ↓ Society satisfaction / Working reception ↑ Recycling level ↓ Employee satisfaction ↑ Disaster risk ↓	Solid portfolio emission ↓ Taxes on the national treasury ↑ Participation in charitable actions ↑ Reputation of a company ↑ Road maintenance costs ↓ Number of available work places ↑	Competition level among similar companies ↑ Care for animals/children around ↑ Use of innovative technologies ↑ Development of innovative technologies ↑ Cooperation with other companies ↑		

Summary

This paper used the systematic method to review 38 articles from 28 journals and 2 databases. Subsequently, these 38 articles are classified into 2 main research domains based on Gopal and Thakkar (2012). The authors analyzed main path analysis (MPA) by following the guideline from Colicchia and Strozzi (2012) and used citation network as a key to link each article and conducted by Pajek software 4.01 (De Nooye et al., 2005) in each research domain.

The analysis shows that there are six research streams in the enhancing supply chain performance domain and three seminal papers in the supply chain measures and metrics domain. This review also observed gaps in research areas related to each paths. The first path describe that many performance dimensions are taken into account. This is the same as in the fourth path which investigate the use of common measurement metrics in an attempt to determine which one(s) are most useful for measuring performance but not including the environmental and social perspectives.

Hence, future research efforts in both these paths should aim to better understand how to measure environmental and social practices.

The second path is a reflection on how quality management programs can be implemented effectively through performance measurement. The third path describe how diagnostic and assessment of logistics and supply chain performance can be done. However, there is a lack of benchmarking research to identify best practices. The fifth path describes various dimensions of performance but the measurement methods are restricted to single-firm case studies. The last path of enhancing supply chain performance domain is limited on how to utilise integrated measures that can highlight the contribution of corporate goals such as Economic Value Added. Finally, the three seminal papers by Beamon (1999), Gunasekaran et al. (2004) and Neely et al. (1995) must be referred to when reviewing supply chain measure and metrics.

This paper is part of ongoing research. Then this proposed conceptual framework will be empirically validated, to prove this framework into accepted and validated model. Results encourage researchers and practitioners to be more highlight the importance of framework development over other factors like developmental strategies, success factors etc which had been the prime focus of earlier researches.

Based on this research, new performance measurement conceptual framework is proposed for existing logistics paradigms. The detailed analysis presented in this research paper offers a set of characteristics and structure that industry as well as academia could use it as a guidance framework to measure logistics service provider performance.

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MANAGING STOCKOUT AND OVERSTOCK OF IMPORTED GROCERY PRODUCTS IN A SUPERMARKET CHAIN

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Introduction

The profitability of the supermarket business is dependent on its sales revenue and efforts to keep operating costs low. It is important for supermarkets to maintain a high level of customer satisfaction by ensuring that the products are made available to customers at the right place, at the right time, at the right quantity and at the right price. Supermarket chains are often concerned with managing out-of-stock (or stockout) and over-ordering of grocery products as demand forecasting for such products can be very challenging.

The costs of stockout (when goods are unavailable) and overstock (when excess goods are accumulated) for a supermarket business can be high. Stockouts lead to immediate loss of sales as customers shop for products or alternatives elsewhere, loss of follow-on business, and loss of goodwill and reputation in the longer term. Overstocking leads to higher holding costs as more storage space is needed, locks up scarce resources as the capital cannot be used elsewhere, contributes to ageing inventory (e.g. inventory held for more than 90 days), and leads to higher disposal costs when the product shelf life expires. Both stockout and overstock situations can adversely impact the profitability of the supermarket business.

This paper examines the stockout and overstock of imported grocery products in a supermarket chain in Singapore. The supermarket chain has over 120 outlets providing a wide range of grocery products sourced from all over the world. The chain has a fresh food distribution facility and a distribution centre (or centralised warehouse) for efficient logistics support. It proactively seeks new supply chain relationships with overseas grocery suppliers to provide more product variety for its customers and keep prices competitive. Products with good saleability in overseas markets are often introduced to the local market despite the potential uncertainty of customer demand for these products. The supermarket chain also diversifies its supply sources to manage the risks involved in bringing in these products into the market.

Finding the right balance of inventory levels for imported grocery products is not easy. Competition in the supermarket industry in Singapore is very intense and supermarket chains have to source for products world-wide to secure competitive prices through bulk purchases. Various promotions and festive occasions throughout the year require imported grocery products to be brought in larger bulk to cater to increased demand. Festive season products tend to be expensive, non-returnable and usually cannot be sold after the festive period.

Therefore, it is important for inventory planners to manage the inventory levels well and strive to make good order forecasts so as to cater to demand during normal and promotional periods. This study attempts to find answers to the following research questions:

- What are the main causes of stockout and overstock of imported grocery products?
- How can the order forecasting of these products be improved to minimise stockout and overstock situations?

Literature Review

According to Gruen et al. (2002), about 47% of stockout incidents can be attributed to store order and forecasting, while 28% is due to upstream causes and 25% is due to store replenishment. Other contributing factors can include container delays and late replenishment order from supermarkets. Gruen et al. (2002) reported that about 31% of consumers would purchase an item from another store when the item is unavailable at the store. Besides the direct or indirect loss of potential sales at the supermarket outlet, there is the issue of customer dissatisfaction.

Aburto and Weber (2007) noted that improving the forecasting accuracy of a supermarket can help to reduce stockout incidents while allowing the supermarket to keep its inventory level low. They advocate that solving the stockout problem requires a reliable prediction of the stock's demand. However, they iterated that this is not easily achieved as sales can be dependent on various factors such as past sales, prices, advertising campaigns, seasonality, holidays, weather, sales of similar products, and competitors' promotions.

Overstocking can be a result of poor management of stock demand where inaccurate inventory data cascades from the warehouse to the stores (Hooi, 2013). It also occurs when a product has a stipulated selling period with unknown demand, where supermarkets deliberately overstock to hedge against uncertainty in the stock's demand (Tsay, 2001). This can happen at the level of the warehouse or retail outlet. When overstocking occurs at the warehouse, stocks are likely to be "pushed" to the supermarket outlets. If the outlet staff has poor management of its shelf spaces, these excess stocks have to be shifted to the storage room. Over time, this leads to high stock returns to the suppliers or stock disposal when products reach their expiry dates. All of these create higher logistical and administrative costs.

Many studies have looked at improving order forecasting, yet it is still a challenge for many supermarkets to make accurate forecasts on orders. This is because order forecasting is highly contextual and is easily affected by various ordering processes and replenishment policies specific to the supermarket business (Chopra and Meindl, 2016). There is never a 100% accurate forecast, but many are striving to obtain an order forecast as accurate as possible.

Methodology and Data

We used the case study method (Saunders et al., 2012) to investigate the stockout and overstock situation at this particular supermarket chain. Qualitative and quantitative data was obtained to address the research questions. To understand the main factors that caused stockout and overstock, we had discussion with the procurement and inventory managers. The cause-and-effect analysis was applied to identify the root causes. We examined the current process for ordering imported grocery products and then attempted to improve the order forecasting process.

Figure 1 shows the current process for ordering imported grocery products. For a new product, the procurement manager gathers necessary information (e.g. price and profit margin) and presents to the ranging committee that meets on a weekly basis for approval. The committee makes a comparison of the new product with existing items. If the product is rejected, no follow-up action is required and the supplier is informed of the reasons for the rejection. If the product is approved, the procurement manager informs the inventory planner to add the new approved items with the existing ones under the same supplier (where applicable) to obtain updated order quantities for the next order. Once the order quantities have been approved, the inventory planner triggers a new order to the supplier.

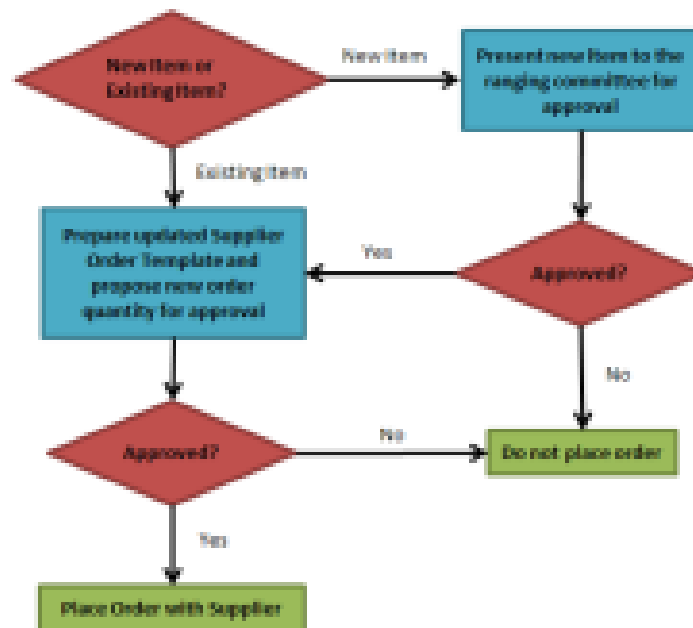


Figure 1: Current process for ordering imported grocery products

The following information was examined to provide a better insight into the ordering process:

- **Monthly Write-Off Report:** This report is used by inventory managers to monitor the monthly write-offs at the warehouse level. Write-offs can be due to damaged products, seasonal products that cannot be sold after the festive period, and stocks past their expiry date.
- **Point-of-Sales (POS) Data:** Data is extracted from the intranet based on various specifications such as by individual store, individual supplier, and items by the respective retail formats.
- **Supplier Ordering Template:** Available on a daily basis, this Excel-based spreadsheet is used by the inventory planner (imports) to help make important decisions on ordering. It consists of up-to-date descriptions and specifications of products under a particular supplier.
- **Temporary Not Available (TNA) Report:** Available on a weekly basis, this report informs the supermarket outlets on products currently unavailable and arrival date of the next shipment.
- **Warehouse Stock Expiry Report:** This report consists of all the items current made available in the warehouse sorted from the earliest expiry date to the latest. This report is useful for monitoring product shelf life and gives the inventory planners time to react.
- **Supplier Product Quotation List:** This list contains product specification and pricing information from suppliers when there are new item proposals for procurement managers to consider.
- **Warehouse Stock Inventory Report:** This report provides an overview of products in the warehouse and supermarket outlets. It includes detailed information on product listing, classifications and inventory level.

Table 1 shows an example of the supplier ordering template for seven different flavours of instant noodles from a certain supplier based on average monthly sales from December 2014 to February 2015. The supermarket wants to place a new order SL003/15 to arrive in Singapore on 16 April 2015. It is important to ensure up-to-date and correct data provided by the suppliers is reflected in the spreadsheet. Table 2 describes the various columns of the spreadsheet.

PURCHASE ORDER & INVENTORY

Supplier: 080-170-130-075-000
 Proposed Date: 12-09-12

										INCOMING ORDER			
										12-Apr-13			
										SKU0125			
ITEM	SKU	PRODUCT DESCRIPTION	UNIT	QTY	UNIT PRICE	AMOUNT	TAX	TOTAL	ORDER DATE	ORDER QTY	ORDER PRICE	ORDER TAX	ORDER TOTAL
1	001	001	001	100	1.00	100.00	0.00	100.00	12-09-12	100	1.00	0.00	100.00
2	002	002	002	200	2.00	400.00	0.00	400.00	12-09-12	200	2.00	0.00	400.00
3	003	003	003	300	3.00	900.00	0.00	900.00	12-09-12	300	3.00	0.00	900.00
4	004	004	004	400	4.00	1600.00	0.00	1600.00	12-09-12	400	4.00	0.00	1600.00
5	005	005	005	500	5.00	2500.00	0.00	2500.00	12-09-12	500	5.00	0.00	2500.00
6	006	006	006	600	6.00	3600.00	0.00	3600.00	12-09-12	600	6.00	0.00	3600.00
7	007	007	007	700	7.00	4900.00	0.00	4900.00	12-09-12	700	7.00	0.00	4900.00
8	008	008	008	800	8.00	6400.00	0.00	6400.00	12-09-12	800	8.00	0.00	6400.00
9	009	009	009	900	9.00	8100.00	0.00	8100.00	12-09-12	900	9.00	0.00	8100.00
10	010	010	010	1000	10.00	10000.00	0.00	10000.00	12-09-12	1000	10.00	0.00	10000.00

Order lead time : 1 month

Table 1: Sample input from the supplier ordering template

Col	Description	Spreadsheet Computation	Source / Remarks
A	Stock Keeping Unit (SKU)	-	-
B	Product Description	-	Supplier product quotation list
C	Carton Pack Size	-	Supplier product quotation list
D	Distribution Centre/Warehouse	-	-
E	Product Shelf Life (months)	-	Supplier product quotation list
F	Warehouse Stock-on-Hand or WH SOH (cartons)	-	Stock inventory report
G	Store Stock-on-Hand or Store SOH (cartons)	-	Stock inventory report
H	Total Stock-on-Hand or Total SOH (cartons)	= (Column F + Column G)	-
I	Average Monthly Sales (cartons)	-	Point-of-Sales (POS) data
J	WH SOH Months of Supply (months)	= (Column F / Column I)	-
K	Total SOH Months of Supply (months)	= (Column H / Column I)	-
L	Proposed New Order Quantity (cartons)	-	Input from inventory planner
M	Estimated Available Stocks in WH (cartons)	=IF((Column F) - (((Column L - Start Date) / 30days)*Column I) > 0, (Column H + Column L) - (((Column L - Start Date) / 30days)* Column I), Column L)	-
N	WH SOH + New Shipment MOS (months)	= (Column M / Column I)	-
O	Estimated Available Stocks in WH & Store (cartons)	=IF((Column H) - (((Column L - Start Date) / 30days)*Column I) > 0, (Column H + Column L) - (((Column L - Start Date) / 30days)* Column I), Column L)	-
P	WH SOH + Store SOH + New Shipment MOS (months)	= (Column O / Column I)	-

Table 2: Description of supplier ordering template

Results and Discussion

Causes of stockout and overstock

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2013	\$504,990.42	\$ 8,375.84	\$29,853.17	\$ 61,076.32	\$126,984.83	\$76,807.82	\$66,474.86	\$41,413.69	\$61,941.13	\$66,381.36	\$ 34,186.89	\$26,491.83	\$1,285,978.11
2014	\$ 62,540.87	\$26,086.78	\$26,829.42	\$ 81,238.57	\$ 34,788.76	\$73,961.82	\$6,732.43	\$62,786.11	\$75,783.58	\$62,224.44	\$ 28,841.79	\$26,121.13	\$ 788,113.85
2015	\$ 76,483.11	\$ 7,386.17	\$11,429.69	\$11,831.51	\$ 47,136.53	\$41,682.34	\$11,437.55	\$41,953.85	\$5,473.37	\$47,791.79	\$21,384.83	\$48,729.93	\$ 668,921.11



Figure 3. Monthly write-off value of imported grocery products, 2013-2015

Improving the order forecasting process

Microsoft Excel Solver was incorporated into the supplier ordering template in an attempt to improve the ordering forecasting process by optimising the order taking into account the average monthly sales, Months of Supply (MOS) and current inventory levels. The following settings in Solver were used (Figure 4):



Figure 4: Excel Solver Parameters

Due to time and resource constraints, it was not possible to gather more detailed for an extensive investigation. Further work can look at conducting surveys with end customers at the supermarket outlet level to gather their response when they encounter out-of-stock situations rather than obtaining information from secondary sources. More studies can also be done to explore ways of increasing the frequency of stock replenishment and improving shelf displays to maximise the space utilisation so as to improve stockout situations.

Another area for future work can be to explore the use of auto-replenishment systems for imported grocery products using sophisticated technologies and software where orders are auto-generated by the system and sent to suppliers. This can provide the supermarket chain a competitive advantage by reducing the order lead time and increasing work productivity.

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PERFORMANCE – BASED LOGISTICS SERVICE BUSINESS MODEL UTILIZING CLOUD COMPUTING

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Introduction

In the contemporary business environment, competition in the consumer markets is largely between supply chains and depends on how well service providers manage their supply chains (Lam, 2013). Manufacturers continually strive to differentiate themselves from their competitors not only in terms of products and services but also their supply chains. These manufacturers as shippers expect logistics service providers (LSPs) to provide high quality services such as on time deliveries, fast and consistent transit times, wide networks, and accurate invoicing (Conaway, 2011).

Currently in the market, third-party and fourth-party logistics providers (3PL and 4PL, respectively) attempt to coordinate complementary services and act as a single contact point for shippers (Tezuka, 2011). We refer them as LSPs in general in this paper. The supply chain process is complex involving various logistics operators/ second-party logistics providers (2PLs). During the integration process, LSPs do not provide all the logistics services by themselves and they often have to engage 2PLs for operations which are not part of their core businesses (Tezuka, 2011). The 2PLs' service quality can directly affect the reputation and performance of the integrators (Bask, 2001). Therefore, it is crucial for LSPs to assess and monitor 2PLs' performance. This leads to a need for having a mechanism to evaluate logistics operators' performance (Dibenedetto, 2007).

Supply chains are further complicated by information distortions and holdup problems because individual entities often only focus on their own objectives and goals, resulting in higher total logistics costs (Lam and Bai, 2016). With a background of a challenging marketplace, the study aims to develop a performance-based intelligent logistics service business model for LSPs which enhances their capability in logistics service offering and improves supply chain performance by utilizing Internet of Things (IoT) network and cloud computing.

After the introduction, section 2 provides a brief literature review. Section 3 illustrates the new business model. Section 4 provides a conclusion and future research directions.

Literature review

This study refers to the evolving concepts of logistics performance in the literature. The management of LSPs and 2PLs is a key issue in supply chain management (SCM) as they are major players in the supply chain processes bringing products and services to end customers (Bask, 2001). LSPs play an important role in improving supply chain performance through collaboration and the integration of logistics activities (Panayides and So, 2005). A body of literature has examined the parameters for logistics performance evaluation (e.g. Jharkharia and Shankar, 2007; Kayakutu and Buyukozkan, 2011). While reliability, cost efficiency, and responsiveness have been widely acknowledged in the literature, little can be found addressing sustainability as a performance indicator for LSP, even sustainability is increasingly important in SCM (Lam and Dai, 2015).

The concept of Performance-Based Logistics (PBL) states that payments to service providers should be based on their success in delivering desired outcomes (Randall et al., 2010). In accordance with Berkowitz et al. (2003), under the practice of PBL, the actual service delivered by LSPs should be measured against predetermined performance standards by customers. PBL is increasingly