



THE DEPLOYMENT OF PERFORMANCE MEASUREMENT SYSTEM UNDER THE SUPPLY CHAIN MANAGEMENT ENVIRONMENT: THE CASE OF MALAYSIAN MANUFACTURING COMPANIES

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ABSTRACT

Performance measurement system in supply chain management (SCM) has been receiving increasing attention by business organizations as a way to evaluate efficiency in supply chain activities. Assessing the performance of supply chain uncovers the gap between planning and actual performance as to trace the potential problems thus ascertain necessary areas for improvement. This research aims to investigate the application of performance measurement system in SCM as well as exploring its relationship with organization's performance among Malaysian manufacturing firms. By utilizing the questionnaire method, respondents involved were requested to indicate the extent to which they use a number of 24 selected performance measures that are related to SCM. The results show that the majority of the observed manufacturing firms utilize specific performance measurement tools in evaluating the supply chain performance. The current performance measurement techniques, the Balanced Score Card is adopted by around a quarter of the total responding firms followed by Supply Chain Operations References Model – SCOR, which attracts total users of only a fifth of the total respondents. In particular, performance measures under customer service category recorded the highest number of usage followed by cost-based performance measures and operations management. The results of this investigation also unveil few major points that are important to be highlighted. Firstly, the obtained outcomes of this study bring to light the significant relationships between the utilization of supply chain performance measures under customer service, operations management and organizational performance. In addition, this study discovered a significant correlation between the size of the organization and the extent of use of supply chain performance measures and how these two variables positively correlated. Lastly, the findings also suggested that the performance measures for SCM has been playing a crucial role in enhancing the performance of the organizations and is increasingly operated as the firms grow in size. Based on the brief highlighted points listed above, it is not an exaggeration to say that this research contributes new information to the body of knowledge in performance measurement system in SCM and its associations with organizational performance.

KEYWORDS

performance measures, supply chain management, manufacturing sector, performance, Malaysia.

Introduction

Over decades ago, there has been a tremendous amount of interest shown towards the application of performance measurement of supply chain. This is in response to the growing recognition of supply chain

management (SCM) in many organizations as a solution to the nature of logistics operations of business enterprises that has becomes increasingly complex over times. In addition, SCM also assists in recognizing the key components in firm's supply chain namely long-term strategic alliance, supplier-buyer

partnerships, cross-organizational logistics management, joint planning, inventory control, and information sharing of the organizations [1]. Although supply chain itself is commonly regarded as one single unit that aids the conversion of raw materials into finished products, the process itself actually comprised of a number of business components which integrates relationships among suppliers, manufacturers, distributors, and retailers [2]. Therefore, in measuring the level of success of SCM, a proper adoption of performance measurement system (PMS) is required for monitoring and controlling purposes. PMS, which serves as an essential management technique, provides the necessary assistance for performance improvement in alleviating supply chain achievement, increasing overall customer satisfaction, level of competitiveness and firm's profitability. To be specific, SCM performance measurement can be concluded as a set of metrics and processes that are related to the assessment on the accuracy of planning of SCM and its execution. This method helps the rise of the overall business capability of both firm and industry levels since it provides a deeper understanding and promotes cooperation among supply chain members [1, 3]. Due to its strategic role within the components, supply chain performance measurement does not only able to provide feedback information that develops progress, enhance motivation and communication and diagnose problems [1] but also allows the tracking and tracing of efficacy and efficiency failures. All these components combined can lead to well-grounded decision making with regard to chain design [4].

As there are many available performance measurements, an organization needs to firstly identify the proper PMS that can cater to the needs of SCM. It is a must for PMS to be appropriately structured as to provide the managers with an easily accessible and comprehensible information [5]. Information will need to be timely in order to achieve broader strategic aims. Reference [3] also supported this notion by claiming that researchers should consider developing measures of supply chain relationships and the supply chain as a whole, rather than relying only on the measures of intra-organizational performance [6]. Therefore, identifying the suitable performance measures on most of the criteria is essential and it should be an integral part of any business strategy. However, due to the presence of multiple inputs and multiple outputs in the supply chain, the choice of the appropriate supply chain performance indicators has become rather complicated. Thus, many manufacturing firms employ different approaches for SCM performance evaluation. However, to recognize

the developing key performance indicators (KPIs), or metrics, is very challenging and there is no set of practical guidelines that is readily available for companies and SCM practitioners [7]. As to solve this complication, there are numerous studies conducted to focus on model and framework of PMS in SCM (see for example 8, 9, 10, 11, 12). Scholars such as [8] for example, argued strongly that a PMS (rather than a single metric) is necessary for securing an effective performance measurement. Reference [7] also stated that companies should focus on only a small list of KPIs that is critical for their operations management, customer service, and financial viability. Even though many researchers believe as such, the availability of empirical evidences to support the application of performance measurement in SCM are unfortunately scarce, in spite of the growing interest in SCM among current market [3]. Therefore, this paper aims to investigate the PMS in SCM as employed by the Malaysian manufacturing firms.

In brief, this paper is organized as follows. This section serves as the introductory section to SCM and performance measurement in SCM. Section 2 will review the literature review of performance measurement and SCM, followed by the details of research methodology in the next section. The results and discussion will be reported in Sec. 4. In the last sections of this article, the Summary and Conclusion will be presented.

Literature review

Many studies have identified the SCM components that need to be addressed by the organizations as [8] stating that a PMS is important for an effective performance measurement in SCM. For example, in a study conducted by [13] which proposed eight components of SCM including customer relationship management, customer service management, demand management, order fulfilment, manufacturing flow management, procurement and supplier relationship management, product development and commercialization, and returns. Reference [14] also classified SCM based on nine key supply chain activities:

- Customer service and support.
- Demand forecasting and planning.
- Purchasing and procurement.
- Inventory management.
- Order processing and logistics communications.
- Material handling and packaging.
- Transportation.
- Facilities site selection, warehousing and storage.
- Return goods handling and reverse logistics.

As the conceptual PMS framework for SCM has been frequently proposed by numerous studies, a vast and diverse body of literature on performance measurement in SCM is now available for future reference. Interestingly, these studies all identified PMS in different categories and dimension of PMS. For instance [8, 10, 11, 15] opted to examine the supply chain performance measurement framework based on the nature of performance measures, that are quantitative/qualitative or cost/non-cost. Their studies have become the groundwork for other researchers' study, in which they further narrowed down these categories into the specific dimension of PMS such as quality, cost, delivery, resources and flexibility (see 8, 4, 12, 16). For instance, a study done by [4] ventured more into the topic by evaluating the usefulness of a novel conceptual model for supply chain performance measurement in an agri-food supply chain. The proposed conceptual framework including four main categories of performance measures (i.e. efficiency, flexibility, responsiveness, and food quality) are recognized as key performance components of the supply chain.

Next, based on the review of the literatures, another important point to note is that PMS can be evaluated based on different levels of performance measurement. Based on a study wrote by [10], PMS framework in SCM can be described using three major managerial level; strategic, operational and tactical focus. In their other study, [17] further developed a framework for SCM performance measurement and metrics that include four major supply chain activities consist of the metrics plan, source, make/assemble, and deliver. These metrics can be viewed from the three managerial level as previously mentioned; strategic, tactical and operational. This approach allows more clarification for the appropriate level of management authority and responsibility for performance. Additionally, there are also a few researchers that perceived PMS in SCM in different perspectives, by observing it in terms of process (a procedural) in supply chain context (e.g. 12, 18, 19, 20).

Other notable studies in the development of framework for supply chain performance measures that should be mentioned are [1, 7, 21, 22]. In previous years, [21] introduced an overview of the various issues related to environmental (green) SCM performance measurement that managed to describe an integrative framework for study, design and evaluation of green SCM performance tools as the outcomes. Meanwhile, [1] developed supply chain performance tool (SCPAT) for SMEs in Thailand. Their study utilized the theoretical approaches proposed by [13]

and [14] as the foundation. The three dimensions of cost, time and reliability encompass both financial and non-financial characteristics of supply chain performance. In return, SCPAT generates the needed intelligence of an organization's internal supply chain activities and is able to identify individual's areas of strengths and weaknesses. Next, another analysis prepared by [22] also advocated a common framework for the empirical analysis of supply chain PMSs that can be operated in different supply chain contexts. As to gain understanding of the metrics selection and achievement of performance, the analysis of the context is very much a necessity. This is applicable in the process of considering opportunities for the application of similar metrics in supply chains with similar key characteristics as well. Lastly, a significant groundwork written by [7] also offered another insights from industry in the area of supply chain performance measurement and initiated a practical approach in the development of performance metrics. The study opts to suggest that "less is better" when discussing the developing performance metrics. The research advocated that companies should center their focus on only a small list of KPIs, particularly on the ones that are critical for their operations management, customer service, and financial viability. Hence, potential KPIs should be initially developed for each of the supply chain operations-reference (SCOR) model's which involve four main processes; plan, source, make, and delivery that need to be hierarchically grouped to primary and secondary metrics.

Following that, there were few empirical evidences on PMS in SCM discovered in few other studies such as [4, 8, 23–27]. An example of study is conducted by [8] in which he observed the performance measurement in commercial supply chains that focuses mainly on cost and customer responsiveness. Meanwhile, [24] took a different twist in their approaches as they identified the main motives and determinants for the adoption and implementation of SCM concepts in the Indian automobile sector. This research came to a generalization that the concept of supply chain performance is rather foreign among the Indian automobile sector and it highlighted the difficulties associated within its implementation. Additionally, in the review organized by [4] a conclusion had been made that four main categories of performance measures (i.e. efficiency, flexibility, responsiveness, and food quality) are identified as key performance components of the tomato supply chain PMS. Next, An evaluation conducted by [25] showed how they implemented secondary financial data in their study to explore the influence of supply chain

on firm performance by using a unified proxy for supply chain performance. The results gained indicated that changes in the proxy do affect the change in the rate of return on capital and rate of cash-to-cash cycle length, both of which are traditional performance measures of improved SCM. The study also inferred that SCM practices indeed leave a positive impact upon improved firm performance. This is supported by [28] who proffered that both accounting and market-based financial performances are closely related to the implementation of SCM. Sourcing strategy, information technology (IT), SC integration, and external relationships altogether make a remarkable contribution to firm-level financial performance.

From a balanced score-card (BSC) perspectives, [26] developed a BSC for SCM based on the lenses of four perspectives: finance, customer, internal business process, and learning and growth. Using three case studies; that focused on the development of BSC, the application in small and medium sized enterprises (SMEs) in India, the study had managed to produce a guidance for the organizations in measuring SCM in a balanced way as to obtain an equilibrium in the performance. Similarly, [27] examined the practices of supply chain measurement and the managers' perception on performance measurement. The outcome of the study highlighted the fact that despite the need to provide a balanced approach to performance measurement, firms commonly remain focused on traditional financial measures (gross revenue, profit before tax, and cost reduction). The observation also revealed the non-tangible measures such as customer satisfaction are found to be the most measured components. Other key logistics performance indicators also include on-time delivery and customer satisfaction.

From the above literatures, it can be clearly seen that there are sufficient guidelines on fundamental conceptual framework of PMS in SCM. It is also evident now that PMS plays a vital role in the application of SCM. Despite this considerable amount of literature, a number of crucial issues have still been overlooked. As argued by [3], a number of important problems have not yet received adequate attention up to this moment including; the factors influencing the successful implementation of PMS for supply chains; the forces shaping their evolution over time, and the problem of the ongoing maintenance. Reference [29] also correspondingly supported this idea, contended that supply chain performance measurement is still a fruitful research area and there is a few very distinctive supportive statements have been inferred for

the need of further research on supply chain performance measurement. They calls for more research on the performance measurement tools to suit the 21st century business models and underline the need for the development of more precise frameworks and empirical testing of the performance measures as well as action research.

Supply chain management and performance

The relationship between PMS and organizational performance have been investigated by substantial studies. Reference [30] suggested that PMS support overall firm-level effectiveness and make direct contributions to profitability and growth. This argument is supported by [31] who claimed that firms that implement a PMS will benefit more than the firms that rely solely on financial measures. [31] in their study found that there is a positive relation between financial outcomes and both customer satisfaction and new product introductions which holds only for firms that use comprehensive PMS. Meanwhile [32] who conducted a study on strategic alignment and purchasing efficacy on performance revealed that the financial performance is significantly improved only if purchasing practice fits purchasing strategy and purchasing strategy aligns with overall business strategy.

Meanwhile [33] who examined the impact of non-financial PMS (NFPMS) on the relationship between lean manufacturing and financial performance indicated that there is substantial evidence that NFPMS mediates the relationship between lean manufacturing and financial performance. Furthermore [34] demonstrated that supply chain integration (SCI) is positively related to firms' operational and financial performance. Despite substantial evidences on SCM and performance, however the information in the context of SCM PMS and its relationship with performance is still scarce. Thus, this study takes up the challenges to fill in the research gap by providing new empirical evidences towards the implementation of SCM in manufacturing sector and serves as an attempt to explore the association of SCM with performance.

This study focuses on a small list of performance measures for SCM that made up of the components 'operations management', 'customer service', and 'financial viability'. These categories are constructed based on the basics purpose of each indicators in measuring the SCM performance. The conceptual framework for this research is shown in Fig. 1.

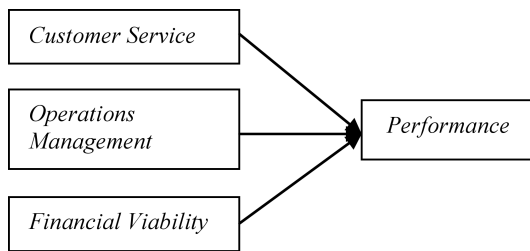


Fig. 1. A conceptual framework of the relationship between PMS in SCM and performance.

SCM performance measurement

Based on the relationships derived and the findings in prior studies, this study proposes the following hypotheses as the foundation to the analysis.

H_{1a}: There is significant relationship between the extent of use of customer service-based supply chain performance measures and performance

H_{1b}: There is significant relationship between the extent of use of operations management-based supply chain performance measures and performance

H_{1c}: There is significant relationship between the extent of use of financial viability-based supply chain performance measures and performance

This study also attempts to explore the relationship of the use of PMS for SCM with the size of organizations using proxy of number of employees. The dissimilarities in SCM performance measures usage can probably be explained by differences in size of the firms. Larger organizational firms usually have more complexities which require a system that can help them to achieve the common purpose and coordinate activities [35]. Thus the following hypothesis is developed to help the analysis.

H_{2a}: There is significant relationship between the size of the firms and the extent of use of customer service-based supply chain performance measures

H_{2b}: There is significant relationship between the size of the firms and the extent of use of operations management-based supply chain performance measures

H_{2c}: There is significant relationship between the size of the firms and the extent of use of financial viability-based supply chain performance measures

Methodology

To proceed with this study, the method of questionnaire survey was employed. It is also important to mention that the construction of this question-

naire is inspired heavily by the study conducted by [7]. The questionnaire was distributed to the 200 selected Malaysian manufacturing firms that are mainly concentrated at the southern region of Malaysian Peninsular. After several follow-ups, 53 usable questionnaires were received which made up a total of 26.5% response rate. The items in the questionnaire comprises of three main categories; profile of firms; the extent of use of PMS and perception on performance of the firms. The PMS related to supply chain activities was measured using 24 selected items by using the scale ranging from 1= rarely used to 7 = highly used. The 24 items utilized in this study are as follows:

A. Customer Service (CS)

- Perfect order fulfilment
- Order fulfilment cycle time
- Responsiveness to urgent deliveries
- Quality of delivery goods
- On-time delivery of goods
- Frequency of delivery
- Customer query time

B. Financial Viability (FV)

- Cost of goods sold
- Variances of material
- Total cash flow time
- Rate of return on investment
- Operation cost per hour
- Costs related to supply chain
- Return on supply chain fixed asset

C. Operations Management (OM)

- Total supply chain cycle time
- Product development cycle time
- Capacity utilization
- Percentage of defect
- Supply chain flexibility
- Supply chain adaptability
- Supplier pricing against market
- Range of product and services
- Supplier delivery performance
- Purchase order cycle time

In the questions related to the firm's performance which is adapted from a study by [36], the respondents were asked to indicate their average business performance against their competitors based on five performance indicators, covering both organizational and operational level from a scale of 1 = Very below average to 7 = Highly above average. The five performance indicators are return on investments, sales margin, capacity utilization, customer satisfaction and product quality.

A reliability test conducted for the main variables employed in this study indicated that all measurements are inferable and reliable, by which the Cron-

bach's alpha values for PMS for SCM and performance are 0.843 and 0.856 respectively. The following section will discuss the findings obtained from this study.

Results and discussion

Demographic of respondents

The profile information in relation to the respondents was collected to gain an overall overview of respondents. Table 1 presents the information for the 53 responding firms.

Table 1
Company profiles.

Company profiles	%
<i>Business duration</i>	
Less than 5 years	7.5
5–10 years	18.9
11–20 years	20.8
More than 20 years	52.8
Total	100.0
<i>Company subsector</i>	
Food and Beverages	9.4
Automotive	11.3
Electric and Electronics	18.9
Basic Metals	18.9
Apparels	11.3
Chemicals and chemical products	15.1
Others	15.1
Total	100.0
<i>Number of employee</i>	
1–5	0
6–75	9.4
76–200	35.8
201–500	34.0
More than 500	20.8
Total	100.0
<i>Annual sales turnover</i>	
0 – RM300,000	7.5
RM300,000–RM15,000,000	20.8
RM15,000,001–RM50,000,000	22.6
RM50,000,001–RM100,000,000	28.3
More than RM100,000,000	20.8
Total	100.0
<i>SCM Practices</i>	
Yes	98.1
No	0.0
Not sure	1.9
Total	100.0
<i>Performance measurement tools</i>	
Balanced Score Card	25.8
Supply Chain Operations References Model – SCOR	19.7
Others	54.5
Total	100

The results indicate that the majority of the respondents have been in business for more than 20 years, which accentuates the degree of experience and the well-established organizations. This features are more apparent when observed in terms of the average number of employees, in which the characteristics of the more established organizations are seen among firms with 76–200 employees and followed by the firms with 201 to 500 employees. Furthermore, there is a correlation between the concentration of respondents in larger firms and the information gathered on the annual sales turnover of the respondents. Almost 30 per cent of the responding firms reported an annual sales with the range of RM50 million to RM100 million. In contrast, there is less than eight percent of the total respondents that indicated an average annual sales turnover below RM300,000. On that note, the results also revealed that the manufacturing activities of responding firms are those that are mainly focused in electric and electronics and basic metal.

In general, the majority of the respondents practice SCM in their business, with more than half of the total respondents indicated that the performance measurements tools other than Balance Score Card (BSC) and SCOR are operated in their management. A contemporary performance measure, BSC is only adopted by approximately 26 per cent of the total respondents. Although it is claimed that BSC provides a more balanced and comprehensive performance evaluation covering both financial and non-financial perspectives, only a quarter of the manufacturing firms adopt this approach. Similarly, SCOR, which is a specific PMS in supply chain, is only put to use by less than 20 per cent of respondents. Therefore, this finding suggests that the Malaysian manufacturing firms prefer to implement a specific performance measures in evaluating the performance of their supply chain activities.

Performance measures used in SCM

Table 2 presents performance measures used in organization's SCM. Based on the results reported, it can be seen that the first five performance measures are related to Customer Service dimensions (Perfect order fulfilment; Order fulfilment cycle time; Quality of delivery goods; Frequency of delivery; and Responsiveness to urgent deliveries) have the highest extent of use. On the other hand, most of the performance measures under the scope of financial viability are at the lowest rank, with exception of the costs related to supply chain and the cost of goods sold. The costs related to supply chain and cost of goods sold are placed at the top 10 rank since these measures

are quite common and can be extracted easily by the firms as opposed to the measure return on supply chain fixed asset, operation cost per hour, and variances of material. This finding is reasonable as cost has been the most crucial elements in providing understanding in regards to the performance of organization. Lastly, the performance measures related to Operations Management are seen to be moderately adopted by the respondents. Capacity utilization; the measure that is related to supply chain is among the highest used performance measure by the respondents under Operations Management category. The findings also signifies the fact that most firms put emphasis on non-financial performance measures related to customers' order and deliveries-related items

in the evaluation of the efficiency of their SCM. These SCM performance measures are closely related to fulfilling customers' orders which consequently can improve customer's satisfaction and helps the growth of the performance for the companies.

Overall customer service-oriented SCM performance measure is highly used by the responding firms where the average value is 6.23 followed by operations management and financial viability with mean values of 5.79 and 5.57 respectively.

Meanwhile Table 3 indicates the descriptive results for organizational performance indicators. The overall organizational performance can be considered good as the average performance value is 5.56.

Table 2
Descriptive results for performance measures in SCM.

Rank	SCM Performance Measures	Min.	Max.	Mean	Standard dev.	Category
1	Perfect order fulfilment	5	7	6.51	.800	CS
2	Order fulfilment cycle time	5	7	6.36	.710	CS
3	Quality of delivery goods	1	7	6.32	1.237	CS
4	Frequency of delivery	4	7	6.30	.799	CS
5	Responsiveness to urgent deliveries	3	7	6.28	.928	CS
6	Capacity utilization	4	7	6.06	.989	OM
7	On-time delivery of goods	3	7	6.04	1.160	CS
8	Costs related to supply chain	4	7	5.96	.808	FV
9	Cost of goods sold	4	7	5.94	.886	FV
10	Total supply chain cycle time	4	7	5.85	.969	OM
11	Supply chain adaptability	4	7	5.81	.856	OM
12	Customer query time	4	7	5.81	.735	CS
13	Supplier delivery performance	3	7	5.79	.948	OM
14	Range of product and services	4	7	5.72	1.045	OM
15	Product development cycle time	3	7	5.72	1.081	OM
16	Percentage of defect	1	7	5.70	1.501	OM
17	Total cash flow time	4	7	5.68	1.105	FV
18	Rate of return on investment	3	7	5.68	1.252	FV
19	Supply chain flexibility	1	7	5.64	.942	OM
20	Purchase order cycle time	3	7	5.57	.951	OM
21	Supplier pricing against market	3	7	5.53	.953	OM
22	Return on supply chain fixed asset	1	7	5.40	1.472	FV
23	Operation cost per hour	4	7	5.40	1.132	FV
24	Variances of material	1	7	4.92	1.452	FV
<i>Average SCM performance measures</i>						
CS	Customer service	4	7	6.23	.623	CS
OM	Operations management	4	7	5.79	.488	OM
FV	Financial viability	4	7	5.57	.661	FV

Table 3

Descriptive results for organizational performance.

	Min.	Max.	Mean	Std. Dev.
Return on investments	3	7	5.11	.934
Sales margin	3	6	5.32	.754
Capacity utilization	3	7	5.55	1.030
Customer satisfaction	4	7	5.94	.886
Product quality	3	7	5.87	.878
Average performance	4	7	5.56	.717

Relationship between the extent of use of PMS and size and performance

Table 4 presents the results of correlation analyses in regards to the relationship between the extent of use of PMS for SCM and performance. The result shows that there are moderate, statistically significant and positive relationships between the extent of use of PMS for Customer Service and Operations Management and firm's performance. Therefore, it is inferable to conclude that the hypotheses H_{1a} and H_{1b} are supported. Table 3 also demonstrates the positive correlation between size of organization and Customer Service and Operations Management-oriented supply chain performance measures. This results imply that the bigger the establishments, the usage of PMS particularly based on Customer Service and Operations Management of performance measures for SCM within the companies also increases. This deduced that the hypotheses H_{2a} and H_{2b} are both supported. Lastly, the findings also confirm the non-existent of significant relationships between the extent of use of PMS for Financial Viability and the firm's performance as well as with the size of organization. Thus, H_{1c} and H_{2c} are not supported.

Table 4

Results of Pearson correlation for the relationship between PMS for SCM and Performance and Firm's size.

	CS	OM	FV	Size	Performance
CS	1				
OM	.678**	1			
	.000				
FV	.408**	.680**	1		
	.002	.000			
Size	.548**	.297*	.030	1	
	.000	.031	.830		
Performance	.365**	.389**	.123	.311*	1
	.007	.004	.382	.023	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Summary and conclusion

In Malaysia, SCM have been implemented by most manufacturing firms due to the complexity of supply chain activities. Endorsing a proper PMS may lead to a better supply chain performance and to the overall organizational performance. The purpose of this article is to investigate the application of PMS among Malaysian manufacturing firms under the SCM environment and to explore the significant relationship of PMS for supply chain with performance. Based on the results of the descriptive analysis of the extent of use of performance measures related to SCM obtained from this study, it is indicated that the majority of respondents implement a specific performance measurement tools in evaluating their SCM performance other than BSC and SCOR model, although some measures overlap with the indicators operated in BSC and SCOR model. It is believed that the establishments may want to opt for a particular performance measures that suit the nature of supply chain activities in their firms the best rather than adopting a complex performance measures. The use of selected performance measures however allow flexibility depending on the suitability and the availability of resources of the organization.

Next, it was discovered that the highest usage of the performance measures are the components related to customers' order fulfilment and deliveries which fall under Customer Service category. Hence, this finding implies that most respondents prefer measurement tools that are closely linked to sales generation, by which affect the performance of the establishments directly. The results also deduce that the responding manufacturing firms are mostly focused on critical aspects in supply chain activities rather than implementing the whole set of available performance measures. This is because the use of a smaller set of performance measures can actually produce a more accurate and accessible information to the management. This outcome is consistent with [7]'s study, in which the author stated it is advisable for firms to focus on only a small list of KPIs that are critical for their operations management, customer service, and financial viability. Interestingly, the moderate use of BSC and SCOR in the management are consistent with the results obtained in the previous literatures [26, 37, 38]. However, [39] argued that despite the recommendations from experts and academicians, the number of organizations that implement BSC and integrated performance measurement such as SCOR is still relatively low. The statistic shows support to [38]'s report, stating that the extent of use of multi-dimensional indicators (such as

BSC) is indeed low. This finding implies that there is actually no ideal framework for any manufacturing firms to design their own PMS. It should be put in utmost consideration that the choice of performance measures depends greatly on the suitability and practicability of the measures apart from other environmental and organizational factors.

Next, the results also unveil how the endorsement of PMS has a significant and positive relationship with the performance. This suggests that firms that endorse a proper PMS may significantly improve their firms' performance. Thus, this serves as one of the evidences to support the claim by [1] and [3] that PMS in SCM does provide a boost in increasing overall business capability of both firm and industry level since it alleviates understanding and cooperation among supply chain members as well as provides improvement, motivation, communication and problems identification [1]. Moreover, PMS is able to provide timely information that can also assist the management in accomplishing broader strategic aims. This research proves that PMS can have a potential impact on firm's performance particularly in the area related to supply chain performance such as customer and quality related performances. Last but not least, the results of this study signifies how the size of the firms is positively and significantly correlated with the use of supply chain performance measures. Generally, this study recommends that supply chain performance measures is increasingly adopted in the management as firms grow in size.

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