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Lean-Agile-Flexibility Supply Chain Strategy and Supply Chain Performance in Malaysian Automotive Industry

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Abstract—The development of automotive in Malaysia has started more than 25 years ago. The positive developments in the industry, which some extent were influenced by the automotive technology management that have been practice by Japan automotive companies. Recently, the selection of the right aspect in the Supply Chain Strategy (SCS) parallel to with the implementation of SCS is widely believed that it can improve the Supply Chain Performance (SCP) in automotive industry. The purpose of this paper are to identify the SCS and SCP measures for Malaysian Automotive Industry and to develop research model of the SCS and SCP measures relationship for Malaysian Automotive Industry. As a result, these researches are to investigating what does SCS contributes to SCP in Malaysian Automotive Industry. A structural relationship model using Structural Equation Modelling (SEM) has been proposed. This model will be used to study the relationship between SCS and SCP in Malaysian automotive industries. Based on the proposed conceptual model and reviewed, research hypotheses are being developed. The research concludes with suggest future research work.

Keywords—lean, agile, flexibility, supply chain, performance

I. INTRODUCTION

The development of automotive in Malaysia has started more than 25 years ago. The positive developments in the industry, which some extent were influenced by the automotive technology management that have been practice by Japan automotive companies. Hence, there are many Japan automotive companies are based in Malaysia. Among automotive management technology was applied to Toyota Production System (TPS), which known as Lean Production System (LPS), and developed by the Toyota Motor Company.

The selection of the right aspect in the Supply Chain Strategy (SCS) parallel to with the implementation of information management is widely believed that it can improve the Supply Chain Performance (SCP). Supply chain is one of an integrated process that include of various business entities such as (suppliers, manufacturers, distributors, and retailers) that are working together in an affair to: (1) acquire raw materials/components, (2) convert raw materials/components into specified final products, and (3) deliver final products to retailers [1-3].

In order to face the intensity of competitiveness, manufacturing companies are trying to improve their manufacturing operations and performance by addressing the specific terms which are needed by certain firms. Depending on market needs analysis, firms can choose different paths of improvement, such as lean and agile with also flexibility manufacturing [4,5]. Christopher [6] and Sukati *et al.* [7] also said that in today's competitive business, manufacturing companies are focus on delivering value to the customer and providing products with services that are more valuable other than compared to its competitors. Moreover, the growth of supply chain are aim to improve profitability, customer response, and ability to deliver value to the customers and also to improve the interconnection and interdependence among firms. This is caused by the growing market for domestic market to global market which demands by customers. For example, demanding to lower prices, faster delivery, quality of the products or service that higher and impact to increasing the variety of goods [3,8,7].

The purpose of this paper are (1) to identify the SCS and SCP measures for Malaysian Automotive Industry and (2) to develop research model of the SCS and SCP measures relationship for Malaysian Automotive Industry. As a result, this research are to investigating what does SCS contributes to SCP in Malaysian Automotive Industry. In this research, there are three domain categories of SCS that are considered: Lean Supply Chain (LSC), Agile Supply Chain (ASC), and Flexibility Supply Chain (FSC). Selection of SCS will be more effective if it is implemented by a good manner [9]. Furthermore, this research also focused towards SCP. There are three elements of SCP: (1) Operational Performance (OP), (2) Flexibility Performance (FLP), and (3) Financial Performance (FP).

In the next section, these papers review the literature on SCS and SCP as well as the research hypotheses. In Section 3, the research are more focus to methodology and measurement of constructs instrument. As a conclusion for this section are to discuss the future agendas for research and practice.

II. LITERATURE REVIEW

Figure 1 present the SCS framework which developed in this research. The framework proposes that SCS will have an impact on SCP directly. SCS is conceptualized as a three-dimensional construct as well as the three performance

outcome (SCP). The three dimensions for SCS are: Lean Supply Chain (LSC), Agile Supply Chain (ASC), and Flexibility Supply Chain (FSC) while three dimensions for SCS are:

Operational Performance (OP), Flexibility Performance (FLP), and Financial Performance (FP). The description details regarding the development of the SCS construct are to provided, as the following paragraph.

2.1 Supply Chain Strategy (SCS)

Many researchers are called SCS as a Supply Chain Management (SCM). There are two terms that bring a same meaning. The term of SCM was originally introduced by consultants in early 1980s [10-12]. Handfield and Nichols [13] and Li *et al.* [14,15] also called SCS as SCM. Handfield and Nichols [13] defines SCM is the integration and management of supply chain organizations and activities through cooperative organizational relationships, effective business processes, and high levels of information sharing to create high-performing value systems that provide member organizations a sustainable competitive advantage.

Ambe and Badenhorst-Weiss [16] defined SCS as a one part of the overall business strategy, designed around a well-defined basis of competition (innovation, low cost, service, quality). Its also integrated with marketing strategy and with customers' needs, product strategy as well as power position. In addition, the SCS also defined a competitors' set of customer needs than its competitors that it seeks to satisfy through its products and services [17,18].

Li *et al.* [14,15] has been state SCM as a one of medium to improve the performance of an individual organization and to improve the performance of the whole supply chain. They also defined that SCM as a set of activities undertaken in an organization to promote effective management of its supply chain that include five dimension of SCM: strategic supplier, partnership, customer relationship, level of information sharing, quality of information sharing, and postponement. It's also proposed to be a multi-dimensional concept, and hence viewed as more comprehensive concept than the narrower view such as the supplier side and customer side.

SCS must state how the firm will gain a competitive advantage through supply chain capabilities, such as cost efficiency, response speed, and flexibility [13,19]. In this study, we considered three categories of SCS (LSC, ASC, and FSC); because they have been shown effect to the SCP. This has been recognized by Reichhart, A. and Holweg, M. [20]. The key of these backbones are flexibility, agility and lean thinking that are important elements in the industry. According to the SCS literature, there have been various dimensions of the SCS that were used by previous studies. Table 1 shown the summary about the SCS dimensions.

Table 1: Summary of SCS Dimensions

Authors / Dimension	Lean Supply Chain	Agile Supply Chain	Flexibility Supply Chain
Agus [21]			*
Ambe and Badenhorst-Weiss [16]	*	*	
Braunscheidel and Suresh [8]		*	
Duarte *et al.* [22]	*		
Fantazy *et al.* [23]			*
Gosain *et al.* [24]			*
Gunasekaran and Yusuf [25]		*	
Hallgren and Olhager [5]	*	*	
Li *et al.* [14,15]	*		
Inman *et al.* [26]		*	
Qi *et al.* [19]	*	*	
Shah and Ward [27]	*		
Sharifi and Zhang [28]		*	
Swafford *et al.* [29]		*	*
Tachiazawa and Gimenez [30]			*
Wang *et al.* [3]	*	*	

2.1.1 Lean Supply Chain (LSC)

In 1980, lean thinking were attracted by considerable interest in the business environment while later, in 1990, agile manufacturing appear as a new strategy for the company [31]. The origin of lean is associated with two concepts, namely Toyota Production Systems (TPS) and Just-In-Time (JIT) philosophy. Lean principles come from the Japanese manufacturing industry. This first terms has been used in 1988 by John Krafik through his article "Triumph of the Lean Production System" [32,33,27,5,34]. The term lean means developing a value of stream to elimate all waste including time and to enable a level schedule [31,18]. As acknowledged by Ambe and Badenhorst-Weiss [16], they identify that in order to meet customer's needs and organisation must identify what customers think of waste. This is because elimination of waste and ensuring value are core objective of lean.

Until today, many researchers have been done study about LSC. Li *et al.* [14] are study about the developing a set of SCM practices (strategic supplier partnership, customer relationship, information sharing, information quality, internal lean practices, and postponement). They are propose that through the elimination of waste, the continued implementation of lean has the advantage within speed up of production processes, improve product quality and customer satisfaction. They also defined that SCM as a one set of activities which has been undertaken by an organization to promote the effective management of the SCP. They have been view in the supplier side and customer side. This support by Habidin [35], that lean

practice are to ensure smooth manufacturing flow by upgrading productivity to the level of quality products, utilization of production labor, reduced delivery time, and at the same time, its impact to the effective manufacturing cost through the continuous improvement process.

According to Duarte *et al.* [22] and Qi *et al.* [19], LSC is a strategy based on cost and time reduction to improve the efficiency. It is focused on optimizing the supply chain in all process, looking for simplification, reducing waste, and reduces the activities that do not add value (mean nothing). Adopters of lean strategy will implement the practices such as mass production, just-in-time, and long-term supplier relationships to eliminate waste and automatically will achieve a lower cost. Duarte *et al.* [22] were explore lean and green supply chain performance using balanced scorecard perspective while Qi *et al.* [19] were investigates that the relationships among competitive strategy, SCS, and business performance.

Shah and Ward [27] also stated lean production is most frequently about associated with elimination of waste which commonly held by firms as excess inventory or excess capacity (machine and human capacity) to improve the effects of variability in supply, processing time, or customer demand. They were developed the concept of lean production based on extant knowledge and use data from a sample of manufacturers to develop an operational measure that consists of 10 reliable and valid scales. All the 10 reliable are supplier feedback, JIT delivery by suppliers, supplier development, customer involvement, pull production, continuous flow, set up time reduction, total productive maintenance, statistical process control, and employee involvement.

Hallgren and Olhager [5] are already mentioned that lean manufacturing as a program aimed mainly at increasing the efficiency of operations. They were studied about the two initiatives (lean and agile manufacturing) that were used by manufacturing plant managers to improve the operational capabilities. The purposes of their research are to investigate internal and external factors that drive the choice of lean and agile operations capabilities and their respective impact on operational performance. They had proved that the implementation of lean manufacturing will impact towards in raises the cost performance.

2.1.2 Agile Supply Chain (ASC)

Competitive pressures in the automotive industry have forced manufacturers to continuously improve the provision of related products and services that required by customers. Many manufacturers are now started adopting practices that enhance their ability to respond rapidly to changes in for customer demand. Based on this factor, the ideal response has been the selection key to competitive advantage compared to other companies. Among the practices used are agile manufacturing or in the other word is agile supply chain. According to history of term agility, it was first introduced as a management paradigm in 1991 [36,31,16]. Agility is the ability to offset of the changes that occur outside of the company's especially in company performance.

According to Ambe and Badenhorst-Weiss [16], agility has been introduced as a total integration of business components like support by technology. ASC is more flexible and responsive for customers need. This support by Iskanius (2006) and Preiss (2005) as noted by Ambe and Badenhorst-Weiss [16], they said agility is a comprehensive response to the business challenges of profiting from rapidly changing, continually fragmenting, global markets for high-quality, high-performance, and customer configured goods and services". Christopher and Towill [37] were concluding that the agility is focuses on responsiveness.

Besides, Gunasekaran and Yusuf [25] has been stated that the agility is the main in capabilities to survive and prosper in a competitive environment of continuous and unpredictable changed by reacting quickly and effectively to changing markets, driven by customer-designed products and services. Gunasekaran [38] have been listed the driver of agile manufacturing. The driver are included virtual enterprise formation tools, physically distributed manufacturing architecture and teams, rapid partnership formation tools, concurrent engineering, integrated business information system, rapid prototyping, and electronic commerce. Furthermore, the agility should be based on not only in responsiveness and flexibility, but also in cost and quality of goods with services that the customers are prepared to accept. It also like a one concept that increase the emphasis on speed response to the other level of the new market opportunities.

Sharifi and Zhang [28] stated that the organization that is always on and rise up in a difficult situation, these organizations have the capabilities to recognize and understand the changing environments and respond in a proper way to every unexpected change. They also said that to achieve agility, the important features for success in the contemporary business environment, are making opportunistic action to capture a new market and respond to a new customer requirement. They split agility capabilities to four stages that are namely; responsiveness, competency, flexibility, and speed. Swafford *et al.* [29] also agreed that agility is more on speed.

Next, Qi *et al.* [19] define that agile supply chain are strategy that can help manufacture facing the changing customer needs and quickly design. So manufacturing should introduce customized products with the unique features to gain and maintain the competitive advantages in a constantly a changing environment.

2.1.3 Flexibility Supply Chain (FSC)

Following the competition in an increasingly competitive automotive industry, the related parties must adopt in the best measures for the company to stay for the competitive. This supported by a statement from IBM Company [39] and Ambe and Badenhorst-Weiss [16] increasing competition, changing market demands and growing needs of customers, it has brought a large increasing in customer demand and preferences. It will affect the delivery system and the quality of goods. So, it can be lead to more pressure on the manufacturers to improve their quality, increasing the styling, enhance the operational efficiency and drive through the innovation of characteristics for their products to attract customers as well as to expand into a new market. Thus, the automotive manufacturers should take a flexible and responsive measure to overcome all the needs of customers.

Until today, many researchers have been done study about FSC. Swafford *et al.* [29] has defined FSC as a represents of abilities in a firm's internal supply chain functions such as those in development, purchasing, manufacturing,

and distribution. The key for flexibility is to understanding that the marketing resources are amenable to change and can accommodate into multiple configuration. They also determined that FSC represents operational abilities within the supply chain functions and suggest that increasing the flexibility is possible by building an effective coordination platform with suppliers. A key element of flexibility is the understanding that marketing resources are amenable to change and can accommodate multiple configurations.

Based on Tachizawa and Gimenez [30] cited in Upton (1994) and Duclos *et al.* (2003), FSC were defined as an ability of the purchasing function to respond in a timely and automatically cost the effective manner to changing the requirements of purchased components in terms of volume, mix, and delivery date. They have been exploring three dimensions of flexibility that are namely as delivery policy, supplier responsiveness, and adaptability. Gosain *et al.* [24] also study about the flexibility. They call flexibility as term supply chain flexibility. The define that FSC refers to the extent to which supply chain linkages that able to adapt to changing business conditions rather than being forced into committed adaptation to a given environment. In their research, they only focus on the flexibility of the linkages that alignment in response to customer needs. They also focus on two types of flexibility; offering flexibility and partnering flexibility.

Furthermore, the FSC is an essential to the success of the supply chain from the supply chain exists in an uncertain environment. It can measure the degree that supply chain which will react to the random fluctuations in supply and demand changes [21]. In addition, flexibility may be defined as the ability to change or react with little of changing in time, effort, cost or performance. There have three dimension of flexibility, product flexibility, volume flexibility, and launch/new product flexibility. Meanwhile, Fantazy *et al.* [23] were listed five types as a main factor for their research. The types are new product flexibility, sourcing flexibility, product flexibility, delivery flexibility and information systems flexibility. They listed all that because they are directly impact to the competitive position of a firm in the market.

2.2 Supply Chain Performance (SCP)

In order to have successful implement of SCS, the construct should impacts on some performance measures. Performance measurement is common in any company or firm. In this section, the literature on performance measurements in supply chain is reviewed. This paper focus on three of performance constructs. There are Operational Performance (OP), Flexibility Performance (FLP), and Financial Performance (FP).

Gunasekaran *et al.* [40] are investigating SCP as a measures that are used to assess the supply chain management of its relative performance. They said that performance measurement have an important role play in setting objectives, evaluating performance, and determining future courses of actions. They also develop framework to promote a better understanding of the importance of SCM performance measurement. In their study, they have listed of supply chain activity/process; plan, source, make/assemble, and deliver/customer [41]. In this study, they have found that through its SCS it will bring an effect on the SCP. A good SCS program will bring about improved cross-functional and intra-organizational process planning and control and more complete to SCP.

In a study by Li *et al.* [14], they focus on the constructs of delivery dependability and time to market. This constructs are called as organizational performance. They were said that delivery dependability is the ability of firm to provide products on time and of the type and in the volume as required by the customer (also cited by Rondeau *et al.*, [42]). Meanwhile, times to market were about the capability of firm to introduce new products faster than the competitors. The constructs were adopted from Zhang [43]. On their study, the two construct were impacted by the supply chain management practices items such as strategic supplier partnership, information sharing, and postponement.

Li *et al.* [15] has defined SCP as an approach to see the capability of an organization in terms of financial and market-oriented capabilities. In their study were measure FP as organizational performances that were divided into two aspects, finance and markets. In the short term SCS is to increase productivity and reduce inventory and cycle time, while the long-term objective is to increase market share and profit for all members of the supply chain. They have been study about the implementation of SCS on the overall financial performance and marketing performance. On their result, the implementation of SCS may directly improve an organization's financial and marketing performances in the long run.

III. RESEARCH HYPOTHESIS

The SCS framework developed in this study proposes that SCS has a direct impact on the SCP. Based on the literature review above it is hypothesized that:

H_1: There is a positive and direct significant relationship between supply chain strategy implementation and supply chain performance in Malaysian Automotive Industry.

Swafford *et al.* [29] has been study about "Achieving Supply Chain Agility through IT Integration and Flexibility". The purpose of their study are to answer the question whether FSC have an impact on SCP or the impact of ASC on SCP. They are using empirical data as a methodology: survey data and Confirmatory Factor Analysis (CFA). They have been use Structural Equation Modeling (SEM) to test their hypotheses. The result of their study have been shows that when FSC (decision flexibility) was implemented, its can improve the organizations performance (SCP). Also, results indicated that FSC and ASC are distinct concepts and that higher level of FSC lead to the higher levels of ASC. As referring to this it will follows that flexibility is an antecedent of agility in a supply chain context.

IV. RESEARCH METHODOLOGY

In this study, sample methods are by using structured questionnaire. The population of this study comprised in Malaysian Automotive Industry. Questionnaires will distribute to respondents from the listing of automotive industry obtained from Malaysian Automotive Component Parts Association (MACPMA), Proton Vendors Association (PVA), and Kelab Vendor Perodua. To analyze the data, two statistical techniques were adopted.

A Structural Equation Modeling (SEM) technique was utilized to perform the required statistical analysis of the data from the survey. Exploratory factor analysis, reliability analysis and confirmatory factor analysis to test for construct validity, reliability, and measurements loading were performed. Having analyzed the measurement model, the structural model was then tested and confirmed.

The statistical Package for the Social Sciences (SPSS) version 17 was used to analyze the preliminary data and provide descriptive analysis about thesis sample such as means, standard deviations, and frequencies. Structural Equation Modeling (SEM using AMOS 6.0) will be as a guide to test the measurement model.

V. A PROPOSED RESEARCH MODEL

Based on the literature review, many previous studies were explored about SCS and SCP. The research aims at analyzing of the relationship between SCS and SCP for Malaysian automotive industries. This model is called proposed research model as presented in Figure 1.

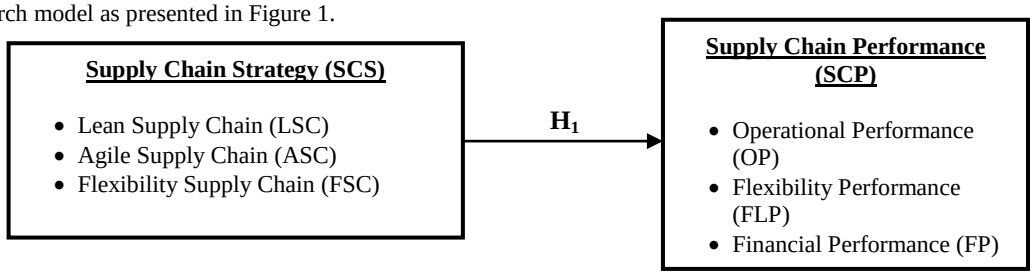

Figure 1. Proposed Model of the Study

VI. CONCLUSION AND FUTURE RESEARCH

In brief, the findings of this research can be benefited, used and contribute not only to academic but also to the industry, especially to the Malaysian automotive practitioners as a whole in making the model and the tool of this study as a benchmark to serve as a guide and reference resources to implement SCS and SCP. A conceptual model has been proposed to examine the relationships between SCS and SCP in the automotive industry in Malaysia. Based on proposed model and a previous study, research hypotheses are being developed. The next step of this study is to design a questionnaire, which will be used for pilot study data collection in automotive industry in Malaysia.

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REFERENCES

[1]. B.M. Beamon, "Supply Chain Design and Analysis: Models and Methods," *International Journal of Production Economics*, vol. 55, no. 3, pp. 281-294,1998.

[2]. R.R. Lummus, and R.J. "Vokurka, Defining supply chain management: A historical perspective and practical guidelines," *Industrial Management & Data Systems*, vol. 99, no. 1, pp. 11 – 17,1999.

[3]. G. Wang, S.H. Huang, and J.P. Dismukes, "Product-driven supply chain selection using integrated multi-criteria decision-making methodology," *International Journal Production Economics*, vol. 91, pp. 1-15, 2004.

[4]. R.H. Hayes and G.P. Posano, "Beyond world-class: the new manufacturing strategy," *Havard Business Review*, vol. 72, no. 1, pp. 77-86, 1994.

[5]. M. Hallgren and J. Olhager, "Lean and agile manufaturing: External and internal drivers and performance outcomes," *International Journal of Operations & Production Management*, vol. 29, no. 10, pp. 976-999, 2009.

[6]. M. Christopher, "The Agile Supply Chain: Competing in Volatile Markets," *Industrial Marketing Management*, vol. 29, no. 1, pp. 37-44, 2000.

[7]. I. Sukati, A.B.A. Hamid, R. Baharun, and H.H. Tat, "A Study of Supply Chain Management Practices: An Empirical Investigation on Consumer Goods Industry in Malaysia," *International Journal of Business and Social Science*, vol. 2, no. 17, pp. 166-176, 2011.

[8]. M.J. Braunscheidel and N.C. Suresh, "The organizational antecedents of a firm's supply chain agility for risk mitigation and response," *Journal of Operation Management*, vol. 27, pp. 119-140, 2009.

[9]. H. Zhou and W.C. Benton Jr., "Supply chain practice and information sharing," *Journal of Operations Management*, vol. 25, pp. 1348-1365, 2007.

[10]. R.K. Oliver and M.D. Webber, *Supply-chain management: logistics catches up with strategy,* M. Christopher, Ed. London: Logistics: The Strategic Issues, Chapman & Hall, 1992.

[11]. B. J. La Londe, "Supply Chain evolution by the numbers," *Supply Chain Management Review*, vol. 2, no. 1, pp. 7-8, 1998.

[12]. D.M. Lambert and M.C. Cooper, "Issues in supply chain management," *Industrial Marketing Management*, vol. 29, no. 1, pp. 1-19, 2000.

[13]. R.B. Handfield and E.L. Nichold, *Supply chain redesign: Transforming supply chains into integrated value systems,* Upper Saddle River, NJ: Prentice Hall, 2002.

[14]. S. Li, S.S. Roa, T.S. Ragu-Nathan, and B. Ragu-Nathan, "Development and validation of a measurement instrument for studying supply chain management practices," *Journal of Operations Management*, vol. 23, pp. 618-641, 2005.

[15]. S. Li, S.S. Roa, T.S. Ragu-Nathan, and S.S. Rao, "The impact of supply chain management practices on competitive advantages and organizational performance," *Omega:The International Journal of Management Science*, vol. 34, pp.107-124, 2006.

[16]. I.M. Ambe and J.A. Badenhorst-Weiss, "Strategic supply chain framework for the automotive industry," *African Journal of Business Management*, vo. 4, no. 10, pp. 2110-2120, 2010.

[17]. S. Chopra and P. Meindl, *Supply chain management: Strategy, Planning and Operation*, Upper saddle River, New Jessey: Pearson, 2007.

[18]. I.M. Ambe, "Agile supply chain: Strategy for competitive advantage," *Journal of Global Strategic Management*, vol. 7, pp. 5-17, 2010.

[19]. Y.Qi, X. Zhao, and C. Sheu, "The Impact of Competitive Strategy and Supply Chain Strategy on Business Performance: The Role of Environmental Uncertainty," *Decision Sciences Journal*, vol. 42, no. 2, pp. 371-389, 2011.

[20]. A. Reichhart, and M. Holweg, "Creating the customer-responsive supply chain: a reconciliation of concepts," *International Journal of Operations & Production Management*, vol. 27, no. 11, pp. 1141-1172, 2007.

[21]. A. Agus, "Supply chain management, supply chain flexibility, and business performance," *Journal of Global Strategic Management*, vol. 9, pp. 134-145, 2011.

[22]. S.Duarte, R. Cabrita, and V.C. Machado, "Exploring lean and green supply chain performance using balanced scorecard perspective" in *Proceedings of the 2011 International Conference on Industrial Engineering and Operations Management Kuala Lumpur*, 2011, p. 520-525.

[23]. K.A.Fantazy, V. Kumar, and U. Kumar, An empirical study of the relationships among strategy, flexibility, and performance in the supply chain context, *Supply Chain Management: An International Journal*, vol. 14, no. 3, pp. 177-188, 2009.

[24]. S. Gosain, A. Malhotra, and O.A.E. Sawy, "Coordinating for Flexibility in e-Business Supply Chains," *Journal of Management Information Systems*, vol. 21, no. 3, pp. 7-45, 2005.

[25]. A. Gunasekaran and Y.Y. Yusuf, "Agile manufacturing: A taxonomy of strategic and technological imperatives," *Int. J. Prod. Res*, vol. 40, no. 6, pp. 1357-1385, 2002.

[26]. R.A. Inman, R.S. Sale, K.W. Green Jr., and D. Whitten, "Agile manufacturing: Relation to JIT, operational performance and firm performance," *Journal of Operations Management*, vol. 26, pp. 343-355, 2011.

[27]. R.Shah, and P.T. Ward, "Defining and developing measures of lean production," *Journal of Operations Management*, vol. 25, pp. 785-805, 2007.

[28]. H. Sharifi and Z. Zhang, "Agile manufacturing in practice: Application of a methodology," *International Journal of Operations & Production Management*, vol. 21, no. 5/6, pp. 772-794, 2001.

[29]. P.M. Swafford, S. Ghosh, and N. Murthy, "Achieving Supply Chain Agility Through IT Integration and Flexibility," *Int. J. Production Economics*, vol. 116, pp. 288-297, 2008.

[30]. E.M. Tachiazawa and C. Gimenez, "Supply flexibility strategies in Spanish firms: Results from a survey," *Int. J. Production Economics*, vol. 124, pp. 214-224, 2010.

[31]. F. Rahiminia, M. Moghadasian, and P. Castka, "Benchmarking leagility in services: The case of a fast food restaurant chains in Iran," *Benchmarking: An International Journal*, vol. 16, no. 6, pp. 799-816, 2009.

[32]. S. Bhasin and P. Burcher, "Lean viewed as a philosophy," *Journal of Manufacturing Technology Management*, vol. 17, no. 1, pp. 56-72, 2006.

[33]. M. Holweg, "The genealogy of lean production," *Journal of Operations Management*, vol. 25, pp. 420-437, 2007.

[34]. J. Pettersen, "Defining lean production: Some conceptual and practical issues," *The TQM Journal*, vol. 21, no. 2, pp. 127-142, 2009.

[35]. F. Habidin, "Structural analysisand tool for lean six sigma, strategic control systems and organizational performance," Doctoral Engineering dissertation, Universiti Teknologi Malaysia, Malaysia, Jan 2012.

[36]. J. Kovach, P. Stringtellow, J. Turner, and B.R. Cho, "The house of competitiveness: The marriage of agile manufacturing, design for six sigma, and lean manufacturing with quality considerations," *Journal of Industrial Technology*, vol. 21, no. 3, pp. 1-10, 2005.

[37]. M. Christopher, and D.R. Towill, "Supply chain migration from lean and functional to agile and customised," *Supply Chain Management: An International Journal*, vol. 5, no. 4, pp. 206 – 213, 2000.

[38]. A. Gunasekaran, "Agile manufacturing enablers and an implementation framework," *International Journal of Production Research*, vol. 36, no. 5, pp. 1223-1247, 1998.

[39]. IBM Company, "Challenges for the automotive industry in an on demand environment," *IBM Business Consulting Services*, 2004.

[40]. A. Gunasekaran, C. Patel, and R.E. McGaughey, "A framework for supply chain performance measurement," *International Journal of Production Economics*, vol. 87, pp. 333-347, 2004.

[41]. A. Gunasekaran, C. Patel, and E. Tirtiroglu, "Performance measure and metrics in a supply chain environment," *International Journal of Operations & Productions Management*, vol. 21, no. 1/2, pp. 71-87, 2001.

[42]. P.J. Roudeau, M.A. Vonderembse, and T.S. Ragu-Nathan, "Exploring work system practices for time-based manufacturers: Their impact on competitive capabilities," *Jounal of Operations Management*, vol. 18, no. 5, pp. 509-529, 2000.

[43]. Q.Y. Zhang, "Technology infusion enabled value chain flexibility: A learning and capability-based perspective," Doctoral Dissertation, University of Toledo, 2001.