

Exploring Information Manufacturing Sharing and Supply Chain Performance: Based on Malaysian Automotive Industry

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ABSTRACT : *The purpose of this paper are to identify the Information Manufacturing Sharing (IMS) and Supply Chain Performance (SCP) measures for Malaysian Automotive Industry and to develop research model of the IMS and SCP measures. As a result, these researches are to investigating what does IMS contributes to SCP in Malaysian Automotive Industry. A structural relationship model using Structural Equation Modeling (SEM) has been proposed. This model will be used to study the relationship between IMS 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: - *Information manufacturing sharing, information quality, integrated technology information, customer information, supplier information, supply chain performance*

I. INTRODUCTION

Brief scenarios in Malaysia Automotive industry have been made a big impact towards the economical infrastructure especially in industrial sector. Besides, it has become part of the Malaysia economy's core sectors. Automotive industries are such an extremely wide range of industrial and related activity from materials supply, productions, sales, and other auto related operations. To maintain the performance, company should think one way to sustain. One of the method is the integrated information in manufacturing sharing.

Since 15 years ago, Supply Chain Management (SCM) and information technology management has been attracted considerable interesting among practitioners and researchers. By using a partnership approach in information technology, an organization will tend to become more integrated. These supports by Zhou and Benton Jr. [1], that integration between supply chain strategies combine with information sharing, so it becomes easier especially in improving supply chain performance. Information manufacturing among supply chain influences the supply chain members' behaviour and decision making as well as the performance in supply chain.

In this study, we used term of information sharing as an Information Manufacturing Sharing (IMS). There have four domain categories in this study that are namely; Information Quality (IQ), Integrated Technology Information (ITI), Customer Information (CI), and Supplier information (SI). Furthermore, this research are also more focused towards Supply Chain Performance (SCP). There are three elements of SCP: (1) Operational Performance (OP), (2) Flexibility Performance (FLP), and (3) Financial Performance (FP). The purposes of this study are:

- To identify the IMS and SCP measures for Malaysian Automotive Industry.
- To investigate the impact of IMS on SCP.
- To develop research model of the IMS and SCP.

In the next section, these papers review the literature on IMS and SCP measures as well as the relationship between IMS and SCP, and impact of IMS on SCP. In Section 3,4, and 5 the researchers are more focus to hypothesis, methodology, and proposed model. As a conclusion for this section are to discuss the future agendas for research and practice.

II. LITERATURE REVIEW

2.1 Information Manufacturing Sharing and Supply Chain Performance

Supply chain is an activity that involving customers and suppliers. Both of them have relationship and the role of each other. It involves a series of activities such as manufacturing, warehousing, and distribution [2,3,4]. SCM is the management that involved in related products, information and financial flows from supply to manufacturing, and installation of the right product to deliver the final product to consumers. To ensure the delivery of goods to customers is going smoothly, the company needed a better of information in manufacturing

system. Through sharing this information, the company will be able to obtain the information from customers and suppliers in an easier way. In addition, IMS should consist of a good quality of information and technology oriented. Hsu *et al.* [5] has defined IMS as the integration of information systems, decision systems, and business process that has been used to conduct information searches, manage business operations, monitor business details, and perform other business activities.

Through previous studies, many researchers and practitioners have been exploring it. The importance of information flow in supply chain is proposed by Singh (1996) cited by Omar *et al.* [3], it must be managed at three different stages, before, during, and after sales have been made. Barratt [6] defined IMS as a mechanism of coordination and integration for the processes or activities along the supply chain. Li *et al.* [7] said that IMS will give more beneficial effect on the supply chain entities and it can contribute to improvements in organizational performance and competitive advantages thus improve the SCP.

In the implementation of IMS, multiple factors should be implemented together to increase the SCP. Previous research on IMS implementation has applied selected SCM practices together, under the umbrella of IMS [7,8,1,5,3] and their summary research findings presented in Table 1.

Table 1. The summary research finding on IMS study

Authors	Purpose/Issues	Findings
Li <i>et al.</i> [7]	Developed a set of SCM practices (strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing, and postponement) and investigate the relationships between SCM practices and performance (competitive in advantage and organizational).	The results shown that the organizations with high level of SCM practice have a high level of organizational performance. The implementation of SCM may directly improve the organization's financial and marketing performances for a long term. As a conclusion, the results of this research thus points are towards the importance of SCM practices to the organization.
Fawcett <i>et al.</i> [8]	To understand how important are the dimension of information sharing capability (connectivity and willingness) is used to enhance SCP.	The results shown that both dimensions found are make impact towards the operational performance. As a result, willingness stronger influence on operational performance than connectivity. As a conclusion, two dimension of information sharing are important element to improved the SCP.
Zhou and Benton Jr. [1]	Investigate the integration of information sharing (quality, content, and support technology) supply chain practice in SCM and the impact of information sharing and supply chain practice on delivery performance.	The results shown that the effective information in sharing and effective supply chain practice have a significant influence on delivery performance.
Hsu <i>et al.</i> [5]	Examined the impact of information sharing capability (information system integration, decision system integration, business process integration, supply chain architecture, and relationship architecture) on buyer-supplier relationships and firm performance.	The analysis result shown that buyer-supplier relationships mediate the impact of information sharing capability on firm performance. As a result, collaborative buyer-supplier relationships represent one medium through which information sharing within the supply chain can be used to improve the performance of the buying firm.
Omar <i>et al.</i> [3]	Investigate the level of sharing information and the quality with usage of Information Technology (IT) tools between manufacturing firms and their suppliers.	The results shown that the information of sharing, quality and technology are the most important thing in manufacturing firms.

Through previous studies of the IMS, this study was identified in four dimension of IMS practice which set in accordance with the practices in the Malaysian Automotive Industry. There are: Information Quality (IQ), Integrated Information Technology (ITI), Customer Information (CI), and Supplier Information (SI). The reasons for choosing these practices are:

- It is often used by different researchers in different industries.
- It has been identified as a component in the implementation of IMS in the industry.

Therefore, it is believed that these practices can be used in the context of Malaysia's automotive industry. More detailed about the discussion of these dimensions is provided as per below.

2.1.1 Information Quality and Supply Chain Performance

According to previous authors [9,10,7,11,12], IQ includes the aspects such as the accuracy, timeliness, adequacy, completeness, and credibility of information exchanged. It's same with Gosain *et al.* [13] but they have added new element of IQ. It is value-added. All these elements are important for information to be shared by the company. The IQ are depends on the what, when, and how it is used together, and most important is to whom the information is to be shared with [14,15,11,3]. Therefore, it will indirectly help the company performance.

Zhou and Benton Jr. [1] have defined IQ as a measured that the degree to which the information exchanged between organizations meets the needs of the organizations. Omar *et al.* [3] have been mention that the quality and quantity of information are important elements in the information sharing. This because, Gosain *et al.* [13] and Wiengarten *et al.* [16] said to gain the full potential benefits from collaboration initiatives, company are need to invest to improving the quality of information shared. So, it can increase trust among the supply chain partners. This support by Li and Lin [11], they said that trust and shared vision indicated a significant impact on information sharing and IQ. Many previous studies have been explored into this dimension (see Table 2).

Table 2. Literature review of IQ and SCP

Author	Scope	Finding
Gosain <i>et al.</i> [13]	relevancy, value-added, timeliness, completeness	Provide Information Sharing Design (ISD). ISD was designed to provide a mechanism to monitor the quality and also to checks and constraints to ensure it. IQ has an impact on supply chain flexibility.
Li <i>et al.</i> [7]	timely, accurate, complete, adequate, reliable	The level of IQ may be influenced negatively by the length of a supply chain when an organization is large. Therefore, they state that organization should emphasize the importance of quality in information sharing. The result shows that SCM practice can effect to the competitive advantage and improve the organizational performance.
Zhou and Benton Jr [1]	accuracy, availability, real-time, internal and external connectivity, updating, completeness, relevance, accessibility	IQ has significant positive influence on delivery performance. They said, the IQ and the type of information shared are important things that should acting by firm.
Wiengarten <i>et al.</i> [16]	relevance, added value, up-to-date, completeness	This study has shown that the impact of information sharing on performance (German automotive industry) are varies significantly. It depends on the quality of information that is exchanged throughout the supply chain. In this study, shown that when IQ is high, it has a stronger positive effect on operational performance. But when IQ is low, it does not improve the operational performance.
Omar <i>et al.</i> [3]	timeliness, accuracy, completeness, adequacy, credibility	The result shown that the elements of IQ are being positive impact to the Malaysian organizations (Original Equipment Manufacturer (OEM)). In this study, they have been shown that firms generally believed that information quality is important on accuracy of the information exchange.

2.1.2 Integrated Technology Information and Supply Chain Performance

Information integration is refers to the sharing of information along the supply chain partner which is enabled used by Information Technology (IT) [17]. In this paper, we are mentioned IT as a new name that called as Integrated Technology Information (ITI). Projogo and Olhager [17] have defined ITI as a one medium that allows company to increase the volume and complexity of information which needs to be communicated with their supply chain network. Next, they also said that ITI can allows company to provide real-time supply chain information, including inventory level, delivery status, and production planning and scheduling which enables firms to manage and control its supply chain activities. Lastly, ITI also have facilitates in the alignment of forecasting and scheduling of operations between firms and suppliers, so its allowing better inter-firms coordination.

Via ITI, information will be easier and faster to be share with supply chain network. ITI are enabling firms to access or exchange information quickly and helping firms to make effective decision [3]. ITI allows quick communication between buyers and suppliers and enables the sharing of large quantity and quality of information on tactical and strategic operations. This support by Sheu *et al.* [18], said that by using ITI capabilities, as well as better communication contribute to a better platform for both parties to engage in supply chain coordination, participation, and problem-solving activities. ITI provides the mechanism for company to effectively gather, store, access, share, and analyze data [19]. Swafford *et al.* [19] said that investing in ITI enables product design information to be shared among product development, procurement, and manufacturing functions. In turn, this improves communication, leading to reductions in development time, ramp-up time, and manufacturing time, shorter lead times enable a firm to be more flexible, and ultimately more agile.

The studies by Li *et al.* [20] found that ITI capabilities and information sharing had a significant effect on supply chain integration of logistics systems, and indirectly on performance. However, no direct effect on performance by ITI implementation was noted. The others summary research finding are presented in Table 3.

Table 3. Literature review of ITI and SCP

Author	Purpose/Issues	Finding
Fasanghari <i>et al.</i> [21]	Provide framework that illustrates the impact of IT on SCM and evaluate the impact to the Iranians automobile industry supplier.	The result shown that the impact of IT on SCM has significant positive. Their stressed that the impacts of IT on SCM are easier to communicate each other, reduces time, and develops teamwork and also customer relationship.
Hsu <i>et al.</i> [5]	To explore the relationships among information sharing capability (information system, decision system, and business process integration) and buyer-supplier relationship (supply chain architecture and relationship architecture) to improve firm performance (overall and financial)	Respondent of their research are consists of three country (USA, Europe and New Zealand). The results have shown the positive relationships between information sharing capability and buyer-supplier relationships in increasing performance of firm. Result also shown that the collaborative buyer-supplier relationship are one of medium in information sharing to improve the performance of the firm.
Swafford <i>et al.</i> [19]	To study the direct and indirect relationships among IT integration, supply chain flexibility, supply chain agility, and competitive business performance.	The results shown that a manufacturing firm with IT integration and flexibility has more potential to achieve supply chain agility than a firm that focuses only on IT integration. At the same time, IT integration can increase the competitive business performance.
Omar <i>et al.</i> [3]	To explore the usage of IT tools in the information sharing among manufacturing companies located in the Northern region of Malaysia.	By using data from 64 respondent from Original Equipment Manufacturer (OEM), with 74% from electronic and electrical industry. The result shown that the application of IT tools such as the internet, VMI, and EDI are among the popular tools used by the responding firms. It's using for exchange information with the suppliers. So, in this study, an IT tool is bringing positive impact to the manufacturing firm.
Projogo and Olhager [17]	To investigate the relationships among information integration (information technology and information sharing), logistic integration, long term relationships and the effects on competitive performance.	By using data from 232 Australian firms, they found that logistics integration has a significant effect on performance. Information technology capabilities and information sharing both have significant effects on logistics integration. Furthermore, long-term supplier relationships have both direct and indirect significant effects on performance and the indirect effect via the effect on information integration and logistics integration.

2.1.3 Customer Information (CI) and Supply Chain Performance

SCM practice more focuses on material movement while IMS are more to information flow. There have two major aspect of IMS; content and quality [22]. Information content refers to Customer Information (CI) and Supplier Information (SI). CI is important for the company to build long-term relationships with

customer and increasing customer satisfaction with also in products and services of the company. Chen and Paulraj [23] said that a long-term relationship is not going only temporary time. It must be continuous. So, it can build the organizational success in SCM practices as well as company performance. Through high CI allows company to differentiate their product from other competitors [10,7,24,25]. CI are consists about a sharing demand planning and replenishment, distribution systems, planning problem solving, risks, and reward [26,24,27]. Their results have been shown that the implementation of SCM practices (customer and supplier relationship) may provide the company competitive advantage.

Following Flynn *et al.* [28] and Wong *et al.* [29], they have been mentioning CI as a dimension of supply chain integration. They have defined supply chain integration as one of strategic collaboration that consists of three dimensions such as customer, supplier, and internal integration. In their study, CI are involves in strategic information sharing and collaboration between a focal firm and its customers which aim to improve visibility and enable joint planning. The benefits of sharing of CI are to enables to know about the market expectations and opportunities or a change, which allows the company more accurate and short response to the customer needs and requirements. The others summary research finding are presented in Table 4.

Table 4. Literature review of CI and SCP

Author	Purpose/Issues	Finding
Zhou and Benton [1]	Investigate the integration of information content (manufacturer and customer information) and supply chain practice that impact to the delivery performance. Customer information are consist 7 items, (purchasing, planning order, inventory level, product design, performance evaluation, future demand and production planning information).	The result shown that customer information has a significant negatively impact on delivery performance. The result shows that when the level of customer information is high, effective delivery practice can improve the delivery performance. So, this finding suggest that when customer information is high, there need more implementation of effective supply chain practice.
Sukati <i>et al.</i> [25]	Purposed that SCM practices that consist of strategic supplier partnership, customer relationship and information sharing, and its relationship between supply chain responsiveness and competitive advantage of the firm (consumer goods industry).	The result shown that it have a positive correlation between independent variables (supplier strategic partnerships, customer relationships, and information sharing) and dependent variables (supply chain responsiveness and competitive advantages of the firm). The result also shown the information sharing was the determinant effect of competitive advantages of the firm compare to customer relationship and strategic supplier partnership.
Singh and Power [27]	To investigate a model of collaboration based on the notion of firms having strong working relationships with their suppliers and customers.	The result shown that the effect of customer relationship on performance is greater than supplier involvement.
Rashed <i>et al.</i> [22]	To investigate the combination that effect in operational information and knowledge sharing (price, quality, purchasing, ordering, product specification, performance evaluation, future demand forecasting, product planning, negotiation record, confirmation order) using technology on supplier-buyer relationship and explore the impact on operational performance.	Data was collected from Garments Industries. The result shown that the customer information sharing with key supplier does not affect the supplier's operational performance. The information and knowledge sharing with customer (supplying firm) has a very weak linkage with supplier-buyer relationship. This is due to the inaccuracy, late response of relevant information and not share at the right time. But, knowledge sharing with the customer has a weak positive relationship with operational performance.

2.1.4 Supplier Information (SI) and Supply Chain Performance

SCM are involve of a managing connected series of activities having various origins and it is concerned with planning, coordinating, and controlling movement of materials, parts, finished goods, financial resources, decisions, and information from the supplier to the customer [30,31]. To ensure that it can be achieve, the information from the supplier is required for the firm. Previous study was called SI as supplier integration. According to Wong *et al.* [29], supplier integration are involves strategic joint collaboration between a focal

firm and its suppliers in managing cross-firm business process, including information sharing, strategic partnership, collaboration in planning, joint product development and so on. The impact of that, it can improve performance in terms of achievements, particularly in the automotive industry. By sharing information, the firm can produce various design of car. SI allows firms to make better decisions on ordering, capacity allocations, production and material planning, through increased visibility of demand, supply, and inventory [32,33]. Next, SI can build and maintain long term relationships with their partners.

Based on Kocoglu *et al.* [31] study, they were listing the benefit of integration with suppliers. There are, strengthens the trust based relationships, establishes the long-term contractual agreements, more coordinated communication channel and transactions are created, and leverages higher synergy and collaborative business environment thus supporting information sharing. The summary research finding are presented in Table 5.

Table 5. Literature review of SI and SCP

Author	Purpose/Issues	Finding
Sezen [34]	To investigate the relationships among supply chain integration, supply chain information sharing (with supplier and customer), and supply chain design on supply chain performance.	The results shown that the regression analysis, only the design of the supply chain who have an impact on output and resources performance. While for the integration and sharing of information are correlated with performance measures, but their relative effect sizes are lower than supply chain design. Data was collected from Turkish manufacturing firms.
Flynn <i>et al.</i> [28]	To study the relationship between three dimensions of SCI (customer, supplier, and internal integration), operational, and business performance, from a contingency and configuration perspective.	The result shown that of both the contingency and configuration approach indicated that SCI was related to both operational and business performance. Furthermore, the results indicated that internal and customer integration were more strongly related to improving performance than supplier integration.
Kocoglu <i>et al.</i> [31]	To determine the influence of Supply Chain Integration (SCI) on information sharing and SCP. They focus on the influence of SCI (integration with; customer, supplier, and inter-organizational) on information sharing (sharing with; customer, supplier, inter-functional, and intra-organizational and SCP (expense of costs, utilization of assets, supply chain reliability, and responsiveness and flexibility, and the role of information sharing in shaping SCP.	The result shown that the SCI has a positive influence on information sharing. This support H1, which SCI positively influences information sharing. Next, the result also shows that SCI has a positive relation with SCP. SCP also positively influenced by information sharing. In conclusion, this study shown that the resulting in a positive triangular relationship between SCI, information sharing, and SCP.
Wong <i>et al.</i> [29]	To testing a theoretical model of the contingency effects of Environmental Uncertainty (EU) on the relationships between three dimensions of supply chain integration (internal, supplier, and customer integration) and four dimensions of operational performance (delivery, production cost, product quality, and production flexibility).	The result shown that internal integration is positively and significantly with four elements of operational performance. Next, supplier and customer integration is also positively and significantly with operational performance. Their analysis sample was involved from Thailand's automotive industry.

III. HYPOTHESIS

To understand the relationship of each IMS on SCP in Malaysian automotive industry, the following hypotheses were set up to be tested. According to literature review above, these hypotheses will be stated based on a numbering system from H1. This style of hypothesis statement is chosen due to the nature of answering hypotheses using structural equation modeling methods.

H₁: There is a positive and direct significant relationship between IMS implementation and SCP in Malaysian automotive industry

IV. METHODOLOGY

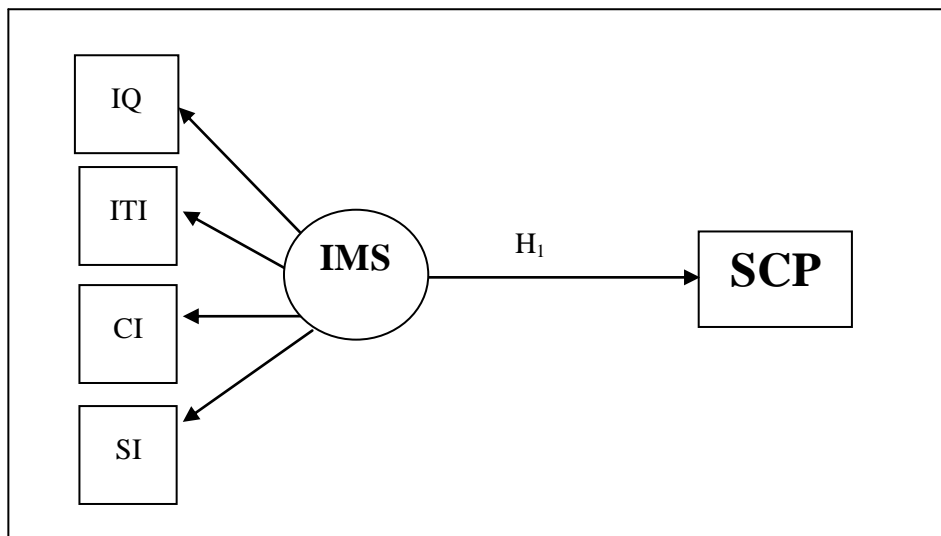
In this study, sample methods are by using structured questionnaire. The population of this study comprised in Malaysian Automotive Industry. Questionnaires will distribute to respondents from the listing of automotive industry obtained from Malaysian Automotive Component Parts Association (MACPMA), 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. 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 IMS and SCP. The research aims at analyzing of the relationship between IMS and SCP for Malaysian automotive industries. This model is called proposed research model as presented in Figure 1.



*Note: IMS= Information Manufacturing Sharing, SCP=Supply Chain Performance, IQ=Information Quality, ITI= Integrated Technology Information, CI=Customer Information, SI=Supplier Information

Figure 1. Proposed Model of The Study

VI. CONCLUSION AND FUTURE RESEARCH

IMS has become most important for SCP and it involves local car manufacturers and automotive suppliers in their effort to become more competitive in pursuing to enhance the organization ability to improve SCP. This study expected to provide valid and reliable for instrument and structural relationship model for IMS constructs. 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 IMS and SCP. 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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