
Analyzing Factors Influencing Supply Chain Management Practices in Medical Device Industry Indonesia

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Abstract

Amidst rapid advancement of technologies; rapid changes of market demands & uncertainties and many competitors in industry, Supply Chain Management has emerged as a leading strategic management tool to create efficiency and effectiveness with the aims to increase organization performance to survive in the market. This study focuses on several organizational capability factors such as Knowledge Management, Organization Agility, and Innovation Capability in relationship with Supply Chain Management Practices. This study uses Structural Equation Modelling (SEM) based on Partial Least Square (PLS) Technique involving 93 respondents whose activities involve supply chain practices in the medical device firms operating in Indonesia. The result of this empirical study shows that those 3 capabilities have significant influence towards the practice of Supply Chain Management.

Keywords: Supply Chain Management Practices, Knowledge Management, Organization Agility, Innovation Capability, Medical Device Industry.

I. INTRODUCTION

In Indonesia, the industry of medical devices is currently a fast-growing healthcare market which is experiencing constant growth over the years growing rate is currently at 12% per year, and valued at USD 3.5 billion prior to the implementation of the National Health Services (JKN) programme back in 2008. According to data from Social Health Security Administrator (BPJS-Kesehatan) and Indonesian Statistic (BPS) Indonesia the demand for health services has increased and are predicted to increase further (EIBN Medical Device Sector Report, 2018). This opens an opportunity for the increasing number of both local medical device companies as well as multinational companies. This is supported by local organizations which report that the increase in demand for medical equipment at this time is too large for the suppliers to fulfil.

Therefore, in this challenging and competitive business environment, firms are demanded to operate and work together more effectively and competitively [1]. Over two decades they have been trying to form a strategic partnership with partners to create an integrated firm which many believe that this approach is becoming the most effective and efficient way for firms to successfully operate their business [2]; which this collaborative approach refers to the terms of Supply Chain Management (SCM). Recently SCM has been a common practice and has become a major factor of securing competitive advantage and improving organizational performance [3] and firms' success now depended on how they design and manage their SCM [4].

While performing or practicing SCM within a firm, information sharing between players is considered as one of the integral parts [5] and as one of the organization capabilities, Knowledge Management can be well implemented to increase the level and quality of the information shared [6]. This will also help the supply chain system perform better in facing uncertainties in the market as today's business world is characterized by rapid changes and constantly evolving. As for instance, supply chains in the medical device industry have a unique and complex structure that is governed by many standards and regulations [7] therefore firms need to be Agile in assessing these kinds of issues as well as Innovative. As many healthcare institutions are now assessing innovative ideas for optimizing their medical device supply chains [7].

An inefficient in practicing SCM could lead to many problematics, a recent report (MedTech Intelligence) by McKinsey stated that medical device industry in US experience a significant loss estimated between \$2.5 and \$5 billion a year which is due failures originating somewhere in the supply chain. Cases also happen in one of Medical Device equipment in Indonesia [8] which experiencing problem which result delay in goods delivering. Lou (2006)

[9] identified that these problems are partly due to ineffectiveness in practicing SCM. In fact, a good SCM practice could save approximately 10 – 15 % of expenses cost of a firm according to a recent study conducted by the Medical Device Supply Chain Council (2011) [4]. While many SCM studies published out there trying to analyze the impact of SCMP towards operational and performance [10], the study is more concerning on whether organization capabilities factors namely Knowledge Management, Organization Agility, and Innovation Capability would have significant influence towards Supply Chain Management Practices in the study context of medical device industry Indonesia which was the main objective of this study. As today business activities are affected by the covid-19 pandemic, the Medical Device Industry in Indonesia currently cooperates with the government and universities to domestically produce innovations as a response to the situation. In this era of globalization, today's business world is characterized by many uncertainties with market demands and rapid advancement of information and technology. Prior to this, authors realize that these 3 capabilities could be essential and will go down to the supply chain level and would lead firms to sustain in today's business world.

II. THEORETICAL FRAMEWORK

A. Literature Review

- a. **Knowledge Management.** Girard (2015) [11] defines Knowledge Management (KM) as the systematic management of intangible assets such as knowledge, experience, and information in an organization. KM refers to the process of creating, sharing, using and managing those intangible assets which enable firms to develop rare and valuable knowledge through organizational learning and lead firms to being progressive to the new products and services, conquer and create new markets [12] [13]. KM is consist of three different dimensions which are (1) creation - stated as process of collecting and transforming data into information and knowledge through various level of organization learning; (2) storage and transfer – stated as mechanism which stored the knowledge and transfer it within organization and between organization; (3) application – stated as process of exploitation and exploration of resources as part of applying and using knowledge [6].
- b. **Organization Agility.** The term “agility” refers to the capacity of an organization to resist, absorb, respond, and even reinvent to cope or in response to rapid and disruptive changes in the environment which cannot be neglected by any organization competing in the market. Chung (2012) [14] defines Organization Agility (OA) as the

ability to predict and sense environmental changes and create appropriate responses by effectively redirecting resources. Organization Agility consist of 4 major categories which broke down into; (1) responsiveness; (2) competency; (3) flexibility; and (4) speed [15].

- c. **Innovation Capability.** Assink (2006) [16] defines Innovation Capability (IC) as internal driving factors in order to establish and explore radical new ideas and concepts, and to develop or generate marketable and effective innovation output. Iddris (2018) [17] then assess IC into 4 different dimensions which are (1) *Innovation strategy* - ability to identify external opportunities to match with internal capabilities to create innovation (2) *Organizational Learning* - bridge between working and innovating; (3) *Innovation Process* - innovative application towards the process and (4) *Idea Management and Implementation* - development and investment of idea management to achieve innovation outcomes.
- d. **Supply Chain Management Practices.** Supply Chain Management (SCM) has recently become an important common practice in the last decade across various industries. SCM can be seen as a systematic and strategic coordination which addresses long-term alliances across all business functions [18]. Meanwhile, Supply Chain Management Practices (SCMP) defined as the set of complete actions applied by organization to improve the effectiveness of management of their internal supply chain process [3], and it defined as 4 dimensions which are (1) strategic partnership - long-term relationship between supply chain players to work effectively and closely between each other; (2) customer relationship – practices to build relationship to manage customer suggestions or input and increase customer satisfaction; (3) Level of information sharing – refers to access of all related data between business partners in various processes in the supply chain; (4) Quality of information sharing – relate with accuracy, adequacy, timeliness, and credibility of information being exchanged.

B. Hypotheses Development

- a. **KM and SCMP.** Shakerian *et al* (2016) [12] recognized KM as the vital element of intensive information sharing and multi-cultural organizational environment, therefore it acts as the major capability in supply chain management. Within this context, knowledge in the supply chain is defined as the use of knowledge resources (information,technology,experience,etc.) obtained from other players for fundamental managerial decision making and to ensure strategy development [19]. Based on such understanding, this study advances following hypotheses:

H1: Knowledge Management has a positive and significant relationship towards Supply Chain Management Practices

- b. **OA and SCMP.** Firms can successfully promote their agility by the synchronous flow of information within supply chain partners [20] making the term of “agile supply chain”. Liu (2014) refers to the agility of a firm as their ability to collaborate between partners in response to market changes. Following this logic, agility in the supply chain level will enable firms to increase adaptability and flexibility to respond and react quickly and effectively to the demand network [21]. Based on such understanding, this study advances following hypotheses:

H2: Organization Agility has a positive and significant relationship towards Supply Chain Management Practices

- c. **IC and SCMP.** Recently, Seo (2014) [22] believed that firms with the capability to innovate could well enhance the performance of supply chain management. Suppliers or supply chain partners could be the source to innovation thus, organization’s capability to innovate and capture ideas from suppliers has become an important driver of collaboration in the supply chain. Innovation capability allows firms to acquire and utilize knowledge effectively and crucial for the supply chain practices or activities to further develop ideas, services, and products [23]. Based on such understanding, this study advances following hypotheses:

H3: Innovation Capability has a positive and significant relationship towards Supply Chain Management Practices

- d. **KM and OA.** According to Teece (2016) [24], implementation of KM could arise the dynamic capability of a firm which enables them to be adaptable and innovative to the turbulent market. By having the right management of knowledge, firms are able to get market insights and can modify organizational decision-making activities to seek the new way to adjust with the market [20]. Based on such understanding, this study advances following hypotheses:

H4: Knowledge Management has a positive and significant relationship towards Organization Agility

- e. **KM and IC.** By generating and utilizing knowledge, firms would be able to rapidly transform and implement new knowledge across the organization and would be able to generate innovation; following this logic, knowledge activities such as gathering, distributing, learning, sharing, and managing play an important role in generating

innovation [25]. Based on such understanding, this study advances following hypotheses:

H5: Knowledge Management has a positive and significant relationship towards Innovation Capability

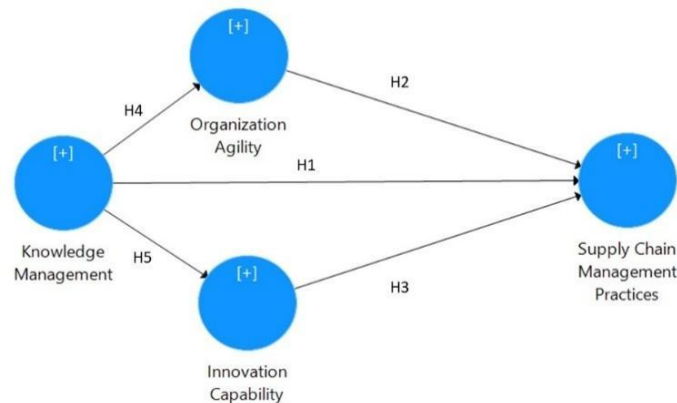


Figure 1. Research Framework (SmartPLS output)

III. RESEARCH METHODOLOGY

Research methodology of the study consist of 4 phases as the following:

1. **Item generation.** Any good measurement requires content validity, meaning that the measurement items of each variable construct covers the major content of that particular construct which in this phase author achieved the item generation through comprehensive literature reviews. Dimensions of each variable construct have been mentioned previously. SCMP measurement consist of 16 items adapted from Li *et al* (2006) [3]; KM measurement consist of 13 items adapted from Garcia (2015) [6]; OA measurement consist of 11 items adapted from Taghizadeh (2015) [15] & Cegarra (2015) [26]; and IC measurement consist of 10 items adapted from Saunila (2012) [27] & Iddris (2018) [28]. Besides literature review, *Focus Group Discussion (FGD)* was also conducted by interviewing respondents from the industry to achieve content validity as well as ensuring that the respondents are capable to answer questions and misinterpretation can be neglected.
2. **Pilot study.** In this phase, questionnaire was deployed into small scale respondents (23) from medical device companies with aim to measure the Validity and Reliability of

the questionnaire before it was spread out to larger scale. From this pilot-study evaluation there were no any modification in the questionnaire

3. **Large-Scale method.** Questionnaire (google form) was spread out to medical device companies in Indonesia through online platforms. A total of 124 respondents completed the survey (includes the first 23 respondents in the pilot study), of which a total of 93 of them considered valid after data screening which most of them [83%] coming from "Large Business" Firm; 76% of the respondents hold bachelor degree and 24% of them hold master degree. The screening was aimed to sort in people whose recognized to have knowledge or understand briefly about supply chain activities in their firm (i.e. Strategic & Operation Planner, Supply Chain Analyst & Manager, Logistic Department, Team leader or Supervisor, Senior Managers).

Table 1. Table of respondent profile

Profile Characteristic	Frequency (%)
Functional Operation	
Supplier/Principal	39%
Distributor	41%
Local Manufacturers	20%
Job level	
Staff/Officer	83%
Middle Level Manager	15%
Top Level Manager	2%
Working Experience	
< 5 years	36%
5-10 years	38%
10-15 years	23%
15-20 years	3%

4. **Model and Data Evaluation.** For the descriptive statistic analysis, study used. SPSS version 26 For model evaluation, this study conducts PLS-SEM analysis technique using SmartPLS 3.0 software. Evaluating models using a *Partial Least Square* technique consist of 2 model evaluation, namely measurement model; in which to evaluate the validity and reliability of the observed variables / items representing each latent variable construct, and structural model; in which to evaluate the relation and significance between latent variable constructs.

IV. RESULT

Table 2 below shows the descriptive table from each latent variable construct as well as the correlation between constructs.

Table 2. Table of descriptive statistic analysis

Latent Variables	Mean	Std. Dev	Min	Max	Variable Construct Correlation*			
					KM	OA	IC	SCMP
KM	3.675	1	1.23	5	1			
OA	3.68	0.928	1.27	5	0.685*	1		
IC	3.65	1.01	1.3	5	0.729*	0.652*	1	
SCMP	3.604	1	1.31	5	0.843*	0.766*	0.792*	1

*) Spearman Correlation; indicates significant at the 0.01 level (2-tailed)

Table 3 below shows the measurement model evaluation which assesses the validity and reliability of each variable construct along with their respective dimensions. To assess the validity, all variables/constructs have a factor loading (Outer Loading) above >0.7 and Average Variance Extracted above >0.5; which according to Hair *et al* (2014) [29] indicates a good validity. To indicate reliability, all variables/constructs have a Cronbach Alpha as well Composite Reliability (CR) above >0.7; which indicates a good reliability.

Table 3. Table of validity and reliability (Measurement Model analysis)

Item		Result			
Construct	Dimension	Factor Loading	AVE	CR	Cronbach Alpha
KM	Creation	0.892	0.569	0.943	0.935
	Storage & Transfer	0.827			
	Application	0.89			
OA	Responsiveness	0.781	0.561	0.927	0.913
	Competency	0.736			

	Flexibility	0.83			
	Speed	0.782			
IC	Organization Learning	0.794	0.537	0.922	0.905
	Idea Management	0.83			
	Innovative Strategy	0.843			
	Innovative Process	0.739			
SCMP	Strategic Partnership	0.9	0.575	0.95	0.943
	Quality of information	0.872			
	Level of information sharing	0.777			
	Customer Relationship	0.892			

The result obtained qualified the requirement. Therefore, the variables/constructs in the model proposed by the research study have a good validity and reliability. Table 4 below shows the structural model evaluation, which informs the conclusion of the hypothesis testing. Study tested the path coefficient at 95% confidence interval level (2-tailed).

Table 4. Table of hypothesis testing (Structural Model analysis)

Hypothesis	Path	β -Coefficient	T-Statistic	Conclusion
H1	KM -> SCMP	0.426	3.311	Supported*
H2	OA -> SCMP	0.319	1.978	Supported*
H3	IC -> SCMP	0.275	2.05	Supported*
H4	KM -> OA	0.826	12.963	Supported*
H5	KM -> IC	0.848	16.384	Supported*

*Indicates significant at 0.05 level, t-value of 1.96

Notes: Goodness Of Fit (GOF) = 0.656; Normed Fit Index (NFI) = 0.51; Standardized Root Mean Square Residual (SRMR) = 0.071; RMS_Theta = 0.147

V. DISCUSSION AND IMPLICATION

In this globalization era, firms began to realize that they are required not only to improve the efficiencies within the firm but the whole Supply Chain Management (SCM) needs to be made effective and competitive. A set of activities conducted within a firm to promote the effectiveness of its whole management of supply chain called SCM practices [30].

The main objective of this study was to analyze organization capabilities with a positive relation towards the practices of firm's management of supply chain. According to the result KM has a significant relation towards SCMP. Thus, Hypothesis 1 (H1) is accepted, which supported previous studies as examples, Shakerian (2016) [12] and Attia (2018) [13] who recognized the KM of the firm plays a major role in information integration and organizational learning within the firm. KM enables and facilitates knowledge sharing among employees as well among supply chain players, which in turn enhances the flow of knowledge, cooperation & long-term relationships, and improves the effectiveness and efficiency of the supply chain [13] [19] resulting value-added products or services to the market.

Besides KM, OA was also found to have significant relation towards SCMP, based on the supported Hypothesis 2 (H2). This result is consistent with previous study from Khastoo (2017) [21]. Agility of a firm as one of the vital characteristics to achieve superior supply chain practices [31]. In such a competitive market, firm needs to improve flexibility and responsiveness necessity to survive. Firms must unite with supplier and customers in advance the the operations and activities associated with the flow of material, technology, and information in order to achieve an agility in supply chain since the terms of agile supply chain refers to a set of firms which are dependent on each other in terms of the business side [21]. Agility of a firm influences the practices of the whole supply chain management to inventory reduction, adapting to market variations more efficiently, enabling enterprises to respond to market demand more quickly, and integrating with suppliers more effectively [32].

Hypothesis 3 (H3) was also supported based on the result meaning that IC has significant relation towards SCMP. This result is consistent with the findings from previous studies from Seo (2014) [22] & Lintukangas (2019) [33] which stated that IC could well enhance the practices and performance of the overall supply chain. In the supply chain context, IC might involve in product, process, and services transformation [34]. For instance, collaboration with supply chain partners play a crucial role in driving innovation in the organization both upstream and downstream, from product development phase until the launch of the product to the market.

Another interesting finding of the study is by confirming that KM does positively influence both OA and IC which is seen by results which supported hypothesis 4 and hypothesis 5. Teece (2016) [24] Olivia (2018) [35] believed that the implementation of knowledge management in firm allows the firm to gain more the dynamic capability in facing today rapid advancement and rapid changing demand meaning firm will have the ability to be more agile or responsive and creative or innovative in response to market volatility and

dynamism. By having the right knowledge firm would be able to exploit for market insight to sense and predict market changes [36] and by integrating knowledge through organization learning, firm would have the ability to capture ideas and implement it into innovative output products, services, and processes [27].

Study Implication

As SCM study continues to increase and develop, many of them have not been able to offer much by way of guidance to help the practice of SCM and the role of organization capabilities factor which influence it [3]. The study contributes theoretically as this study confirms the relationships among the latent variable construct taken from previous studies with different research contexts. While many of studies published focus more focusing of what SCMP can bring to the performance of the firm, this study provides development of factors affecting SCMP in a more integrated and holistic way the different perspectives of such relationships whereas previous studies have not comprehensively examined such relationships by extending the theoretical development previously developed by several researchers. With the study context SCM in medical device industry Indonesia, the study also extended the validity of previous findings with the cross-industry validity.

The study also contributes practically by giving insight for medical device firms in Indonesia to enhance their Supply Chain Management Practice, by paying attention to Knowledge Management, Innovation Capability, and Organization Agility strategy in their day-to-day management. This study implies that Knowledge Management implementation has the biggest influence not only based by the β -coefficient value but also by the significant influence towards both Organization Agility and Innovation Capability.

In the context of supply chain management, having a right knowledge management utilization such as external learning from the chain members can help an organization to improve its innovativeness and help firms to respond to market changes quickly and efficiently [32]. For example, in the industry of medical devices; with the unexpected market demands caused by the COVID-19 pandemic, firms with a knowledge could get a market insight about the high demand of products (i.e. ventilators) in the future. Then it will increase their flexibility and responsiveness and the firm will therefore do collaboration (i.e. suppliers, universities, etc.) to manage and implement the idea to produce marketable innovative products in order to answer market demands. The whole process involved many firms in their practices of SCM.

VI. CONCLUSION

Supply Chain Management has emerged as the strategic management tools to enhance the performance of the whole management in order for firms to sustain in this very competitive market as well as help firms in obtaining competitive advantage over their competitors. The study contributes by showing that organization capabilities such as knowledge management, organization agility, and innovation capability are key drivers in enhancing Supply Chain Management Practices in the industry. Knowledge Management was found to be the most essential part in driving agility and innovativeness of firms to leverage the SCM practices.

VII. LIMITATIONS AND FUTURE RESEARCH

This study has several limitations, all of which open up opportunities for any future research to be conducted. First, this study is a cross-sectional study, therefore it cannot determine causality relationship between variables studied; therefore study should be conducted in a longitudinal timeline. Second, this study focused only upon the Medical Device Industry in Indonesia; As SCM research continues to develop, many researchers are focusing on the cross-industry validity of previous findings; therefore there is a need to re-study the hypothesized relationship between different industrial sectors in Indonesia. Third, this study only conducted in a quantitative method; conducting a mix-method (collecting data also through qualitative method) could add further value and interpretation to the respective findings.

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