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Exploring the Link between Supply Chain Agility, Supply Chain Cost, Supply Chain Responsiveness, Global supply Chain Risk Management, and Contribution in Global Manufacturing: An Indonesian Perspective

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Abstract—During last decade, supply chain management has emerged as a key for sustainable competitive advantages. Increasing globalization has given birth to new philosophies and businessman has started focusing on the new ways of occupying market share. However, the share of Indonesia in global production has decreased from 31.953% in the start of this year to 20% in 2017. Which shows a gradual decrease of 11% in 16 years. To address this issue, the ultimate objective of this study is to develop a framework to boost global manufacturing through supply chain activities. This objective was achieved by examining the effect of supply chain agility, effective supply chain cost, supply chain responsiveness and risk management practices. Survey questionnaires was used to collect the data and P19SEM used to analyze the data. It is found that supply chain agility, effective supply chain cost and supply chain responsiveness has significant positive effect on global manufacturing. Moreover, risk management practices as a moderating variable strengthen this effect and enhances the global manufacturing activities.

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Keywords: Supply chain agility, supply chain cost, supply chain responsiveness, risk management, global manufacturing.

1. Introduction

During last decade, supply chain management has emerged as a key for sustainable competitive advantages [1]. Increasing globalization has given birth to new philosophies and businessman has started focusing on the new ways of

occupying market share [2]. Innovation has been playing key role during the time and still it is a key competitive advantage. However, interestingly the practice of supply chain management is guided by some basic underlying concepts that have not changed much over the centuries. Modern SCM practices have sought to generate a dynamic flexibility, allowing organizations to deal with change in demand and technology. Thus, SCM practices involve a set of activities implemented to support the supply chain effectiveness of an organization. These activities include; transit time, staff quality, distribution channels, information communication technology (ICT), performance, audit activities, leadership etc. [3] [4] [5] [6] [7] [8]. However, the reviews portray by different authors are vary in term of perspectives with a common goal to improve organizational performance and competitive advantage.

Supply chain is a complex function which come with an enormous level of risk inherent from its core operations. The risk can be minor with major implications on overall functioning of production department such as a small delay in activity which can appear as a bottleneck for remaining activities [9]. There are many examples of such issues such as Ericsson, who after firing its only supplier

Phillips Chips fabric in New Mexico bared loss of \$ 400 million. Similarly, the natural disasters in Japan, have caused production efficiency issue in Toyota by dropping production by 40,000 vehicles, which caused a loss of & 72million.

Globalization of business is coming up with unique challenges, and cross border expansions of supply chains and international outsourcing are common now a day. This expansion has made the supply chain more complex and foreign sales of any company and even share of any country in global production is dependent on the efficiency of supply chain management of any country. Though the multinational operating form developed country are aware of the risk associated with complexities of supply chains however, the firms operating in developing and emerging economies such as Indonesia are still trying to cope up with the issue.

On the one side the globalization of supply chain has emerged as an issue, whereas on other hand they have emerged as an opportunity for the firms operating developing and emerging countries.

Actually, global integration of firms blessed any firm with number of opportunities of accessing unique resources available in global markets. Meanwhile, it also helps any economy to reap the benefits from the competitive advances of globalizations. The other side of globalization of supply chain management is associated risk, as despite it offers economies of scope but it also offers a great deal of risk and any minor bottleneck can lead to a high loss.

Though the risk assessment in global supply chain management has been identified as an important antecedents of supply chain success [10] [11] [12] [13] [14] [15] [52][53][54][55]. However, how they impact global production is still a puzzling question to be answered in operation management literature.

Indonesia is among emerging economies, whereas the share of Indonesia in global production has decreased from 31.953% in the start of this year to 20% in 2017. Which shows a gradual decrease of 11% in 16 years.

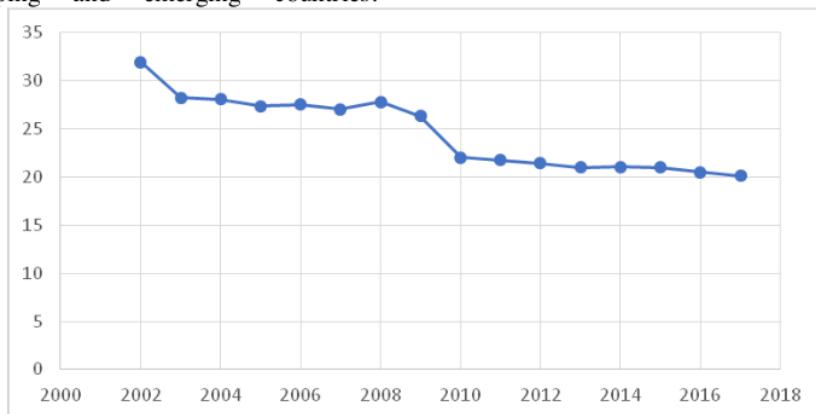


Figure 1. Indonesian global production
Source: [16]

The figure 1 above indicates that the Indonesia is facing a significant decline in global manufacturing share, owners the share of research and development by

Indonesian economy in GDP is just 0.1 percent of overall GDP.

The supply chain performance which includes the supply chain agility, supply chain cost, and supply chain

responsiveness help the firms in developing a sustainable global supply chain and affect the relationship between global production and global supply chain risk. Thus, the ultimate objective of this study is to develop a framework to boost global manufacturing through supply chain activities.

2. Literature Review

2.1 Global Supply chain risk Management

Supply chains management (SCM) has acknowledged a great deal of interest by researchers and practitioners. SCM has become universal way across industries since its addresses seller-buyer partnerships, shared planning, continuing strategic coalition, control of inventory cross-organizational, information sharing and logistics management. Effective SCM will lead to provides the necessary level of customer service to a specific segment by reduction the entire amount of resources and enhancing customer services through improved product availability and reduced order cycle time [17] [18] [19][55][58].

SCM adopts systems perspective across firms and functions as an absolute system by processes of coordination. Thus, the key to the creation of supply chain value are possibly made through collaboration among participating firms. Companies may engage in information exchange and structural collaboration. Information exchange may include the inventory supervision, forecasting techniques and delivery. Meanwhile, the structural collaboration may include vendor-controlled inventory, outsourcing, co-locating factories and just-in-time [20] [56] [57]. [21] identifies demand chain collaboration can be referred to the long affairs with partners in downstream supply chain to create end-customer value. It is characterized through the information exchange, operations, cross firm forecasting and shared planning with downstream partners. Meanwhile, [22] highlighted that outsourcing also opens the door to practicing SCM as tools

and/or plays a beneficial role to make SCM more effective and efficient. In SCM, in order to serve clients, upstream company is directly to suppliers and downstream to distributors.

Generally, labor, capital, information, technology, materials, financial assets and other resources through the supply chain. Given that the goal of a company is to capitalize on profits, the companies must reduce costs and exploit benefits along the supply chain [23] [59][60]. Physical logistics more dependent on information technologies, and these technologies enables of further cooperative arrangements. [24] states that firms faced an inter-dependence and shared fortune when the management of an extended enterprise as a network of processes, relationships and technologies creation. Thus, the environment of supply chain management becomes apparent to participating companies with victorious implementation in the dynamic comprehensive environment of the business world, augmenting with risks, and it greatly affects the processes of the decision-making in business management. It has significant effect on risk management of an enterprise [25][61] [62]. Therefore, nowadays, SCM becomes a popular management tool in helping firms improve their competitiveness. The concept of SCM has been recognized to be vital importance for textiles and apparel industry [26]. The management can utilize the functions of SCM to plan, coordinate, and control logistics knowledge flow, capital flow, and information flow of the business. It enables firms to improved response speed and reduced uncertainty of the supply chain.

The supply chain is an important component of world trade. However, a supply chains itself is not enough; it is more critical to understand its features and the role played by each function in the overall supply chain to work efficiently and effectively [27]. Since SCM has been considered as the strategic and systematic

coordination of traditional business activities, firms are starting to pay attention to their supply chain to increase competitive advantages [28]. As the twenty-first century begins, SCM has turned into a significant strategic instrument for firms to reduce costs, but also enable firms struggling to enhance quality, improve customer service, and increase competitiveness [29]. Supply chain and SCM have played an important role in firm efficiency and have attracted scholars' attention in recent years [30]. The real contribution of SCM not only attracted scholars' attention, but also received attention from practitioners.

In contemporary, the characteristic of competition increasing to global business environments [31]. Therefore, it is vital that textile organizations to cooperate to attain common goals such as minimizing delivery cost, stock holding cost, increase punctuality, enhance quality, improved flexibility, and quick respond to ensure profitability [32] and customer satisfaction. Otherwise, the company will lose competence in extreme varied and fast change market [33]. For instance, Zara Spanish apparel organization provides a real illustration of the hybrid supply chain. It is one of Spain's greatest and dynamic apparel organizations, producing trendy apparel to a universal target market of 18 to 35-year old. Since, major difficulty in most supply chains is lacked visibility in actual demand, so, forecast driven was better than demand driven. Therefore, Zara developed a quick response system for the industry to handle visibility problems.

The uncertainty issues associated with supply chain has emerged as a problem of modern time business world. The uncertainty associated with speed of delivery, price volatility, inventory stock, and order cost are affecting supply chain performance and becoming continuous threat to supply chain efficiency. Though Supply chain management has been emphasizing on supply chain risk and offered verity of tools for the mitigation of supply chain risk. However, the

globalization of business and cross border integration of supply chain has come with unique risk of complexity and offering unique risk such as macroeconomic risk, policy risk, and taxation and regulatory risk [34] [63].

According to [35] argued that the supply chain risk can be of various types and can rise from verity of issues such as error in forecasting, capacity issues, break down in system, and disruptions the supply chain risks could be in the form of delays of materials. Whereas argued that apart of these risks, supply chain management of modern days is more competitive and agile than past, especially increasing globalization has given birth to certain risks. ¹

The global supply chain risk management is a process that involves steps from risk identification to risk mitigation. However, it includes two additional steps which are not in traditional supply chain risk management, which are dynamics of globalization and its impact on supply chain risk management and consolidation of cross border supply chains are offering unique risk. One of unique risk is macro level risk, which advocates the shifts in comparative advantages in economies. Meanwhile another macro level risk is variation in doing business status among different countries. In addition to that which are crucial to supply chain are uncertainty in lead time and reliability of supplier [36]. The reason why lead time uncertainty is important because logistic activity is affected by lead time and lead time can be extended using advancement in IT. ⁴

2.2 Supply Chain Agility

The supply chain agility has gain interest of operation management researchers and photospheres and merged as key strategy of operational success [37]. Agility is a reactor force which defines as prompt response or reaction of any change in supply or demand. Mostly the concept of agility is confused with lean. However,

both are distinct constricts as agility characterized with flexibility as a function of market sensitivity under the condition of unpredictability whereas the lean addresses flexibility under predictability.

In SCM, there are several studies defined the different number of characteristics of agility. Characterizes supply chain agility in terms of two factors, which are flexibility and adaptability, whereas [38] characterized supply chain agility in terms of six factors, which including operational alertness, operational response capability, strategic alertness, strategic response capability, episodic alertness, and episodic response capability. [39] characterized supply chain agility in terms of four characteristics which including demand response, customer responsiveness, joint planning, and visibility. Whereas according to [40] social and life science theory characterizes supply chain agility in terms of five factors which including alertness, decisiveness, accessibility, flexibility, and swiftness. In this study, the total of six characteristics are used to define supply chain agility, which including alertness, decisiveness, accessibility, flexibility, swiftness, and demand response.

2.3 Supply Chain Responsiveness

In 1984, textile industry research program in US has started the quick response movement. In a rapidly changing market environment such as textile and apparel market, responsiveness is one of the critical determinants to significantly improve supply chains performance [41]. Therefore, firms need to faster respond to customer requirements in order to be competitive in today's quick-change markets. In the meantime, technological support is required to achieve higher levels of customer responsiveness with stringent time and quality targets. Generally, supply chain responsiveness is led to minimized costs, increased speed and improved flexibility [42].

To achieve supply chain responsiveness, a suitable and effective adoption of supply chain technology is crucial and desirable to assure the effective communication and efficient material flow along the value chain [42]. From an operation's standpoint, understand customer needs and high responsiveness is needed to benefited firms in achieving higher performance. However, several studies show that manufacturer in fashion apparel industry was not fully efficient in quick response such as dissatisfied response time and lack of response accuracy [43]. Nevertheless, responsive supply chain has led the increasing number of fast fashion organizations emerging in the fashion market.

To achieve higher responsiveness in the supply chain, require practices from various aspects such as sharing information, established good relationships with supplier and customer, partner involvement, and adoption of supply chain technology (e.g., RFID, EDI, CAM, CAD), electronic point of sale, and automatic replenishment systems [44]. Another study noted that traditional approach for apparel business is totally depended on market demand forecasts, in fact, the forecasts never accurate enough because customer demand is kept changing at all the time. Therefore, in order to be responsive to customer demands, the strategy should change from demand forecast to demand driven. The speed or time to market was a fundamental way and competitive weapon in fashion markets.

2.4 Supply Chain Costs

Supply chain costs can be defined as the costs related with operating the business functions in the supply chain, including procurement, manufacturing, and distribution [45]. However, costs related with overhead functions, sales and promotion, and marketing are not reflected in supply chain costs. Nevertheless, the lead times for manufacturing goods are widely affected the operating costs such as

overtime and delivery costs [45]. For the practical example reported by [45], the firm required to operate overtime and sends the goods to customer by fly instead of boat at their own cost if the firm missed a deadline given by the customer. However, shared planning and forecasting information to well matched demand and supply quantity able to reduce overall supply chain costs.

In Indonesia mostly produced for export and the competitive success was mainly based on the combination of quality, cultural, cost advantage [45], and

value advantage. Inventory carrying costs and damage costs are not less important in the supply chain [43], while the transportation or logistic costs usually the highest among the operating cost in the supply chain [46]. In today's business environments, as transportation and petrol costs are kept increasing, thus the optimal management of 68 operations and resources are vital [47] [64]. It is suggested that the adoption of e-commerce on textile and apparel supply chain can lead to inventory cost saving, facility cost saving, and transportation cost saving.

2.5 Research Framework and Hypothesis

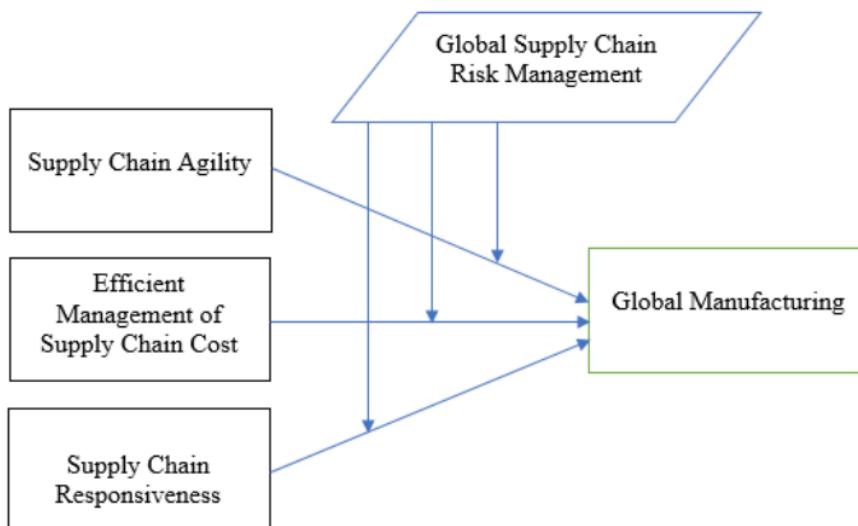


Figure 2. Theoretical Framework

² **H₁:** There is a significant relationship between supply chain agility and global manufacturing.

H₂: There is a significant relationship between efficient management of supply chain cost and global manufacturing.

² **H₃:** There is a significant relationship between supply chain responsiveness and global manufacturing.

H₄: There is a significant relationship between global supply chain risk management and global manufacturing.

³ **H₅:** Global supply chain risk management moderates the relationship between supply chain agility and global manufacturing.

³ **H₆:** Global supply chain risk management moderates the relationship between

efficient management of supply chain cost and global manufacturing.

3. Method

Selection of research method is one of the most crucial element of every study [48]. Therefore, by following the nature of the study, cross-sectional research design was selected, and data were collected from managerial employees of supply chain companies ¹¹ in Indonesia. Survey questionnaires was used to collect the data.

Moreover, data were collected by using area cluster sampling technique. As it is one of the suitable technique when population is spread on a wide area [49]. Three hundred (300) questionnaires were distributed among the supply chain employees. Sample size was selected based on [50]. According to [50], 300 sample size good to conduct a research study.

From 300 distributed questionnaires, 245 were returned in which 11 were not complete. Therefore, total 234 questionnaires were used to analyze the data. All the measures were adopted from prior studies. Smart PLS 3 were used to analyze the data.

4. Data Analysis and Results

Smart PLS 3 was preferred to analyze the data. PLS SEM is a suitable technique to analyze primary data. Before testing the key hypothesis of the study, there is need to fulfill the important assumptions of PLS SEM. These assumptions are generally includes to achieve a certain level of discriminant and convergent validity. To achieve the convergent validity, factor loading, composite reliability and average variance extracted (AVE) was analyzed.

Table 1 shows the results of measurement model assessment. According to [51], factor loading should not be less than 0.5. Composite reliability should be more than or equal to 0.7 and AVE should be more than 0.5. Table 1 shows that all the values are in acceptable range.

The second assumption of PLS SEM is confirmation of discriminant validity. Below Table 2 shows the discriminant validity. It is attained through square root of AVE. The

result shows that square root of AVE is more than all other values which confirm the discriminant validity.

After the completion of all the assumption related to PLS SEM, the structural model was analyzed to test the concerned hypothesis. While testing the hypothesis, 1.96 level of t-value was considered. Table 3 shows the results of structural model assessment without moderating variable. From these results, it is evident that t-value for all relationships are more than 1.96 which confirm the hypothesis.

After analyzing the direct hypothesis, the interaction term was created through PLS bootstrapping technique. As it is shown in Table 4. In interaction term, the moderating role of global supply chain risk management was examined. It is found that moderating effect for the relationship of supply chain agility and global manufacturing is significant. Moreover, moderating effect between effective management of supply chain cost and global manufacturing is also significant. However, it is insignificant in case of supply chain responsiveness and global manufacturing as the t-value is below 1.96.

Table 1. Convergent and Discriminant Validity

| Construct | Indicators | Loadings | Composite Reliability | AVE |
|--|------------|----------|--------------------------|-------|
| supply chain agility (SCA) | SCA1 | .689 | 0.755 | 0.553 |
| | SCA2 | .720 | | |
| | SCA3 | .867 | | |
| | SCA4 | .728 | | |
| | SCA5 | .602 | | |
| Efficient Management of Supply Chain Cost (EMSCC) | EMSCC1 | .799 | 0.701 | 0.553 |
| | EMSCC2 | .680 | | |
| | EMSCC3 | .621 | | |
| | EMSCC4 | .667 | | |
| | EMSCC5 | .687 | | |
| | EMSCC6 | .832 | | |
| Supply Chain Responsiveness (SCR) | SCR1 | .785 | 0.822 | 0.511 |
| | SCR2 | .782 | | |
| | SCR3 | .852 | | |
| | SCR4 | .772 | | |
| | SCR5 | .623 | | |
| Global Supply Chain Risk Management (GSCRM) | GSCRM 1 | .720 | 0.776 | 0.524 |
| | GSCRM 2 | .794 | | |
| | GSCRM 3 | .820 | | |
| | GSCRM 4 | .780 | | |
| Global Manufacturing (GM) | GM1 | .848 | 0.721 | 0.550 |
| | GM2 | .888 | | |
| | GM3 | .789 | | |
| | GM4 | .700 | | |
| | GM5 | .721 | | |

Table 2. Discriminant Validity

| | 1 | 2 | 3 | 4 | 5 | 6 |
|-------|--------------|--------------|--------------|--------------|--------------|---|
| SCA | 0.948 | | | | | |
| EMSCC | 0.734 | 0.878 | | | | |
| SCR | 0.888 | 0.730 | 0.821 | | | |
| GSCRM | 0.921 | 0.808 | 0.735 | 0.856 | | |
| GM | 0.611 | 0.784 | 0.787 | 0.781 | 0.821 | |

Table 3. Structural Model Assessment Results

| Hypotheses | Relationship | (β) | SD | T-value | P-Values | Decision |
|----------------------|---------------------------|-------------|-------|---------|----------|-----------|
| H₁ | SCA \rightarrow GM | 0.317 | 0.110 | 2.857 | 0.011 | Supported |
| H₂ | EMSCC \rightarrow GM | 0.207 | 0.105 | 1.960 | 0.050 | Supported |
| H₃ | SCR \rightarrow GM | 0.401 | 0.203 | 1.962 | 0.049 | Supported |

Table 4. Moderation effect

| Hypotheses | Relationship | (β) | SD | T-value | P-Values | Decision |
|----------------------|-------------------------|-------------|-------|---------|----------|---------------|
| H₄ | SCA* GSCRM ->GM | 0.280 | 0.101 | 2.752 | 0.003 | Supported |
| H₅ | EMSCC* GSCRM ->GM | 0.451 | 0.140 | 3.201 | 0.001 | Supported |
| H₆ | SCR* GSCRM ->GM | 0.030 | 0.112 | 0.259 | 0.553 | Not Supported |

From Table 5, it is evident that the variance explained is 76.3%. It describes that all the latent variables are expected to bring change approximately 76.3% in

dependent [6] variable. According to literature, this is substantial value for variance explained.

Table 5. Variance Explained (R^2)

| Variance Explained (R^2) | |
|------------------------------|-------|
| Global Manufacturing | 76.3% |

5. Research Findings and Discussion

Results of the current study revealed that all the latest exogenous variables have significant positive effect on dependent variable, namely; global manufacturing. According to the results, it is found that supply chain agility, efficient management of supply chain cost and supply chain responsiveness has positive contribution in global manufacturing. It indicates that increase in supply chain agility, efficient management of supply chain cost and supply chain responsiveness increases the global manufacturing activities.

supply chain risk management practices are most important for supply chain in global manufacturing.

Additionally, the moderating role of global supply chain risk management was also examined. It is found [3] that moderating effect of global supply chain risk management is significant between supply chain agility and global manufacturing activities. Moderation effect indicates that global supply chain risk management strengthens the relationship of supply chain agility and global manufacturing, as shown in Figure 3.

Moreover, it is found that moderation effect between effective supply chain cost and global manufacturing is also significant and it strengthens the relationship. It is shown in Figure 4.

Furthermore, it is found that moderation effect between supply chain responsiveness and global manufacturing is insignificant.

Moreover, it is found that global supply chain risk management practices are also most important for global manufacturing. The results of the study show that global supply chain risk management practices have significant positive relationship with global manufacturing. Efficient risk management practices enhance the global manufacturing practices. Thus, global

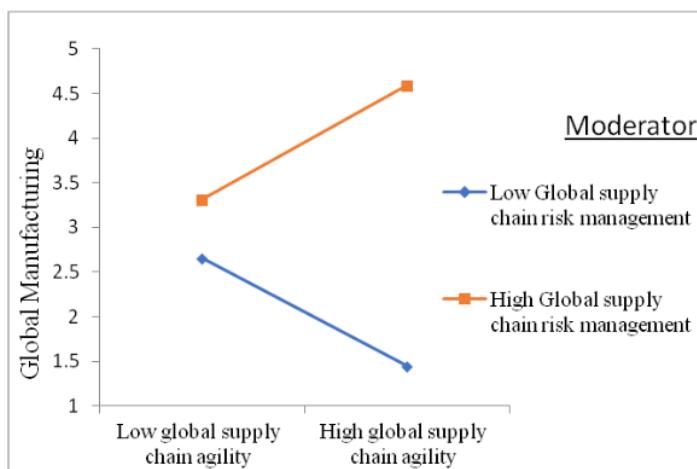


Figure 3. Moderation effect between effective supply chain agility and global manufacturing
Source: Authors own estimation

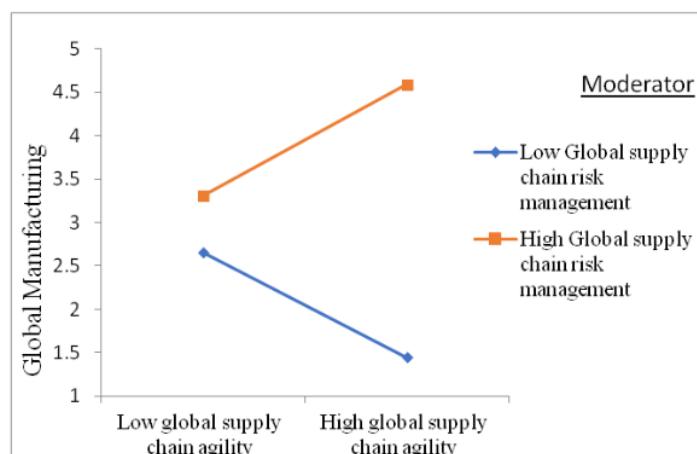


Figure 4. Moderation effect between effective supply chain cost and global manufacturing
Source: Authors own estimation

6. Conclusion

While analyzing the data it is revealed that supply chain agility, effective supply chain cost and supply chain responsiveness has major contribution towards global manufacturing. These are the major determinants of global manufacturing. Indonesian firms must enhance supply chain agility, effective supply chain cost and supply chain responsiveness to

enhance global manufacturing activities. Decrease in these elements will decrease the global manufacturing activities. Moreover, supply chain risk management has most important to enhance global manufacturing in Indonesian. Effective risk management activities have positive effect on global manufacturing. Risk management practices enhances the positive effect of supply chain agility and

effective supply chain cost on global

manufacturing practices.

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