Internal Performance of an Integrated Supply Chain: Does Flexibility Matter?

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***Abstract*— The prime objective of the currents study, is to investigate the link between supply chain integration (SCI) and Internal Supply chain performance (ISCP). Apart of investigation the impact on internal performance of integrated supply chain, the current study is also interested in investigating the mediating role of Supply Chain flexibility (SCF) in the relationship between SCI and supply chain internal performance ISCP. The structural equation modeling which a twostep process i.e. inner model assessment and outer model assessment is and is an upgraded version of multiple regression is used to answer the research questions. The current study has used the AMOS to analyze the data collected from production managers of Indonesian manufacturing firms. The findings of the study have revealed the fact that SCI has significant impact on the internal supply chain performance (ISCP). The SCF has significantly mediated the relationship between SCI and ISCP. The study will be helpful for policy makers in researcher in understanding the issues related to supply chain, its integration, flexibility, and internal performance.**

Keywords: *SCI, flexibility supply chain management, Indonesia*

1.0 Introduction

Just as the external chain was defined as dealing with the external parties, the internal chain refers to interested parties within the organization. It is related to the internal aspects [1]. This consists of all functions within the organization such as production, maintenance, quality, human resource, accounting, engineering, etc. In the work by [2], they illustrate the relationship of a company's supply chain where specifically the internal supply chain was described. Internal supply chain can be across departments such as Purchasing, Human Resource and Finance or it can be within the production line itself which can be from one production process to another (such as from bonding to molding and cutting etc). Emphasis on internal supply chain research can be seen in studies such as the one on future research direction for supply chain [3], and those that talks about how the use of information and communication technology (lCT) such as enterprise resources planning (ERP) should be deployed in a small and medium sized manufacturing environment compared to a large corporation [4]. In the work by [4], they highlighted the lack of study into the knowledge gap faced by organizations of differing sizes in the implementation of the ERP system. The knowledge level (both from the aspect of education as well as experience) required in each organization would be contingent upon their size (example it is expected that for successful ERP implementation in big organizations they knowledge level required would be more than those of smaller organizational size).

Parties involved in the internal chain basically are related to the function they play in the supply chain [6]. For example those related to the production function could be engineering staffs, production operators, supervisors managers, quality inspectors etc.. In some organizations the parties are categorized into two main groups, namely the direct staffs such as operators, inspectors, line-leaders etc. and the indirect staffs who are those such as supervisors, managers etc.

This traditional thinking however is not relevant today. In fact, now it is expected that every functional area can interact with customers, especially electronically [7]. Though the active parties are as mentioned earlier on, it is not uncommon to have the external parties dealing directly with the internal members especially in todays well-connected world [8]. As such the active parties in the internal chain (all the personnel within the organization) are all in a sense linked to the external chain too [9].

As we enter or rather as we are in an "age of information", an area that is much related to the internal supply chain is communication. It is not only verbal or non-verbal but covers the issue of communication ethics of which managers of today would need to be aware of. A wise manager should be well aware of this matter in their specific environment when they make decisions and communicate them [10].Many organizations (especially Multi-National Corporations (MNC» are linked to their external supply chain for both suppliers as well as customers via business-to-

business electronic marketplaces (EMPs) as it brings about improved efficiencies and reduced cost in the supply chain [11]. However, in order to do so the fundamental is to establish within the organization the infrastructure such as having an enterprise resource planning (ERP) system in place

2.0. Literature Review

2.1. ISCP

Although many different ways to measure performance of SCM exist, such as integration [12],cost effectiveness [13],inventory level [14],throughput efficiency [15],flexibility [16],information and material flow [17],and delivery performance [18],research points to the need for more studies [19], [20], and [21].One example is in the study by [19],where he argues that measuring SCM performance should include some guidelines. The guidelines mention three measurement which are a) resources measurement (Efficiency). b) the measurement of outcomes such the satisfaction of the customers, in addition to that c) the flexibility which is a solution to uncertainty especially supply chain flexibility it more from the economic stand point rather than the customer satisfaction which was advocated by [23].The enormous challenges such as flexibility in production, increasing inventory cost, time and quality are offering continuous threat as well as opportunities for the firms in achieving sustainable market position [24]. The Wall mart a leading retail chain and among top 10 in fortune 500 has achieved its “everyday low price” by introducing cross doc inventory strategy. This strategy has offered the wall mart production flexibility, lowered the cost, reduced the order time and improved the quality [23]. The above said criteria are interchangeably used as the hallmarks of supply chain performance [23]. The exploratory study dwell on the question of what were considered the most important SCM practices in the area of planning, sourcing, making and delivery.

The performing supply chain is defined as a supply chain the organization core standards of performance which include everything related to cost saving and delivery, production, etc. Supply chain management (SCM) has received increasing attention from industrialists in light of strategic planning in the design, maintenance, and operation of the supply chain process [8]. However, the supply chain efficient has been subjecting of concern [25]. The reduction of cost and agility are discussed as pre-conditions of efficient supply chain management.

In SCM to serve clients, the upstream company is direct to suppliers and downstream to distributors. Generally, labour, capital, information, technology, materials, financial assets and other resources through the supply chain [8]. Given that the goal of a company is to capitalize on profits, the companies must reduce costs and exploit benefits along the supply chain [25].

2.2. SCF

For an organization to perform. it would need to understand the customer's needs and respond to it. Customer's request comes in various forms such as quality, pricing, turn-around-time etc [26The flexibility should be both in the delivery time as well as flexibility of product delivery time [27]. These are all essential so that the competitive advantage can be maintained or enhanced. It is well said that companies need to be flexible enough to react to changes in customer's demands [28]. Though flexibility is sort after by all organizations. One has to be conscious of the cost of having flexibility [29]. For instance, in order that a particular production line can be flexible in running a diverse range of products depending on the customer's request. Additional features would need to be designed into it and this will definitely come with a price tag. As such though flexibility is much desired. there is the balance that management needs to weigh with regard to the cost of flexibility. This is because there is the issue or possibility of the cost-containment in supply chains not being able to keep pace with cost volatility [30], [31].

In order for the organization to be on the cutting edge in term of SCF, it need to be intimate with the customer so as to know their needs such as their specific specifications, market behavior, product demand trend (such as whether it is seasonal or not), life span of product etc. This better connectivity with the customers will be useful inputs even for the internal supply chain as the members working there will know what adds value to customers and what doesn't [30], By being so sensitive to the customer's need the organization can thus make appropriate decisions that are value added. Despite the need for SCF the overzealous effort of some organizations to create agility in respond to the ever-uncertain environment and severe customer request (both for quality and quantity). it often leads to complexity which often time is counter-productive [32].

The SCF is basically the ability of firm’s supply chain to respond any change in the production,

delivery or purchase at any step of the supply chain [32]. Basically, the it is an effective adaption of any change in micro and macro environment in which a particular firm is operating [33]. Prior researches have recommended to carry out a stream of studies on the issues of flexibility in different countries [31], [33]. Flexibility is not a departmental subject, rather it is strategic subject which covers everything from the procurement of raw material to delivery of finish goods [26]. Every component of the organization, such as labor, assets, and market cap abilities need to be molding to achieve the flexibility [26].

The prime objective of the attaining the flexibility is to attain the completive advantages in a market of stiffer competition [37]. Increasing dynamism of market especially because of technology has made it necessary to gain the SCF [37].

2.3. SCI

The SCI requires effective communication among all members of the supply chain such as in the virtual enterprise e-supply chains used by fabless semiconductor companies [40],[41] It is by doing so that the improved synergy through integration could bring about more competitive advantage to the organization [43]. To achieve this there is a necessity to have an effective construction of practices in the supply chain [44]. Research however also reveals that most companies are still grappling with the internal process integration (internal supply chain) with very few achieving closer integration with their customers [45], Interestingly the research also gave insight into the prominence of "soft" collaborative issues rather than the "hard" technological issues in the integration drive. In another research the authors concur with what was said by their findings which shows limited empirical research on the matter of SCI and the claimed benefits of adopting it [46]. They also revealed that there is significant confusion regarding the term SCI.

Supplier refers to a party that provides materials, parts, services, and goods directly to a manufacturer [46]. The definition of supplier integration is “environmental collaboration between a firm and its suppliers in implementing environmental management practices” [22]. It is a phase where upstream segment of company’s supply chain and product are focused [41]. Suppliers should be involved in the implementation of environmental practices in terms of material management procedures and purchasing processes. The supplier’s environmental performance is increasingly monitored by manufacturing organizations to ensure that the equipment or materials supplied have gone through environmental-friendly processes. The main players in automobile industries like Toyota and Ford have required their suppliers to obtain ISO 14001 certifications in supporting the environmental initiatives. This is due to the reason that suppliers are important partners as they can be in a position to provide assistance to improve environmental performance of the supply chain [43]. Internal integration is referred to “environmental management practices conducted within a company” [45]. Many studies have classified internal integration as “level of integration in combining and improving information and internal resources in the company to generate knowledge sharing beyond the boundaries of individual functions or departments in reducing and preventing pollutions”. Communication and cooperation are crucial to successful environmental practices as GSCM involves all departmental boundaries between and within organizations [46], [47]. It is also stressed about the influence of coordination across functional department within the entire supply chain to improve environmental management. Most of the time the implementation and adoption toward environmental practices internally seem to be the main issue [48], [61-65]. However, the GSCM practices like minimizing wastes and attracting customer cooperation for eco-design of product for instance, would require internal coordination mechanisms [49], [49], [50]. There are many firms going toward environmental direction these days with their environmental management systems, environmental auditing of departments, internal evaluation of environmental reports, and certification of ISO 14001 [49],[51]. Therefore, cooperation from within the organization is essential to ensure sustainable performance, economically and socially as well as achieving environmental objectives. Logistics integration is “environmental management practices of the planning, implementing, and controlling of goods or service to the point the consumer or customer is served” [52]. [53] defined logistic integration in GSCM scope as integration in adopting green supply chain management practices that relates to the supplier and the customer in terms of managing information and material flow along supply chain management. There are many things to be taken care of as it needs to be transported at the right time, to the right place, and in the right condition. Under the scope of green practices, every process of material and

information movements needs to be carried within environmental requirements. The adoption of sustainable performance management requires a good flow of information in the supply chain to ensure great decisions made by the managers [48]. Traditionally, supply chain performance and logistics focus on time, cost, and accuracy (Shaw, Grant, and Mangan, 2010). In other words, the logistic integration involving the supplier and the customer lead to time efficiency, cost reduction, and accuracy of information exchange [49]. Unfortunately, one of the main causes that may hinder the organizational sustainable performance goals is logistical and technological integration [54]. For many manufacturers, achieving sustainable performance goal through logistics is a tough challenge to overcome without strong collaboration or cooperation among green supply chain partners [50].

Technology integration can be defined as "environmental practices of the use of technology tools taking place between a buying and supplying organization regarding activities such as product development, process reengineering, and technical training" [48]. The technology integration in green supply chain activities is becoming a necessity in most industries due to rapid movement in green technology [43]. Innovation of green technology is the key driver to achieve sustainable development and aims to decrease the bad impact of product lifecycle toward environment [47], [48], [50]. Although technology integration is an important part of the GSCI, it is always hard to obtain the latest green manufacturing technologies . Furthermore, apart from being costly affair, integration of technology is also challenging and need to be carried with exhaustive pre-analysis [52],[53]. Due to this situation, manufacturers are more likely to lack the knowledge of green technology. Therefore, the manufacturer should make an effort to acquire information across the supply chain internally and externally through assistance and training as a result of inadequate professional knowledge about processes or new products [54].

On a negative note, SCI may also result in setbacks such as deterioration of quality (due to number of process owners reduced). It is important to be able to identify under what circumstances the integration brings positive outcomes and when it is otherwise. Towards this end there are case studies which attempt to study the effect of SCI such as the one by [52], in the field petrol industry. As such more studies in differing industries would need to be conducted.

H1: SCI has significant impact on the ISCP.

H2: SCI has significant impact on SCF.

H3: SCI has significant impact on ISCP.

H4: SCF mediates the relationship between SCI and ISCP.

Figure 1 depicts the theoretical framework of this study. The coordination-theoretic is used to conceptualize the framework shown in figure 1. The underpinnings theory used in this study is coordination-theoretic perspective in supply chain management. The theory has been widely used to analyze interorganizational dependencies and alternative mechanism's influence in the supply chain activities through prior studies by [55]

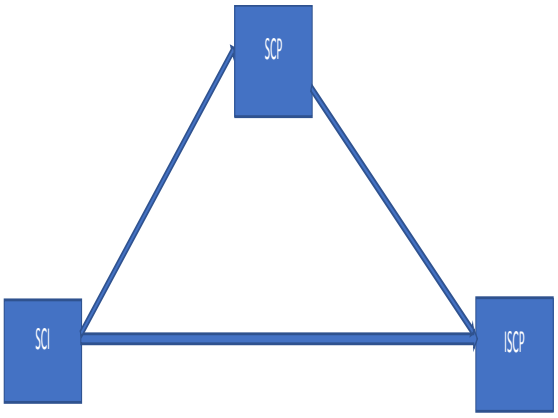

Figure 1: Conceptual framework

3.0. Methodology

The survey-based mythology is used to answer the research questions of the current study. Basically, questionnaire-based survey-based methodology with the aid of an adopted questionnaire is employed. The structural equation modeling is used to check the measurement as well as structural model of the current study. In structure model both the direct and indirect relation are examined. The estimation of the sample size a critical as well as most important aspect SEM. Therefore, the current study has earlier benchmarked the [56] table to estimate the sample size which in our case is 310. However, later, following [57], to address non-response bias we have increased our final sample size to 600. We have distributed 600 questionnaires and well receive the 435. The response rate is 62.5 percent. Currently, the widely used statistical packages for structural equation modeling are AMOS, and SEM-PLS. Thus, considering the unique objective and research competencies we

have used AMOS to analyze the research objectives

4.0. Research Analysis and Discussion

Basing on the research objective of the current study, we have used SPSS for basic data analysis. The data was coded in SPSS and then analyzed in AMOS. SPSS v19 and AMOS v21 are used in this study.

The structural equation modeling (SEM) is used, which is the most advance form of multivariate analysis in social science especially in business literature. Basically, SEM is a multivariate analysis used to test the causal direct and indirect relationships among and between variables by estimating a series of separate, still interdependent, multiple regression equation simultaneously. The main difference between multiple regression and SEM is that earlier, examines the casual relationship between and among the variables independently, whereas later examines simultaneously. The main objective of SEM analysis is to determine the extent to which the proposed model for observed and latent variable is supported by sample data collection [57]. Specifically, SEM is used to examine the co-variation structure among the observed variables. The observed variables are a set of variables that researchers use for defining or inferring the latent variables or construct [57]. The term latent variables are explained as an unobserved phenomenon which required more or more constructs or variable explain them. SEM analysis was evaluated by using maximum likelihood estimates, which is the most common estimation method for generating estimates of the overall SEM analysis.

As explained earlier that the SPSSv19 is used to analyze the data. Therefore, we have used SPSS to check the reliability of our data. From the findings, it is clear that all measures have reliability with all values are above threshold levels. The claim is made on the basis of [58] asserted that an instrument with coefficient value of 0.60 as poor, 0.70 as acceptable; and 0.80 and above as good. Additionally, the rule of thumb provided by [57] states that alpha values of greater than 0.50 are adequate and acceptable for testing the reliability of constructs; while the values of less than 0.50 are considered not acceptable. [57] (1967) also suggested that a modest reliability range of 0.50 and 0.60 would suffice. Basing on the above studies and most recent debate on the issue the current study has used 0.60 as threshold values of Cronbach alpha. and basing on them it is evident that all the constructs in our model are reliable. After accessing the reliability, the next step in SEM-AMOS is to measure the inner model. The value of model fit CFI =.94, TLI .938, PNFI .933 and RMSEA = .05). are above the threshold levels which indicates that there are no model fit issues in our study.

The inner model assessment includes CFA, which included the composite reliability, discriminant validity and factor loading. According to [57] and [58] confirmatory Factor Analysis (CFA) with the measurement model where the evaluation of the measurement instruments will be assessed through confirmatory factor analysis (CFA).

Table 1: CR, AVE, MSV, ASV

	CR	AVE	MSV	ASV
SCI	0.933	0.503	0.336	0.289
SCF	0.924	0.529	0.336	0.276
ISCP	0.955	0.508	0.227	0.208

Next, evidence of the discriminant validity of measures used in this study is provided. Discriminant validity refers to the extent to which

	SCI	SCF	ISCP
SCI	0.709		
SCF	0.580	0.727	
ISCP	0.457	0.476	0.712

different measures of different constructs are distinct from each other's. In the present study, discriminant validity was established by comparing the items loadings with cross-loadings as presented in Table 1.

Table 2. Discriminant Validity

The second step is structural equation model which specifies the structural relationships among latent variables in the measurement model using a path diagram for the testing of the hypotheses. Once the measurement model has achieved its goodness of fit, it is considered that the model is appropriate for hypothesis testing. The next step is to convert the measurement model into a structural equation model to test the relationship between the endogenous and exogenous models.

Table 3. Direct Effect

	(β)	SD	T-value	P-Values
H1	0.211	0.135	3.211	0.000
H2	0.357	0.152	3.678	0.000
H3	0.321	0.035	3.261	0.002

The mediation results of the currents study are reported in table 4.

Table 4. In-Direct Effect through Mediation

	(β)	SD	T-value	P-Values
H4	0.322	0.121	4.311	0.000

Path analysis SEM is a technique for observed variables, it measures the direct and indirect relationship as well as it measures model fit. This is the reason we have preferred structural equation modeling over conventional multiple regression techniques [66-70]. The hypothesized structural equation model is developed in first order construct since the intention is to test the relationship between latent constructs in this study. The relationship between constructs is determined through the path coefficient which will be used to make decisions on hypotheses tested in this thesis. The results of the direct hypothesis are shown in table three. The results revealed the fact that all the direct hypothesizes are accepted significantly
The results of the current study have shown a great deal of agreement with the hypothesized results.

5.0. Conclusion

In a sense the external supply chain is never broken from the internal supply chain at any one time. This is because what is happening within in the internal supply chain will affect what the organization communicates externally. For example, when it comes to the decision on when to begin a job order, the internal supply chain need to be confirmed through some well-established communication channels such as whether there is sufficient inventory. labor, equipment etc. The main purpose of the of the currents study, is to investigate the link between SCI and ISCP. Apart of investigation the impact on internal performance of integrated supply chain, the current study is also interested in investigating the mediating role of SCF in the relationship between SCI and ISCP. Traditionally, in the internal supply chain, the marketing staffs undertake certain roles such as understanding and representing customer needs to the different company departments. The structural equation modeling which a twostep process i.e. inner model assessment and outer model assessment is and is an upgraded version of multiple regression is used to answer the research questions. The current study has used the AMOS to analyze the data collected from production managers of Indonesian manufacturing firms [59, 60]. The findings of the study have revealed the fact that SCI has significant impact on the ISCP. The SCF has significantly mediated the relationship between SCI and ISCP.

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