Design and Development of Migration Path for Supply Chain Integration for Manufacturing Industries

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Abstract

There is a need to integrate the information systems and also organizational activities of the supply chain among the supply chain partners for collective and effective coordination. However, so far research in supply chain integration has paid little observation in identifying and developing a migration path to know the present position of integration among the supply chain members. Therefore the objective of the paper is to evolve a framework for supply chain integration. In the proposed research, the informational, organizational and information technology integration is operationalized for the evolution of Supply Chain Integration framework for manufacturing industries. Developed framework for supply chain integration is validated through a pilot study to help the organizations to know the present level and provides a migration path to move to the next level of supply chain integration. Present work builds on to the authors who have set forth study in the domain of supply chain integration.

Keywords
Supply Chain Management (SCM), Supply Chain Integration (SCI), Organizational Integration, Information Technology (IT), Original Equipment Manufacturers (OEM)

1. Introduction

The term "supply chain", "supply chain management" (SCM), "supply chain integration (SCI)" is not well-explained constructs. They differ in meaning for many people in different way (Bagchi et al., 2005). Supply chain is explained as sequences linking every element from customer and supplier between manufacturing and services so as to constructively supervise the flow of material, money and information to cater the needs of enterprises (Pramod Shahabadkar, 2012). SCM has grown as a solution to every industry to enhance the productivity beyond the organization's boundary (Eyaa et al., 2010). The normal insight in most SCM writings is that the additional integration will contribute to enhanced performance of the supply chains (Bagchi et al. 2005). The contemporary organizations emphasizes that the competition is not between the companies but it is between their supply chains (Power, 2005, Handfield et al., 1999, Singh, 2011). In an integrated supply chain, the complete activities covering the supply chain is devised as a unit (Lee, 2000). Supply chain integration (SCI) defined as the scope and strength of relationship of supply chain processes covering organizations. Supply chain integration is generally complex involving management of individual flows and poses interesting challenges for effective integration (Singh, 2011). Supply chain integration (SCI) is simplified by information, operational and relational integration. SCI can be a convincing behavioral answer to a few uncertainties, by assisting indirect relations that help cooperating, interrelating and steering materials and information (Wong et al., 2015) among members of a supply chain to evolve the potentiality to acknowledge to swiftly changing environments. In this context, integration of a supply chain is a working idea for integration of supply chain members for improving system profit and responsiveness (Singh, 2011). To achieve seamless and boundary-less flows, supply chain partners need to work so as to achieve a united structure (Mentzer et al., 2001). When supply chain partners are distinct and individual economic institutions, this plan of action has to cover framework for migration path for their integration (Bagchi et al. 2005, Narasimhan et al., 2002). Here is a direct correlation connecting organization association and organizational accomplishment (Pandiyan et al., 2016).

1.1 Research Background

Supply chain integration (SCI) recognized as well thought out activities that can lead to upgrade organizational performance (Chang et al., 2016). Supply chain integration is a multiplex operation necessitating total participation and dedication of all the members of supply chain (Lee et al., 2000, Uusipaavalniemi et al., 2009, Bagchi P K et al., 2005). So far supply chain integration has been considered as very limited concept and requires more comprehensive frameworks in integration (Singh 2011, Uusipaavalniemi, 2009). Majority of current researches on supply chain integration like: (Lee et al., 2000, Pandey et al., 2010, Zhenxin et al., 2001, Lee et al., 2007) focused on establishing relationship between integration and performance. Further, few researchers like: (Handfield et al., 1999, Crag et al., 2011, Koh et al., 2006, Gunashekharan et al., 2004) have concentrated on IT and supply chain integration. Limited researchers like: (Harland, et al., 2007) have studied barriers for supply chain integration. Available publications focus on the need to understand supply chain management practices (SCMPs) which are crucial to remain competitive in the global race with sound growth. SCMPs will enhance the capability of an organization along with the performance of the total supply chain. Supply chain management seeks near integration of inner functions in the company and external linkages with providers, clients and different channel participants. Although some organizations have found out the importance of imposing supply chain control, they often do now not understand exactly what to combine (Pandiyan et al., 2016). In the literature, no research is documented for developing a framework or setting a ways to achieve integration in practice. Establishing a guidelines and framework for identifying the amount of supply chain integration is however a challenging, as many of integration variables are interrelated and hence achieving an integration is thus a complex (Bagchi et al., 2002, Uusipaavalniemi, 2009, Flynn et al. 2016). Researchers like: (Bagchi et al., 2005) have illustrated lack of integration in real life supply chains. One reason for the shortage of integration is the lack of awareness about the way to obtain integration in exercise (Bagchi et al., 2005, Uusipaavalniemi, 2009). Thus, there is a clear need for developing of framework and a migration path for SCI. Therefore, objective of the paper is to evolve a framework for supply chain integration. In the proposed research informational, organizational and information technology (IT) integration is initiated for establishment of supply chain integration framework for manufacturing industries. The remainder of the paper furnishes a comprehensive understanding of supply chain integration in general and specifically organizational, informational and IT integration. This is followed by extent of integration, development of integration framework and at the end a pilot study for conceptual and analytical validity of the frame work is presented. This is followed by conclusions and references. Figure 1 explains the mapping of the research methodology followed.

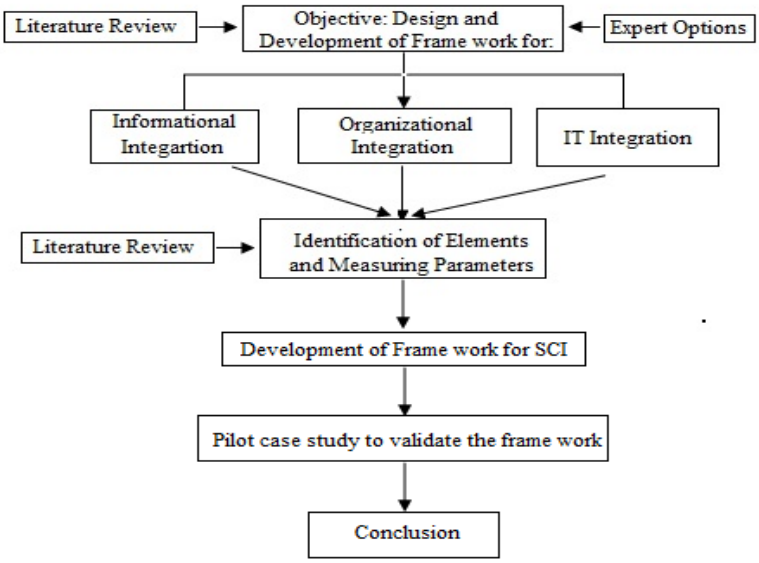

Figure1. Mapping of the Research Methodology

2. Supply Chain Integration

Basic enabler for effective supply chain management is integration of supply chain. Stevens', 1989 first provided four stages of integration: base line integration, functional integration, internal integration. Since then integration has moved towards broader channel or network perspective. The focal point of joining has moved from functional integration (Departments) towards integration of various partners in the supply chain. That is from internal integration towards external integration (Bowersox et al., 1999)[25]. John T Mintzer views the supply chain integration as the synchronization of different flows in a supply chain. Lee figures three measures of supply chain integration: information, coordination and organizational integration. Information integration deals with the sharing of information and expertise between the partners in the supply chain (Mentzer, et al. 2001). The coordination point out to the realignment of decisions and responsibility in the supply chain. It also includes communication channels between the members in the supply chain, performance measurement, and sharing of common visions and objectives. Authors (Bagchi et al., 2002, 2003, 2005) viewed the integration through informational and organizational.

John T Mintzer proposes three scopes of supply chain integration: dyadic integration, triadic integration or an extended integration. A dyadic integration involves focal company and their customers or suppliers. A triadic integration includes focal company, their customers and suppliers. Extended integration refers to the integration of more than three entities along the supply chain. The examples of an extended integration involve focal company, customer, supplier and customers' customer and suppliers' supplier etc. In this study, two dimensions: informational and organization integration is operationalized for triadic scope of integration, which involves focal company, customers and suppliers for development of the framework. Figure 2 shows the scope of integration in the proposed study.

Figure2. Scope of Integration

2. Informational Integration

Information is the key aspect of the supply chain. Perfect information about the system cannot be secured is a point of concern in the supply chain. Each member in supply chain has perfect information about himself as an individual, however, however perfect information about other members of the supply chain is absent (Zhenxin et al, 2001). Each member will have more information about others, when all members ready to share accurate information with other members. This increased sharing of information among members is called as informational integration (Lee et al., 2000, Pandey et al., 2010, Zhenxin et al., 2001). Key aspect for effective management is information sharing among partners (Lee et al., 2000). Looking at the direction of information flow, the information sharing in supply chain can be viewed as a two-way communication between the downstream and upstream of organizations. Flow of information like orders, forecast, planning from customer to suppliers are called backward flow. The backward flow of information is assumed to take between manufacturing industries and their suppliers (Mentzer, et al., 2001). The flow of information related to capacity, availability and delivery schedules is called as forward flow. The forward flow of information typically takes between manufacturing industries to customers (Lee et al., 2000, Pandey et al., 2010). In addition to this, information sharing also includes major factors which affect performance criteria, such as data related to production, quality, early complete date, and production capacities among the partners. In the context of supply chain, information sharing refers to the availability of critical and exclusive information to members of the supply chain (Lee et al., 2000). The availability of relevant information increases the performance of the supply chain. For example, when accurate information on demand levels are provided, firms are able to forecast how much is required to produce on time, making it possible to deliver on time and eliminate the bullwhip effect. The access to accurate information minimizes the costs arising out of stock outs and over stocking and ensures that deliveries are made on time. Previous research at the importance of formal and casual information sharing among buying and selling partners has proven that effective information sharing enhances transparency and reduces uncertainty (Handfield et al., 1999). It has been reported by several authors like (Bagchi et al., 2005, Lee et al., 2000, Pandey et al., 2010) that supply chain performance has close relationship with sharing of right information at right time, which in turn, reduces bullwhip effect, wastage and decreases lead time. The capability of supply chain member to access important information across the supply chain can help the members to modify existing actions or to plan future operations.

Five specific dimensions of information sharing identified through literatures are timeliness, accuracy, adequacy, and completeness and information credibility. The various attributes for information sharing are accuracy at which the information is shared, amount of information being shared, and timeliness, quality and frequency of the information being shared among upstream and downstream members of the supply chain. The author (Lee et al., 2010) argues that the information sharing has to happen with both downstream (customers) and upstream (suppliers) for its effectiveness.

2.2. Organizational Integration

The three levels of integration are internal integration; customer integration and supplier integration (Bagchi et al., 2003). Sharing of objectives, common visions, resources, and performance measurement are the essential part of organizational linkage (Bagchi et al., 2005, Larsen et al., 2002, Lee et al., 2000). Supply chain members encouraged by the organizational integration, become long-established members of the network which instills a feeling of belongingness to the network (Bagchi et al., 2005). In an integrated supply chain, trust among the partners can easily be established. Safety stocks required can be reduced to great extent through organizational integration which promotes collaboration and decision delegation. Irrational behavior and 'second guessing' among supply chain members can also be reduced through organizational integration (Bagchi et al., 2005, Singh, 2011). The target of organizational integration isn't just to determine conflicts should they emerge, but instead to perceive and keep away from potential conflicts. Organizational integration results in the supply chain members to behave like a single entity and sharing ideas, skills and culture common to them. In the absence of organizational integration supply chain integration may fail to blossom (Bagchi et al., 2005, Singh, 2011). The essential requirement of supply chain management is that all the members irrespective of the hierarchy in multiple organizations must work together to achieve common goal. The point of significant importance is managing coordination among the supply chain partners. Study shows performance and collaboration are practically interrelated in the areas such as supply chain design, inventory management and customer relationship management (Bagchi et al., 2005).

2.3. Information Technology Integration

Information technology (IT) tools like internet and communication devices expedited the process of information sharing in particular and SCI in general (Liu et al., 2010, Ashish et al., 2003, Childer et al 2003). Much of the literature suggests that IT tools are the main drivers for integration (Power 2005, Handfield et al., 1999). The supply chain activities are substantially helped industries by the arrival of computers, the outburst of the internet and World Wide Web. The usage of these new technologies also assisted in coordinating the various flows in supply chain (Gunashekharan et al., 2005, Ashish et al., 2003). Appropriate and well organized information can be exchanged among the partners by the use of reliable information and communication technology tools. Supply chain members can share all minute information about their production activities using IT tools like Electronic Data Interchange (EDI) technology, internet and extranet. Practically vendors can access the activities of the production planning and control system. This facilitates vendors to arrange deliveries without any paper transactions. Likewise vendors can get their payments in time using internet banking. This results in significant reduction in the cost of doing business and increases the efficiency of the supply chain. A notable gain in the productivity among supply chain members is visible by the integration of IT enabled e-commerce tools like bar coding, e-messaging, EDI global network management and internet. Reduced cycle time from order to delivery, increased visibility of transactions, better tracing and tracking of orders, reduced transaction costs and enhanced customer services are the total results of IT integration. These offer greater competitive advantage for all participants in the supply chain. In spite of all the goodness of information technology, many firms continue to face problems in accomplishing flawless supply chain management.

Information and Communication Technology (ICT) tools consist of both hard ware and software, used for integrating the supply chains. IT tools helps to gather, store, share and analyze the information and makes the information available to right person at a right time. In the literature, researchers have defined three levels of IT integration (Uusipaavalniemi, 2009). In level 1 minimal amount of information is shared electronically. If the amount of information shared electronically is moderate and only few members can change the information then its level 2 and if complete information shared electronically, and any member from the supply chain can alter the data then it refers to level 3.

3. Design of Migration Path for Supply Chain Integration

In this section, the details of design and development framework for supply chain integration is discussed

3.1. Development of Migration path for Informational Integration

Sharing of information means exchange of any type of data which can influence the performance of the supply chain. Consequently in this study we would like to know the extent of sharing of the information related to sales forecast, inventory levels, product design development, market trends, companies future plans, knowledge sharing, resource sharing and sharing of the decisions between the supply chain partners in the both upstream and downstream of the supply chain. In the literature, informational flow been described and explored extensively, but is still difficult to find measures for informational linkage. It is to examine that what metrics on should use to evaluate the level of integration in supply chain (Uusipaavalniemi 2009). Available literature presents many facets to information integration. Here these aspects referred as 'elements' of information integration. Every element is treated as an essential component of information sharing in a supply chain.

Literature distinguishes two aspects of information sharing: level of information sharing and quality of information being shared. The extent to which the critical and important information shared between the supply chain partners is considered as level of information sharing. Present study treats different types of information shared between supply chain partners as first element.

Characteristics of information being shared in supply chains include type of information, accuracy of information and availability of information at appropriate time to authorized person. Especially, suppliers depend on type, quality and accuracy at which information being passed on to them by focal company (Customer). The available information can be shared through paper, fax or, electronically. Further, in the literature, four common factors considered describing information quality and they are: accuracy, usefulness, reliability and completeness of information shared. Accuracy means extent to which received information is confirmed to the actual information. Inaccurate information may lead to confusion which may be harmful. Reliability of the information refers to probability that information is correct. Reliability can be two types: Content reliability and source reliability. Complete information about subject indicates completeness of the information. Partial information may be useless or have reduced value to its users. If the information is presented when it is required is called as availability of information. Availability of information helps in decision making at all the levels. An integrated supply chain helps its members to share accurate and quality of information at more frequently. An important aspect of structured management of information flow is communication and interaction at regular interval. In the literature, authors presented different angles to define and describe the extent of shared information. The extent of information shared can be none, partial and full information sharing. Some describe extent of information shared as low to high. Few have described extent of information sharing through the concept of transparency. Authors categorized varying degrees of transparency moving from opaque (no information sharing) through translucent to transparent. In this paper the authors assumed the extent of information being shared is from low to high.

In the literature, Direction, Scope and Level are the three concepts used to narrate the extent of integration. The direction of integration describes weather the integration is directed downstream or upstream or both. Scope describes dimension of integration. Level refers to what extent the activities are integrated with in the direction and dimension**.** Table1 presents the migration path and framework for Informational Supply Chain Integration and it has following characteristics:

1. Scope of Integration: Both upstream and downstream of supply chain
2. Dimension of Integration: Informational integration
3. Extent of Integrations: Low, Medium and High level
4. Elements of Informational Integration: Type of Information shared, Frequency at it is shared, quality and timeliness of shared information.

Table1. Migration Path for Informational Supply Chain Integration

Dimensions of Supply Chain integration	Elements of Integration	Variables of Integration	Level of Integration (Upstream) with suppliers			Level of Integration (downstream) with OEMs		
			Low	Medium	High	Low	Medium	High
Informational Integration	Types of Information sharing among the supply chain members	Sales forecast	Five point Likert scales (1extremely low frequency –5 extremely high frequency))			Five point Likert scales (1extremely low frequency –5 extremely high frequency)		
		Inventory levels						
		Product Design developmen						

		t						
		Market trends						
		Companies future plans						
		Knowledge sharing						
		Resource sharing						
		Sharing of the decisions						
	Frequency of information sharing between supply chain partners	Low , medium and high frequency	Five point Likert scales (1extremely low frequency –5 extremely high frequency)			Five point Likert scales (1extremely low frequency –5 extremely high frequency)		
	Time related information	Information availability	Information is provided when demanded	Part of the information is put in real time	All information is available in real time	Information is provided when demanded	Part of the information is put in real time	All information is available in real time
		Information lead time	Slow information sharing	Moderate lead time	Lead time close to zero. Real time information sharing	Slow information sharing	Moderate lead time	Lead time close to zero. Real time information sharing
	Quality of information		There are deficits in accuracy, usefulness, reliability and completenes s of the information	Accuracy, usefulness, reliability and completenes s of the shared information is at the acceptable level	Accuracy, usefulness, reliability and completenes s of the shared information is at the acceptable level	There are deficits in accuracy, usefulness, reliability and completenes s of the information	Accuracy, usefulness, reliability and completenes s of the shared information is at the acceptable level	Accuracy, usefulness, reliability and completenes s of the shared information is at the acceptable level

Note: 1 for low integration and 5 for high integration

3.2. Organizational Integration Framework

The collaboration between the organizations among supply chain members needed for increasing the performance. Due to impact of the technological progress over the supply chain operations, from the literature it can be documented that many authors are exploring collaboration in the SCI. The studies either relate combined efforts in implementing such technologies or the impact of various technology systems on performance.

Involvement of customers and suppliers in research and development, product design, production planning activities, marketing and sales promotion, supply chain design and implementation, quality improvement, cost reduction, long term and short planning of the organization considered in this study for the development of migration path. Mutual trust is necessary between the organizations involved for effective supply chain integration. Sharing resources and technical expertise between the organizations helps the weak member to improve their resources and technical expertise. Table 2 presents the various elements considered in this study for Organizational Integration and it has following characteristics:

1. Scope of Integration: Both upstream and downstream of supply chain
2. Dimension of Integration: Organizational Integration
3. Extent of Integrations: Low, Medium and High level
4. Elements of Organizational integration: Involvement of customers and suppliers, communication channels, joint training programs to train manpower and sharing of technical knowledge, combined cultural activities to connect, trust among the organizations, vendor managed inventory

Table2: Migration Path for Organizational Supply Chain Integration

Dimensions of Supply Chain integration	Elements of Integration	Variables of Integration	Level of Integration (upstream) with suppliers			Level of Integration (downstream) with OEMs		
			Low	Medium	High	Low	Medium	High
Organizational integration	Involvement of customers and suppliers	Research and Development	Five point Likert scales (1extremely low frequency –5 extremely high frequency)			Five point Likert scales (1extremely low frequency –5 extremely high frequency)		
		Product Design						
		Production Planning activities						
		Marketing and sales promotion						
		Supply chain design and implementation						
		Quality improvement						
		Cost reduction						
		Long term and short planning of the organization						
	Communication channels		Only at top management	Top management and Managerial levels	At all levels	Only at top management	Top management and Managerial levels	At all levels
	Joint training programs to train manpower and sharing of technical knowledge	Low , medium and high frequency	Five point Likert scales (1extremely low frequency –5 extremely high frequency)			Five point Likert scales (1extremely low frequency –5 extremely high frequency)		
	Joint cultural programs to achieve bonding	Low , medium and high frequency	Five point Likert scales (1extremely low frequency –5 extremely high frequency)			Five point Likert scales (1extremely low frequency –5 extremely high frequency)		
	Trust among the organizations		All Material from suppliers are inspected and then sent to production	Majority of materials from suppliers are inspected and then sent to production	Few of materials from suppliers are inspected and then sent to production	All Material are inspected and then sent to production	Majority of materials are inspected and then sent to production	Few of materials are inspected and then sent to production
	Vendor managed inventory		Not used	Experimental stage with few suppliers	With majority of suppliers	Not considered		

Note: 1 for low integration and 5 for high integration

3.3 Informational Technology Integration

Information and Communication Technology (ICT) tools are the enablers for information sharing. In the literature, telephone, fax, email, written communication and face-to-face communication are referred as traditional communication methods. Modern communication methods include computer-to-computer links, Electronic Data Interchange (EDI), Enterprise Resource Planning (ERP). Modern communication tools broaden and deepen the

accessibility of information between members. IT tools increases the frequency and reduces the lead-time for information sharing. Table 3 presents the framework for Informational Technology Integration and has following characteristics:

1. Scope of Integration: Both upstream and downstream of supply chain
2. Dimension of Integration: Informational Technology integration
3. Extent of Integrations: Low, Medium and High level
4. Elements of Informational Integration: IT and communication tools, automation and IT coverage

Table3: Migration Path for Information Technology Integration

Dimensions of Supply Chain integration	Elements of Integration	Level of Integration (upstream) with suppliers			Level of Integration (downstream) with OEMs		
		Low	Medium	High	Low	Medium	High
Informational Technology Integration	Use of IT tools for sharing the information	Majority of information sharing is paper based/Fax or informally	Partly is shared electronically and partly by informally and paper based	Fully shared electronically	Majority of information sharing is paper based/Fax or informally	Partly is shared electronically and partly by informally and paper based	Fully shared electronically
	IT coverage	Some data and information is in the files/folders and much data is in the hard copies	Most data and information needed is in the systems and not accessible to all.	All data and information needed is in the systems and can be accessed by all.	Some data and information is in the files/folders and much data is in the hard copies	Most data and information needed is in the systems and not accessible to all.	All data and information needed is in the systems and can be accessed by all.
	Communication tools	Phone/Fax/email	LAN/Electronic links with selected suppliers	Dedicated server and extensive use of EDI/Internet/XML links with supply chain members	Phone/Fax/email	LAN/Electronic links with selected customers	Dedicated server and extensive use of EDI/Internet/XML links with supply chain members
	Automation	Software are used on functional basis related suppliers and SRM activities	Software are used for connecting key suppliers	Software are used for connecting all suppliers	Software are used on functional basis for marketing and CRM	Software are used for connecting key customers	Software are used for connecting all customers

Note: 1 for low integration and 5 for high integration

3.4. Calculation of level of supply chain integration

Following steps narrate how to calculate levels achieved in supply chain integration.

1. The data collected from the survey or through the case study for identifying the level of supply chain integration. Collected data transferred on to five point Likert scale (1extremely low and 5 extremely high).
2. Upstream and Downstream integration for all the tree dimensions of supply chain integration is calculated as:

Up - stream Integration or down - stream Integration = [∑ measured numbers] ÷ Number of Upstream or Downstream elements

3. Three dimensions of supply chain integration is calculated by using formula:

Level Informational integration = [∑ upstream integration and downstream integration] ÷ 2

Similarly, the level of organizational and IT integration are calculated

4. Last step is to calculate a Supply chain integration index = [∑ (Level of Informational Integration+ Level of Organizational Integration+ Level of IT Integration)] ÷3

If the calculated supply chain integration index is between 1 and 2 then organizations is a low level, if it is between 2 and 4 then medium and if it is between 4 and 5 then it is a high level of supply chain integration. The different level of integration can be calculated by using this framework and these levels help the organizations to know the present status integration and provide them a migration path to improve the integration level.

4. Pilot Study to Illustrate Supply Chain Index

The proposed framework for identifying the level of supply chain is validated by collecting the data from the two pilot industries. The purpose of sample study is to check the migration path for conceptual and analytical validation. The data collected by conducting a case study. The structured questionnaire is prepared and data is collected for all the variables discussed in the study. The collected information are converted and measured in five point Likert scale (1 extremely low and 5 extremely high). The details of the data collected and their level of integration are shown in the table 4, 5 and 6. From these data the level of supply chain integrations/index are calculated.

Total Informational integration index for Organization O1= (Average Upstream integration + Average Downstream integration) ÷2. That is (2+1.90) ÷2=1.95 similarly for O2= 1.63

Total Organizational integration index for Organization O1= (Average Upstream integration + Average Downstream integration) ÷2 that is (2.4+2.33) ÷2=2.365 similarly for O2= 3.015

Total IT integration index for Organization O1= (Average Upstream integration + Average Downstream integration) ÷2 that is (2.75+2.75) ÷2=2.75 similarly for O2= 2.375

Supply chain integration index for O1= [∑1.95+2.365+2.75] ÷3 = 2.355

Similarly for O2=2.34

Table 4: Calculation of Level (Index) of Informational Supply Chain Integration

Informational Integration	Upstream integration												Downstream integration											
	Information sharing								Frequency of Information	**Lead time in information sharing	Quality of information shared	Average Upstream integration	Information sharing								Frequency of Information sharing	Lead time in information sharing	Quality of information	Average Downstream integration
	Sales forecast	Inventory levels	Product Design development	Market trends	Companies future plans	Knowledge sharing	Resource sharing	Sharing of the decisions					Sales Forecast	Inventory levels	Product Design development	Market trends	Companies future plans	Knowledge sharing	Resource sharing	Sharing of the decisions				
O1	2	3	1	2	2	2	2	1	3	2	2	2	2	3	2	2	2	1	1	2	2	2	2	1.90
O2	1	2	3	1	1	2	1	1	3	2	2	1.72	1	2	3	1	1	2	2	2	1	1	1	1.54

Note: 1 for low and 5 for high integration

Table 5: Calculation of Level (Index) of Information Technology Integration

IT integration	Upstream integration					Downstream integration				
	Use of IT tools for sharing the information	IT coverage	Communication tools	Automation	Average Upstream integration	Use of IT tools for sharing the information	IT coverage	Communication tools	Automation	Average Downstream integration
O1	3	2	3	3	2.75	3	3	3	2	2.75
O2	2	3	2	2	2.25	2	3	3	2	2.5

Note: 1 for low and 5 for high integration

Table6: Calculation of Level (Index) of Organizational Supply Chain

Organizational Integration	Upstream integration												Downstream integration											
	Involvement of Suppliers in decision making												Involvement of Customers in decision making											
	Research and Development	Product Design	Production Planning activities	Marketing and sales promotion	Supply chain design and implementation	Quality improvement	Cost reduction	Long term and short planning organization	Joint training programs to train manpower and sharing of technical knowledge	Joint cultural programs to achieve	Trust among the organizations	Vendor managed inventory	Average Upstream integration	Research and Development	Product Design	Production Planning activities	Marketing and sales promotion	Supply chain design and implementation	Quality improvement	Cost reduction	Long term and short planning of the organization	Joint training programs to train manpower and sharing of	Joint cultural programs to achieve bonding	Trust among the organizations	Vendor managed inventory	Average Downstream integration

O1	2	3	2	3	2	3	3	2	2	2	3	2	2.4	2	2	2	3	2	4	3	2	2	2	2	2	2.33
O2	3	3	4	4	3	4	3	3	3	2	3	3	3.2	3	3	3	2	3	4	3	2	2	3	3	3	2.83

Note: 1 for low and 5 for high integration

5. Conclusion

In this paper, an effort is made for developing a migration path as tabled in table1, 2 and 3 and to define new term supply chain integration index for identifying the level of supply chain integration in the manufacturing industries as Tabled in 4, 5 and 6. Surely many researchers will question its generalization and elements considered here in this study. With marginal changes in the elements and variables detailed in the Table 1, 2 and 3, developed migration path can be used to know the state of integration of a supply chain. Future research should focus on implementing this migration path in the manufacturing industries. So, developed migration path should be operationalized for different types of industries like: Original Equipment Manufacturers (OEMs), Auto Component Manufacturers etc. We believe a larger study should be carried out and compared with our work to obtain better understanding of supply chain integration index and migration path for SCI.

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