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## The Impact of Supply Chain Integration on Performance: Evidence from the UK Food Sector

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### Abstract

Supply chain Integration has emerged as a major field of interest over the years that involve the strategic alignment of functions and processes within an organization. However, there have been major debates regarding the true design of the kinds of integration that would lead to performance of supply chains. This study develops a conceptual framework from the literature and defines four constructs of integration (customer, supplier, internal, and information integration) to see how this would lead to improved supply chain performance (such as production flexibility, inventory turns, order fulfilment rate, total logistics costs, and operational performance).

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## 1. Introduction

With the increasing level of competition in the global economy, the search of improved ways of gaining advantage to stay relevant or outwit the competition is evolving. This has made supply chain managers and professionals look at integration as a possible strategy of creating strategic partnerships to improve supply chain performance and achieve cost reduction and reduced lead time [1]. Models of most manufacturing organizations in the past were usually said to be vertically inclined with the focal firm fully or partially owning its raw material suppliers. However, firms realized the inefficiency and rigidity this model caused their supply chains in responding to changing market demands making them switch their models to a horizontal one where integration is chased with other companies that creates a high value chain [2]. Therefore the design and interaction of elements within a supply chain is of major significance [3].

Supply chain integration (SCI) is characterised by a situation where members along the supply chain collaborate and work together for better performance and profitability while meeting the demands of the customer. Firms integrating their information and material flow would lead to optimal management of the supply chain [4]. It involves the alignment of business functions internally within a firm and with its supply chain partners so as to reduce costs, increase customer value and overall performance across the supply chain for all partners [5].

Although the benefits of SCI are greatly covered in literature, the key design elements that will lead to improved performance have not been fully developed. Also there have been inconsistencies in the results as to whether integration really leads to improved supply chain performance. This study aims to make key contributions such as defining key performance indicators through which supply chain integration can be measured. This study defines four constructs of SC integration which are the customer, supplier, internal, and information integration. Customer integration involves the strategic competencies and activities firms apply in providing optimum services with customers through relationship building [5]. Supplier integration refers to the processes and steps involved in sharing information and joint planning with key suppliers to achieve stated objectives and goals of the focal firm with benefits of cost reduction, customer satisfaction and improved lead times [6]. Internal Integration has been said to be the foundation of other kinds of integration and is defined as the linkage of business processes of departments in an organization into a strategic fit for improved performance [7]. Finally, information integration involves the sharing of key information data among supply chain partners through IT systems in order to bring about mutually beneficial outcomes [8]. The study develops a conceptual model and applies to food manufacturing firms in the UK to test if supply chain performance can be achieved from this integrated design and help supply chain managers and professionals investing huge resources to achieve competitive advantage. The focus on food manufacturing industries is due to the fact that this sector is a major driver of the UK economy. The study therefore attempts to answer the research question ‘Does Integration has an effect on supply chain performance?’

## 2. Supply Chain Integration

The rising level of competition that exists among firms globally has brought a shift to do more than just strategy formulation and implementation but to go beyond that and seek partnerships with other firms which would lead to competitive advantage in the market place [9]. Over the years, manufacturing firms have focused on developing strategies that would bring about the much desired level of change and operational performance in the organization. However, firms have realized that creating strategies along with integrating internal functions, suppliers and customers in a business relationship is the proper model for achieving competitive advantage [10]. This created the platform for supply chain Integration (SCI) as practice being adopted by firms that were striving to improve firm performance with closer relationships being built among other links in the supply chain [11]. The shift came with organizations moving from their previous strategies of vertical integration to being an association of firms that collaborate to procure, manufacture and supply products and services to their customers. SCI as a concept is concerned with the synergy that exists between the internal functions of a firm and its external activities across its supply chain that leads to organizational performance [12].

### *2.1. Drivers of Supply Chain Integration (SCI)*

SCI has been found to improve performance of the supply chain. According to [13], in the study of 125 manufacturing firms in the UK it was found that SCI and information sharing leads to improved supply chain performance. A study found that integrating with a firm's suppliers and customers along with the firm's competitive strategy will lead to improved operations performance [14]. The relationship between supply chain linkages involving customer, supplier, and internal processes of the firm with performance has also been studied by [15]. They studied 122 manufacturing firms operating in the US and found out that internal integration is the main strategy for cost reduction in the supply chain while supplier integration leads to better operational performance. Some performance measurements such as improved customer service, internal efficiency, demand flexibility, and product development [16] are all indicators that firms try to improve and do so through SCI.

Since this study is focused on the SCI in food sector where the quality and safety of food are two fundamental components associated with consumers [17]. This has driven firms to integrate and increase the amount of information they share with their suppliers to ensure that there is visibility across the supply chain so that food products material sourcing can be tracked [18]. Many firms seek to enter into new markets to boost their profitability. This has driven them to seek for better strategic relationships to give them the platform for such marketing opportunity to a larger customer network. According to [19] firms want to create value activities that would reduce their operational costs and boost profitability. This would require internal and external integration of their processes.

The environment in which businesses operate is characterised by quick changing market demands that require firms to enter into partnerships to be able to be responsive to such external factors [20]. Meeting the demand of the customers through marketing activities would still involve business processes integration to ensure goods availability [21]. International competition from other firms, entry to new markets, and international laws and regulations are other globalization factors driving supply chain integration among firms [22].

### *2.2. Benefits and Barriers to Supply Chain Integration (SCI)*

Numerous studies have been conducted to show that supply chain integration leads to improved financial performance and profitability. In their study [23] took a sample of 195 firms in china and realised that supply chain integration is a major facilitator of financial performance, highlighting the role of management taking advantage of the strategic relationships of SCI to boost financial figures. Also [24] found out those companies that have strong internal integration within the business processes creates sufficient requirements for the organization to improve their financial performance. When members of a supply chain are integrated and there is proper communication flow they are able to quickly adjust to any changes in the market place whether in the long run or short run [25], thus improving their flexibility. SCI has been found to be a facilitator of shortening the lead times between processes and improve product availability [26]. SCI with partnerships involve a win-win situation helping organizations to look for the best possible ways to reduce costs across the supply chain whether it is manufacturing, inventory or transaction costs and boosts profitability of every member in the supply chain [27]. Thus, it is evident that SCI brings numerous benefits to organisations.

A firm's ability to integrate its processes internally and externally with its supply chain partners aids its ability to respond to the changing demands of the customer. Although firms have faced major challenges in integrating their supply chains internally and with other supply chain partners [20], the barriers can actually be a major driver to improve performance as it tries to solve the challenges encountered in business environment by enhancing its linkages internally and externally. When firms do not trust their supply partners it makes them keep an arm's length position with their links and partners in the supply chain [28]. Integration is also greatly impeded by conflicting goals and interests in the supply chain. Sometimes within a company the conflicting goals exist with different departments having different objectives and goals thus impeding a smooth synchronized system ([29]. Another important kind of risk associated with the integration in the supply chain is the possibility of trade secrets being revealed and leaked to competitor firms which could be costly to some organizations as such information can be used to leverage competitive advantage [30]. The culture of an organization is also an important factor that comes to

play as a barrier to integration in the supply chain. It is quite difficult for organizations to change their processes and unique ways of doing things because they want to get into a partnership with other firms in the supply chain [31]. Additionally, the internal barriers within an organization are usually the most important factors that limit any possible effective relationship building with other members of the supply chain [32].

### 2.3. *Measures of Supply Chain Integration (SCI)*

Literature identifies internal integration, supplier integration, customer integration and information integration as key measures of SCI. Hence this study is aimed at investigating their impact on the supply chain performance. Internal integration is the coordinated and strategic alignment of business processes and functions within an organization that is organized to ensure that firm achieves maximum performance. According to [33], SCI starts first with internal integration among the different departments and functions within an organization before external integration is pursued. In their study, [32] also found out that internal integration improves the firms performance by reducing costs and limiting the ability of departments within the organization from taking steps that would distort the overall goals of the organization.

Supplier integration represents a situation where suppliers are involved in the key decision making processes of the firm with information regarding demand forecasts, production and inventory levels being shared between them. It involves focal firms working in partnership with their key suppliers to maximize the benefits of the relationship such as improving the lead times, innovation, and quality [34]. The customer- supplier integration process should be one that focuses on solidifying the relationships between both parties for their collective benefits [35]. The major drive of supplier integration with customers should be on how to improve the customer experience or serve them better.

The integration of customers in the supply chain gives the opportunity for firms to have an overview of the requirements and their specific needs giving them the advantage of serving them better. Integrating customers in a supply chain is centered on drawing information from customers such as their buying patterns, their preference for products and their ability to purchase products which would then be used in making better decisions during the manufacturing process or sales to customers [36]. When firms collaborate with their customers, they are able to respond in a quick and efficient manner with their customers improving their order fulfilment as well as improving visibility.

Information integration has been found to be a necessity for firms looking to integrate with their customers and suppliers [37]. Information integration however is not just restrained to the efficiency and application of technology. It requires the inputs and role playing of people, technological systems to originate, sort, process, and disperse information to the designated location at the right time for effectual decision making process [38]. When information is shared across the supply chain, data can be collected in real time as closer communications are then created with other members in the supply chain which would lead to improved customer service and improved demand forecasting [37].

Integration in the supply chain has been found to improve performance of the chain therefore it is important for organizations to set out clear cut indicators on what they intend to measure. There are some itemized indicators such as higher quality, stock-out rates, and improved lead time. In explaining supply chain performance [39], centered on the direct benefits of supply chains being measured such as faster response times, on-time order deliveries, reduced logistics costs but also highlighted other indirect benefits that can be difficult to measure such as customer satisfaction and retention rates. According to [40], performance measures should focus on the overall performance of the supply chain taking into account variables of financial, customer service, flexibility, efficiency indicators. Production flexibility is the ability of manufacturing firms to switch production schedules in a speedy manner in which they react to threats or opportunities from the external environment. Production flexibility has found to be improving the performance of manufacturing organisations which is also be regarded as the efforts taken by manufacturing firms to respond to changes in the environment with minimal costs [41]. Inventory turns is also an important performance measure of the supply chain. Firms are constantly working to manage their inventory levels at optimum positions and making sure they are improving the performance of the inventory as it constitutes up to 50 percent of the total value of a firms assets [42]. Fulfilling customer demand as promised and on time leads to improved delivery performance. Logistics cost is the most sought after metrics supply chain managers focus on

when measuring supply chain performance [43]. Total Logistics cost is the totality of all the costs associated with the supply chain operations of a firm. Research has shown that reducing logistics costs would ultimately lead to increased profitability [43].

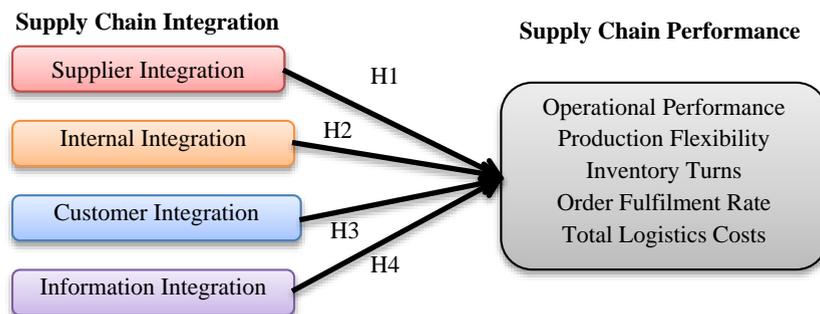
There have been numerous studies [13], [44] etc. that indicate integration improves supply chain performance but most of these studies ignore the impact of these individual indicators on specific performance indicators. A lot of integration studies [44] also ignore the role of information sharing as integration constructs. Our study therefore aims to examine the relationship between the four constructs of integration and supply chain performance. The study also investigates other performance measures that were studied altogether in SCI studies such as operational performance, inventory turnover, and order fulfilment rate. The conceptual model is shown in Figure 1 and hypotheses that were tested are presented below;

*H1: Supplier integration is positively linked to supply chain performance.*

*H2: Internal integration is positively linked to supply chain performance.*

*H3: Customer integration is positively linked to supply chain performance.*

*H4: Information integration is positively linked to supply chain performance.*



**Figure 1: Conceptual Framework**

This study is focused on understanding the impact of SCI on the performance of the UK food sector. According to Food and Drink Federation (FDF) [45] the food industry is the largest manufacturing sector in the UK. The industry is characterised by a large number of firms, an estimated 8,000 and providing employment for over 400,000 individuals. Despite the economic difficulties that have challenged the UK, the food industry continues to boom contributing around £103.0 billion which is 7.6% of the Gross Value added to the economy (DEFRA) [46]. UK food and drink productivity has increased by 11% over the last five years compared to an overall UK productivity increase of 0.5% [45]. There was also a 4.0% increase in the consumption expenditure of individuals which was about £196 billion [45]. An estimated 27 million households and 64 million people are fed daily by the UK food and drink industry [47]. This shows the importance of this sector to the UK economy hence our study will provide useful insights of SCI to food practitioners that can benefit the whole sector.

### 3. Methodology

This study follows a mix methods approach where the empirical data collected through the survey questionnaire was first analyzed and findings were further verified through the inductive approach by conducting two semi-structured interviews. The primary data was collected from a questionnaire survey of UK manufacturers in the Food Industry. A web based survey was employed and the sampling list was generated from FAME database that lists all the Food Manufacturing firms in the UK. The database identified about 3,400 companies in the Food Manufacturing Industry. The survey was designed to reach out to respondents who were managers, directors in the supply chain and logistics fields of the manufacturing Industry or individuals who had adequate knowledge of how their firms carry out their supply chain functions and how effective their supply chain performance has been. The survey data was collected from June 2015 to August, 2015. Three email reminders were sent to the respondents, and finally 60

responses were identified who fully completed the survey. Semi-structured interviews were conducted with two managers from UK food manufacturing organizations.

#### 4. Findings and Discussions

The survey data was analyzed using SPSS statistical software. Around 73% respondents were from organizations that employed less than 50 employees whereas 17% firms who responded employed between 50-250 employees. Around 10% organizations responding the survey employed more than 250 employees. 85% of respondents were located in England, followed by 11% in wales, and 4% in northern Island. The results indicate that respondents who had their job function fully related to supply chain management were 43%, followed by respondents who had their job functions partially related to supply chain management which was 42%. Around 15% respondents didn't reveal their job positions. With regard to awareness about the SCI, around 30% of respondents were fully aware, followed by 23% respondents who partially understand the term supply chain integration. However, surprisingly around 36% respondents acknowledged that they haven't heard of the term before. These respondents could be the ones who either had partial knowledge of supply chain or were not working in supply chain related roles.

In order to test the hypotheses proposed earlier in section 2.4, a correlation analysis was conducted. The supply chain performance construct which consists of operational performance, production flexibility, inventory turns, order fulfilment rate, and total logistics costs was converted to a single scale item for analysis as Cronbach Alpha value was  $>.70$  (.89). The correlation analysis is shown below in Table 1. The correlation analysis shows that supplier integration is positively linked to supply chain performance thus supporting H1. Customer integration was also found to be positively associated with supply chain performance, thus supporting H2. Similarly, H3 and H4 were also found to be true. Thus, the data supported that SCI constructs are positively linked to supply chain performance.

Table 1: Correlation Analysis					
	SI	CI	INTI	INFI	SCP
SI	1				
CI	.739**	1			
INTI	.760**	.842**	1		
INFI	.753**	.883**	.934**	1	
SCP	.649**	.776**	.843**	.873**	1

SI: Supplier Integration; CI: Customer Integration; INTI: Internal Integration; INFI: Information Integration; SCP: Supply Chain Performance

To support the findings of the survey, two semi-structured interviews were conducted with managers of the two food manufacturing organizations operating in the UK. The interview findings provided good support to the survey findings. Both interviewees agreed with the importance of the supplier integration and emphasized on building good relationship with their suppliers. Both respondents further pointed out the role of IT systems in their information sharing with suppliers as one of the respondents stated, '*Our company uses Electronic Data Interchange (EDI) systems, so all financial information, orders, invoices, credits, debits that kind of it all goes electronically*'. When asked about the customer integration, the first respondent replied: '*we enter into partnerships and agreements with some of our customers*', while the second respondent said: '*we have a department and personnel that handles our relationship with customers on a regular basis*'. Both interviewees also highlighted the importance of internal integration and supported the view that this improves the performance of their organizations. Information integration was also core for their organizations and both of them were using EDI systems. Both interviewees also agreed the significance of SCI in improving the supply chain performance as one of the respondents said, '*supply chain performance is very vital for us and yes definitely integration and information sharing has improved our performance*'. Thus, it is evident that interviews provide a good support to our survey findings.

## 5. Conclusions

This study examined the linkage between the SCI indicators and supply chain performance in the UK food sector. All the hypotheses tested showed the constructs of integration positively and significantly correlated to supply chain performance and the results from the interview further confirmed this. A greater percentage of respondents agree that information integration is central to their supply chain operations and a key driving force to achieve supply chain performance. SCI provides numerous benefits such as reduction of total logistics costs which would ultimately lead to increased profitability for the firm and improving the flexibility of organization to respond to external changes in the market. The barriers that usually hinder from integrating include lack of trust among firms, conflicting goals as firms have different objectives they are chasing and usually cannot align their business processes with other firms. Risk, bureaucracy, costs and unique culture were also identified as major hindrances to integration. This study shows that organizations must integrate all constructs to derive the benefits stated in literature. Well integrated internal processes can lead to organizational improvement and facilitate integration with suppliers and customers through proper information sharing. Future studies can focus on collecting more survey responses and also extending the study beyond the UK food sector to collect a holistic view on the impact of SCI or supply chain performance.

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