

## Supply Chain Integration, Flexibility, and Operational Performance

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### ABSTRACT

This study aims to establish the impact of supply chain integration and flexibility on operational performance. Moreover, the resource-based view theory was tested on pharmaceutical manufacturing firms in Karachi, Pakistan. A quantitative approach was adopted for this study, and a multi-item measurement scale was adapted from previous studies; a structure questionnaire was developed to collect primary data. A total number of 236 responses was collected from Karachi-based manufacturing companies. Regression analysis was applied for hypothesis testing. The findings confirm that all the proposed hypotheses were retained, and all independent variables (internal information integration, external information integration, reactive supply chain flexibility, and proactive supply chain flexibility) have positive and significant results. However, these results vary from one dimension to another, but all the adopted dimensions positively affect operational performance. This research study can be helpful for supply chain managers and decision-makers. It gives them a guide for enhancing operational performance. It provides a framework for manufacturing firms to enhance their operational performance by enhancing quality.

**Keywords:** Internal information integration, External information integration, Reactive supply chain flexibility, Proactive supply chain flexibility, Operational performance.

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## **Supply Chain Integration, Flexibility, and Operational Performance**

### **1. Introduction**

Recently the markets all over the world have been unstable because of interrelations that exist between various countries and their economies. For that reason, one country's economy can affect another country's economy because of interrelationships. The trade practices followed nowadays are the most impactful in front of unexpected market conditions. Some conditions are mainly considered during international business affairs, including technological developments, business culture, business communication and political conditions (Zeibote et al., 2019). Moreover, the tough completion in the world of businesses pushes the firms to effectively coordinate their business processes and operations like supply, marketing and production across borders (Ristovska & Ristovska, 2014; Rosnerova & Hraskova, 2020). In that way, the firms need to know how to make strategies for the supply chain that ultimately helps firms to achieve competitiveness in the market. The concept of the supply chain is explained as the relationship between the value chains (Vandchali et al., 2021). The practitioners observed that the organization with enhanced SC capabilities could effectively play a role in helping the decision makers and provide dynamic solutions to the problems (Hong et al., 2018). Therefore, the firms must be flexible in their SC operations to quickly respond to their problems and issues (Moon et al., 2012).

Supply chain flexibility is the mixture of SCM theories and dimensions of flexibility (Delic & Evers, 2020). In the area of the supply chain, the concept of flexibility is described as the firm's capability to boost the effectiveness of SC and increase performance levels (Rojo et al., 2018). Few past researchers found that organizations must have the SC flexibility to stay competitive in the market for effectively facing uncertain conditions that afterwards result in the financial and operational performance of the firm (Jermstipparsert & Srisawat, 2019; Tigga et al., 2021). However, the main question is how to achieve adequate SC flexibility through outbound/inbound logistics, internal firm design / external establishment of relationships. Few research studies propose that internal and external integration are the primary source of flexibility in the supply chain. It was also found that integration in the supply chain can affect the flexibility performance of a firm (Ataseven & Nair, 2017).

#### **1.1 Problem statement**

In past research studies, the author Dubey et al. (2017), the association between Sustainable supply chain systems and advanced information technology has been shown through the collaboration of strategic suppliers. It is still unclear whether smart SCM and information system flexibility directly impacts each other. The irregular flow of information and data requires a flexible arrangement and a proper medium to transfer the information within the firm or between two organizations. In past research studies, the importance of the digital system in firms is described to gain a significant level of responsiveness in their processes (Gligor et al., 2020). It was also observed that agile SC structure in organizations is vital in facing uncertain and unexpected market conditions. Digital systems in firms provide the opportunity to transform foreign boundaries into smart cities. The researcher Chatterjee et al. (2018) display the significance of significant data sources utilized. These sources include the Internet of Things (IoT), which plays an immense role in building smart cities with intelligent machines, equipment and technologies. This kind of mixed results obtained from past studies opposes the high-level utilization of integration to reach flexibility of SC in business practices to some extent. Organizations and various businesses are trying to enhance their competencies to face uncertain ecological conditions by executing integration concepts in firm operations and information systems of their SC (Rojo et al., 2018). The food industry is an excellent example of a dynamic atmospheric condition in which customers have high expectations about food safety and sustainability of produced food products. Also, customers demand that the firms must have knowledge and information about the food production process and food delivery to the customers (Hong et al., 2018). Investigation and exploration of the relationship between SC integration, SC flexibility and performance level of an

organization are critical in a theoretical and practical context. In the current research, a new study on this topic will concentrate on information integration and simplify its part in activities and performance related to the element of flexibility in a firm. The research outcomes will further guide in producing impactful integration approaches for the managers in SCM. Current research explains the influence of information integration in the supply chain on both perspectives of flexibility, proactive and reactive, which was not thoroughly described in past studies. Therefore, firms are motivated to enhance their competencies in dealing with environmental variations by modifying various processes. This research also examines the influence of SC flexibility on the association between SC information integration and operational performance. Consequently, this research work can provide a deep knowledge to the firms about improving their operational performance through implementing SC flexibility.

## 1.2 Research objective

The main objective of this study is to delve into the relationship between organizational resources and capabilities and how the organization get advantages from the optimum synergy of resources and capabilities. In addition, there are some following specific research questions for this study:

*RO1: To determine the effect of internal information integration on operational performance.*

*RO2: To determine the effect of external information integration on operational performance.*

*RO3: To determine the effect of reactive supply chain flexibility on operational performance.*

*RO4: To determine the effect of proactive supply chain flexibility on operational performance.*

## 1.3 Research Questions

The following research questions are considered in this research study:

*RQ1: Does Internal information integration has a significant effect on operational performance?*

*RQ2: Does external information integration has a significant effect on operational performance?*

*RQ3: Does reactive supply chain flexibility has a significant effect on operational performance?*

*RQ4: Does proactive supply chain flexibility has a significant effect on operational performance?*

## 2. Literature Review

### 2.1 Supply Chain Integration

The concept of supply chain integration is defined as the extent to which an organization cooperates and coordinates with its supply chain members and mutually manages processes and functions that occur between two firms or within the firms in order to achieve an adequate level of integration (Shou et al., 2018; Alam, 2022; Asif, 2022). This concept of integration in a supply chain system arises and acts as an essential field of interest that involves the strategic arrangement of various supply chain processes and functions within an organization or between supply chain partners (Kumar et al., 2017). A firmly integrated SC system involves collaborations and interactions that exist between suppliers, customers, and organizations that highly depend on the exchange of quality information, joint actions and dependence between SC partners (Huang & Huang, 2019; Ivanov & Dolgui, 2020; Anwar, 2022; Amjad, 2022; Hunaid et al., 2022). The cross-functional border integration of various activities, functions and processes that includes suppliers and customers in SC is believed to be the main element for accomplishing competitive benefits in the business field (Cámara et al., 2015). Alternatively, to obtain the full potential results after implementing supply chain integration, it is essential to assimilate all the functions, processes, technologies and supply chain partners working in the supply chain network

(Alzoubi, 2018). An organization achieves the elements of integration through sharing of information and integration of its financials and physical elements (Rai et al., 2006).

As a single entity, the firms must apply the concept of integration within the firm also in between their partners & in the overall supply chain system (Ashby et al., 2012). However, it was observed by the practitioners that organizations are not entirely successful in obtaining effective results after implementing the integration concept in their supply chain (Mejza & Wisner, 2001; Zhu et al., 2017). Few research studies highlight that weak external integration occurs when firms face a low level of integration in their internal functions (Rasheed, 2022). Strong integration within the firm is the initial stage for a more comprehensive integration all over the supply chain network (Ali, 2022). A primary hurdle came into the researcher's observation that acts as an obstacle to achieving an adequate level of integration inflow of information and other materials throughout the supply chain which is the insufficiency of the internal management systems in those organizations that work as an individual entity. For that reason, to attain effective integration within the firm, the firm needs to ensure a high level of coordination between processes & functions, which is critical (Victory et al., 2022). Therefore, supply chain integration aims to avoid the boundaries of a firm between functions. Also, it is responsible for breakdown down the obstacles between two supply chain firms.

## **2.2 Supply Chain Information Integration**

In this research study, the term supply chain integration is related to the concept of transformation of integration through the electronic medium. Many researchers highlight that an effective integrative system in the supply chain enhances an organization's operational performance (Lu et al., 2018; Munir et al., 2020). The literature of various studies shows that the association between integration in the supply chain and a firm's operational performance is not always the same as it depends on the arrangement of interlinked elements of the firm (Lu et al., 2018; Rashid & Rasheed, 2022). Supply chain information integration is the concept that plays an immense role for firms in lessening the chances of uncertainty in their processes and idle time in all phases of supply chain processes (Wong et al., 2015). The firm's functions, capabilities, and resources can enforce internal integration to reduce the risk of duplicate tasks and ensure the product's quality level and design (Huo et al., 2014). Information sharing occurs at all functions; for example, sharing information and knowledge occurs in planning, predicting and implementing or replenishing processes (Agyabeng-Mensah et al., 2019; Wong et al., 2015). Few research studies highlight the benefits of lessening the inventory levels, lead time and attaining competitive benefits between supply chain members (Ha et al., 2017). However, at the same time, other authors highlight the limitation of accumulated risk and cost spent on sharing information between supply chain members (Lu et al., 2018). Many research studies show that the efficiency of the supply chain system is highly affected by the implementation of integration among members of the supply chain and within the firms (Munir et al., 2020).

A theoretical study has displayed that supply chain integration is more effective in sharing accurate and quality information between partners than the association between the partners that do not share their quality information (Agyabeng-Mensah et al., 2019). An organization's ability to accept knowledge and information related to their customers and supplier's production planning and predictions, for example, can increase their quality of planning and forecasting. Accurate planning and forecasting about their production lead to minimizing their inventory, lowering the cost of inventory, and reducing the transportation cost, ultimately improving the firm's operational performance. Consequently, enhancement in performance level and variations in supply chain operations happens due to the information integration (Ataseven & Nair, 2017). Operational performance is the construct that acts as an output construct for this particular research study. Through the literature of studies, supply chain information integration is considered the main element that enhances operational performance (Huo et al., 2016).

## **2.3 Supply Chain Flexibility**

The term supply chain flexibility is considered a firm's competency that helps an organization to effectively respond to uncertain conditions and unforeseen variations in the demands and requirements of the customers. Supply chain flexibility also enables the firm to know competitors' moves in the dynamic atmosphere of the business field. Several scholars believe that flexibility is the crucial component that acts as an essential element to achieving proficiency, competency and sustainability in the firm (Chaudhuri et al., 2018; Delic & Eysers, 2020; Rojo et al., 2018). A scholar named Martinez-Sanchez and Lahoz-Leo (2018) mentioned five dimensions of SC agility: effectiveness, visibility, velocity and flexibility. The technology for business operations can be attained. However, the firms need to develop enough knowledge and information in their internal business environment to train their managers to extract quality data and information and utilize it for complex decision-making. Few researchers believe that organizations are still incapable of assessing and enriching technology users' skills, which are a significant obstacle to getting positive technology results at their optimum level. The competency of an information system of the firm increases the flexibility in a structure that, in response, enhance the SC adaptability to cater for the continuously changeable business environment (Christopher & Holweg, 2011). Most organizations show their capacity and ability to announce a business intelligence model in the electricity market to make their SC system more intelligent, efficient and agile (Božič & Dimovski, 2019). Variations in technology and variations in people's attitudes and behaviour act as crucial elements for generating the elements of flexibility in their operations (Daher & Anabousy, 2020). From a broader viewpoint, the concept of supply chain flexibility can be obtained by installing a system of information technology through a structure with flexibility that provides an opportunity to obtain the features of an intelligent SC system through properly implementing information theory.

## **2.4 Underpinning Theory**

This study is based on the theoretical groundings of supply chain compatibility and supply chain process integration, so the base theory for this research study is a resource-based view (RBV). The organizational resource-based view recommends that organizations can achieve a competitive position in their market sector through the valuable, rare, and non-substitutable capabilities and resources that organizations own. By utilizing these resources, organizations can make and implement effective strategies in their firm, which are difficult for the firm's competitors to implement the same strategies in their firm. Valuable capabilities and resources enable the organization to compete with other firms effectively and efficiently (Barney, 1991; Peteraf, 1993; Wernerfelt, 1984; Hashmi et al., 2020). By following the Resource-based view, an organization can be explained as a bundle of capabilities, competencies and resources, and this perspective can be proven to be an effective and impactful theoretical framework for knowing and understanding how competitive advantage and high level of financial performance are achieved (Corbett & Claridge, 2002). Usually, the element of capabilities mainly links to the abilities of an organization to utilize its assets and resources "to affect the desired end" and are equivalent to the intermediate goods that are produced or manufactured by the organization through various firm processes to deliver "improved resource productivity" (Amit & Schoemaker, 1993). In opposition to resources, capabilities are surrounded by the interactions of more than one source of knowledge and information. They are more specific to the organization and less exchangeable, which ultimately leads to the firm's competitive advantage. Organizational competencies and capabilities can be enormously categorized into those competencies utilized to perform basic functional processes and those used to guide the improvement of existing functional activities (Collis, 1994). Concerning utilizing resources, the Resource-based view holds a perspective that organizations have various levels of capabilities and resources. The survival of an organization depends on creating new and rare resources that build upon existing competencies or capabilities of the firm to make them more incomparable (Peteraf, 1993).

## **2.5 Hypothesis Development**

### ***2.5.1 Internal Information Integration & operational performance***

In the concept of supply chain integration, supply chain information integration mainly consists of external and internal information integration (Ataseven & Nair, 2017). Internal integration is related to how organizations can develop their organizational practices, behaviours and methods into a cooperative, coordinated, and manageable processes to meet the demands and requirements of the firm's products and services (Ayoub et al., 2017; Tavana et al., 2019). Through the use of ERP medium internal information integration mainly includes information system integration (Tarigan et al., 2021). However, on the other hand, other technological platforms transfer and share exact and accurate searching of inventory and other information related to their operations across all the functions that occur within an organization (Oghazi et al., 2018).

Practical information and knowledge management are essential to improve the process management level (Nazifa & Ramachandran, 2019). Internal information management provides a capability to the employees to imagine and explore the opportunities for minimizing the level of variations in process management and time laps of the production process that ultimately result in the enhancement of firm performance (Huang & Huang, 2020). Internal information system allows organizations to integrate their several process-related activities and functions like production, distribution of material and product, and supplier management, so, in that way, they allow firm to enhance their level of improvement in their systems. For instance, the ERP system that is installed in various firms enables them to transfer the correct information at the right time within an organization that increases the process quality level of process management, which is required to deliver competencies and capabilities of the lean production (Aljawarneh & Al-Omari, 2018). Correspondingly, organizations are enabled to effectively run their functions by implementing, monitoring and controlling the process. That is needed to deliver the services and goods within an organization through efficient access to detailed information and knowledge that enables the firm to perform its cross-functional communication in an effective manner (Sutduean et al., 2019). Therefore, it is believed that internal management and process integration highly depends on the high quality of information sharing process based on on-time data, reliable & trustful knowledge and information.

An effective information system in the organization allows the firm to deliver the correct data on time and ensure the availability of information about its inventory in real-time (Mouhib et al., 2018). The effective ERP system and advanced computerized system of information in firms act as a capability that helps organizations build contact with their SC partners effectively; organizations successfully implement the concept of integration in their firms or in between SC firms (Murdihardjo et al., 2020). Management of information in internal functions of a firm provides a facilitator for organizations to save their real-time data and deliver it to the most relevant member of the supply chain. That is why effective management of external processes and internal integration of the firm may be required for completing the product distribution process, transport system and warehousing effectively (Amoako et al., 2020). Overall, the efficient information system allows the firm to ensure the constant flow of accurate information within the firm to transfer it to their SC partners, which play a massive role in the management and integration of external processes smoothly and on a timely basis (Kim, 2018). Therefore, we hypothesize as follows:

*H1: Internal information integration has a significant effect on operational performance*

### **2.5.2 External Information Integration & operational performance**

According to the perspective of the resource-based view, the concept of external information integration is the degree to which relationships that are based on electronics are developed for sharing accurate information and for communication through the process that exists between two individual firms (Amoako et al., 2020; Yuen & Thai, 2017). The practice of external integration is mainly known in which firms develop their association with their supply chain partners to develop various strategies, methods, practices, and behaviours into joint and manageable processes (Siagian et al., 2020). The external integration of firms includes associations with customers and suppliers mainly based on strategies (Alshurideh et al., 2019; Gu et al., 2017). The concept of external information integration can

be distributed to two extents: customer information integration and supplier information integration (Gu et al., 2017).

Supplier information integration occurs when firms work and operate with their suppliers to exchange knowledge, data and information and build a cooperative and coordinated flow of information (Duhaylongsod & De Giovanni, 2018). A firm and its suppliers need a system that uses information by linking and integrating essential resources of an organization's resource planning system, warehouses of data and other applications of the firm into a mutual platform through the computer system. An organization can develop performance metrics according to the task performance and their final results and learn about complex environmental variations through the normalization of models based on data and query languages, mutual applications developments and direct contact with suppliers through the computer medium. That enables an organization and their suppliers to organize the process of production and delivery of the product and enhance the level of forecasting and planning (Zhang et al., 2018) that, ultimately allowing the firm to develop the actual performance of valuation throughout the supply chain system (Cai et al., 2010; Paulraj & Chen, 2007). The exchange of information to the suppliers mainly relates to the scheduling, forecasting, shipment notices and estimating sales to suppliers. This allows an organization to enhance its inventory management level and renewal planning (Lai et al., 2012). In response, it helps the firm minimize its cost of operations, risk of transactions, and cost of coordination and communication and increases productivity. Therefore, we propose that.

*H2: External information integration has a significant effect on operational performance*

### **2.5.3 Reactive Supply Chain Flexibility & Operational Performance**

Supply chain flexibility is a crucial strategy applied to effectively deal with uncertain conditions in the supply chain system of a particular firm. Various research studies have discussed various strategies to increase flexibility capability (Singh et al., 2019). Rojo et al. (2018) stated that the capability of flexibility could be reactive or proactive. The reactive flexibility addresses the ecological uncertainty that occurs both external and internal, which is faced by the firm (Alikhani et al., 2021). The flexibility with proactive nature enables an organization to define the uncertainties.

Safety stock is the strategy and a common approach used in firms to enhance flexibility when firms face uncertain conditions related to supply and demand (Singh et al., 2020). With the safety stock approach, an organization can minimize the risk of inventory shortage (Darom et al., 2018). Safety stock also enhances the level of responsiveness in the firm (Gonçalves et al., 2020). Scholars argued that safety stock is a reactive strategy as this particular strategy only responds to the recent uncertain condition whiteout, trying to proactively minimize the uncertain condition (Aldrighetti et al., 2019; Panda & Ramteke, 2018). Another strategy discussed in various literature on flexibility is flexible capacity, mainly used to cope with uncertainty (Nasiri et al., 2021). However, it is also observed that in various conditions, it is a costly deal or sometimes it is difficult to energetically adjust the capacity level of the firm (Elluru et al., 2019). Therefore, to attain adequate flexibility, the organizations need to set the level of capacity higher than the average level of demand. In that way, they can avoid many scarcities during peak times. Moreover, supplier backup is also considered a reactive strategy as it is believed that a firm's single supplier can create a risky situation for the firm (Aldrighetti et al., 2019; Hosseini et al., 2019). That is why organizations mainly maintain more than one supplier that guarantees their presence, but they increase the cost level most of the time. Hiring multiple suppliers by the firm to enhance flexibility in supply chain operations has been widely discussed in the literature (Yoon et al., 2018). Therefore, we propose that;

*H3: Reactive supply chain flexibility has a significant effect on operational performance*

### **2.5.4 Proactive Supply Chain Flexibility & Operational Performance**

The concept of proactive supply chain flexibility states that a firm's capability to endure and sustain its functions like internal disturbance and external disruptions. On the other side, y applying a

proactive strategy in the firm, organizations can persistent their functions and operations instead of disturbances and interruptions (Sharma et al., 2017), whereas the firm can easily adjust in significantly less time to deal with the uncertain and unexpected market condition through reactive strategies (Saenz et al., 2015; Töyli et al., 2013). In addition, due to the rapid increase in uncertain disruptions, the manufacturing organizations must have the capability and competency to make reactive & proactive strategies for dealing with the uncertain situation of the firm as well as environmental uncertainties (Kamalahmadi & Parast, 2016; Töyli et al., 2013).

The supply chain system of firms requires proactive capabilities to be flexible for handling interruptions in their system (Mackay et al., 2020). Proactive flexibility is a capability of the supply chain system to identify, anticipate and protect against the continually changing shape of risk before any negative result (Yu et al., 2018). Tenhiälä & Salvador (2014) highlight the requirement for a formal communication network to effectively manage disturbance and interruptions and improve the firm's flexibility level. Various theoretical types of research in the supply chain highlight several proactive capabilities like flexibility, robustness, adaptability, collaboration, integration, market strength, variety and efficiency to measure supply chain resilience (Sinthupundaja et al., 2019). Organizations are now applying various proactive strategies through which they successfully redesign their product & processes. Proactive strategies also include reducing the setup time as the long production period cannot create volume in their production and mix the flexibility level. Therefore, we propose that.

*H4: Proactive supply chain flexibility has a significant effect on operational performance*

## 2.6 Conceptual Framework

The proposed conceptual framework of this study is shown in Figure 1. The framework shows that internal information integration (III) and external information integration (EII), reactive supply chain flexibility (RSCF) and proactive supply chain flexibility (PSCF) act as independent variables and the operational performance (OP) act as the dependent variable.

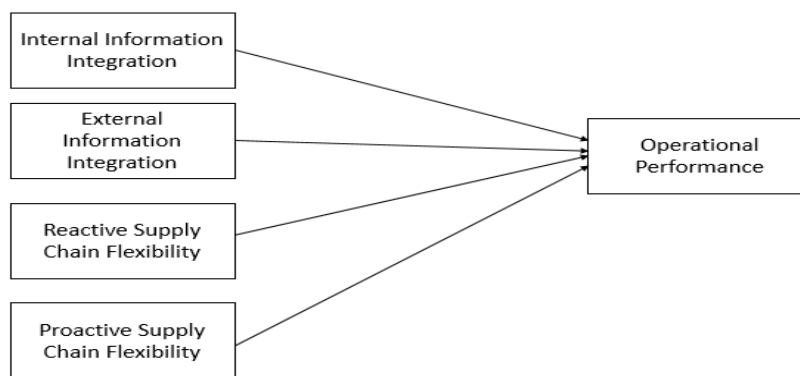


Figure 1: Conceptual framework

## 3. Research Methods

Globally, every research study exists in two main types of research approaches that are qualitative research approach and quantitative research approach (Creswell & Creswell, 2017). Besides this, the combination of these two approaches is termed the mixed approach, such that research is based on both types of data, descriptive and numbers (Rashid et al., 2021). The qualitative study aims to discover new concepts or develop a new theory. In contrast, a quantitative study examines the association among various developed concepts or theories. In the case of the current research study, the objective was to test the association between dependent and independent variables. In contrast, these variables were based on existing theories, so a quantitative approach was used for conducting this study (Hashmi et al., 2020).



### **3.1 Data Collection Source**

Saunders et al. (2009) defined two significant sources of data collection; primary source and secondary source of data collection. In primary source data, the data is in real-time and is collected explicitly by the researcher for thorough research. Primary data include surveys, observations, experiments, focus groups, and interviews. On the other hand, secondary sources include books, newspapers, journals, annual reports, websites, and research articles. The current research study uses the primary source in its collection process because the data will be new and collected using a questionnaire (Hashmi & Mohd, 2020).

### **3.2 Population and Target population**

The pool of people who can be part of research and participate in research is known as the population of the study (Hashmi et al., 2020a). In this study, the population will be the employees working in manufacturing firms because the main objective of this study is to enhance operational performance by adopting flexibility factors in supply chain factors. In addition, it is not necessary that the whole population can be highly related to fulfilling this objective. Hence, the author specifies that population by target population to target the employees specifically related to supply chain and working in manufacturing firms of various sectors. The sectors covered in this study were the cement, pharmaceutical, textile and printing & packaging sectors.

### **3.3 Sample and Sampling Procedure**

After setting the target population, the next step is to collect data. However, it is not feasible and possible to cover the whole target population because a researcher has limited resources. So Saunders et al. (2009) recommend sampling a targeted pool of individuals to take a sample of a few respondents representing the whole population. There are two essential sampling techniques; probability sampling and non-probability sampling techniques. These two sampling methods are further divided into numerous types. In probability sampling, the researcher chooses participants for a response based on predefined procedures, i.e. random, systematic, stratified, and cluster sampling. Besides this, in non-probability sampling, the researcher has no predefined chances of sample selection, but everyone can participate in the study and respond. It is further divided into various types such that it is divided into types which include convenience sampling, quota, snowball and purposive sampling (Rashid et al., 2021). In the current study, the sample was selected based on non-probability sampling, and a convenient sampling approach was used.

### **3.4 Sample Size, Instrument, and Statistical Tools**

The sample size stated that the subset of the target population represents the whole population. The sample size should be reliable for getting accuracy in results. However, in the present research study, the sample size was selected 236 respondents. As a sample, more than 200 respondents are adequate to generalize the research findings (Hashmi et al., 2020b). The instrumentation used to measure variables was developed by adapting construct from existing studies. A close-ended 5-point Likert scale questionnaire was developed using the study constructs (Rashid, 2016; Rashid et al., 2020). The next step (after data collection) was to manage the collected data through data management strategies. In the current study, the data were entered into an MS excel sheet and then transferred to the SPSS worksheet for coding and statistical inferences (Rashid & Amirah, 2017). Some preliminary tests were ascertained to eliminate the errors during the data collection (Rashid et al., 2019).

The objective of this study was to test the association between independent and dependent variables, so the appropriate statistical model for hypothesis testing is regression analysis (Tabachnick & Fidell, 2007). Moreover, there were some preliminary tests applied to examine the data. These tests include descriptive statistics, reliability analysis and bivariate correlation analysis. These tests were performed using IBM SPSS version 22.

#### 4. Data Analysis

The 300 questionnaires were distributed in various manufacturing firms, and the supply chain department was explicitly focused on questionnaire responses. The responses reverted were 236, 78.6% of the total questionnaire. Table 1 shows the demographic attributes of the respondents: a far more significant proportion was single (154, 77%) than married (46, 23%); the majority were aged 25–30 years (151, 64%), followed by aged less than 25 years (48, 20.3%), then 36–40 (27, 11.4%), and above 40 (10, 4.2%); almost all were male (202, 85.6%), with very few females (34, 14.4%); their experience, in descending order of numbers, ranged from 121 (51.3%) with less than three years, 81 (34.3%) with 6–10 years, 17 (7.2%) with 7-10 years, and 17 (7.2%) over ten years of experience; and finally, 12 (5.1%) completed diploma, while 70 (29.7%), 85 (36%), 57 (24.2%), and 12 (5.1%) earned their intermediate or less, graduation, and master’s degrees, respectively.

Table 1: Demographic profile

Demographic variable	Category	Frequency	Percentage
Gender	Male	202	85.6
	Female	34	14.4
Age	Less than 25 years	48	20.3
	25- 30 years	151	64.0
	36-40 years	27	11.4
	Above 40 years	10	4.2
Experience	less than three years	121	51.3
	3 to 6 years	81	34.3
	7 to 10 years	17	7.2
	above ten years	17	7.2
Education	Diploma	12	5.1
	Intermediate or less	70	29.7
	Graduation	85	36
	Masters	57	24.2
	M Phil/PhD	12	5.1

#### 4.1 Descriptive Statistics

Descriptive statistics were performed to test the univariate normality of data. It contains mean, standard deviation, skewness and kurtosis. The acceptable value of skewness and kurtosis is  $\pm 2.5$  (Hair et al., 2009). The consolidated results are presented in table 2. The given results illustrate that the maximum skewness value ( $sk=0.770$ ) is for construct Proactive supply chain flexibility (PSCF) (Mean= 3.50, S.D=0.64), while the minimum skewness value ( $sk= 0.271$ ) is for construct External information integration (EII) (Mean= 3.53, S.D=0.63). Beside this, the maximum kurtosis value ( $k=1.335$ ) is for construct proactive supply chain flexibility (PSCF) (Mean= 3.50, S.D=0.64), whereas, the minimum kurtosis value ( $k=0.014$ ) is for construct reactive supply chain flexibility (RSCF) (Mean= 3.57, S.D=0.77). These findings illustrate that all the skewness and kurtosis values are not greater than  $\pm 2.5$ , so all adapted constructs are achieving the acceptable requirement of univariate normality.

Table 2: Descriptive statistics

Construct	Mean	Std. Dev.	Skewness	Kurtosis
External information integration	3.53	.63	-.271	.333
Reactive supply chain flexibility	3.57	.77	-.664	-.014
Proactive supply chain flexibility	3.50	.64	-.770	1.335
Operational performance	2.88	.66	-.753	1.104

#### 4.2 Reliability Analysis

Reliability analysis was tested to examine the data's internal consistency, which emphasizes the error related to data collection. The consolidated outcome for reliability analysis is presented in table 3. According to the results presented, the highest reliability value ( $\alpha= 0.790$ ) is for constructing External information integration (EII), and the minimum reliability ( $\alpha = 0.751$ ) is for constructing reactive supply chain flexibility (RSCF). These outcomes show that all constructs have at least (0.70) reliability value,

so all adapted constructs are reliable for this study, and there is no issue with internal consistency (Hashmi et al., 2021; Khan et al., 2022; Khan et al., 2022; Baloch & Rashid, 2022; Shaheen, 2022).

Table 3: Reliability analysis

Construct	Standardized Cronbach's Alpha s
External information integration	.790
Reactive supply chain flexibility	.751
Proactive supply chain flexibility	.779
Operational performance	.756

#### 4.6 Correlation Analysis

The correlation analysis was ascertained to check the strength of the inter-construct relationship, and the acceptable value is from  $\pm 0.30$  to  $\pm 0.90$  (O'Brien & Scott, 2012). Summarized outcomes are shown in table 4. The consolidated results shown in table 4 indicate that the most vital relationship ( $r=0.562$ ) is between operational performance (OP) and proactive supply chain flexibility (PSCF). Besides this, the weakest relationship ( $r=0.350$ ) is between proactive supply chain flexibility (PSCF) and External information integration (EII), as these results are fulfilling the acceptable range of correlation values. Hence, all adapted constructs show the association with each other.

Table 4: Bivariate correlation

Construct	T_III	T_EII	T_RSCF	T_PSCF	T_OP
Internal information integration	1				
External information integration	.446**	1			
Reactive supply chain flexibility	.468**	.470**	1		
Proactive supply chain flexibility	.403**	.350**	.482**	1	
Operational performance	.466**	.388**	.562**	.549**	1

\*\* correlation is significant at the 0.01 level (2-tailed).

#### 4.7 Construct Validity

Construct refers to the measurement scale, but this scale is different from other scales such as ordinal, nominal, and ratio scales. They are usually known as latent factors, which explain the unobservable variables through different valid items. The convergent, discriminant and convergent were carried out to examine construct validity for this study (Agha et al., 2021; Haque et al., 2021; Khan et al., 2021; Khan et al., 2022).

##### 4.7.1 Convergent validity

The convergent validity checks the relationship among all items in one construct. These all should measure different concepts (Hair et al., 2009). So to check the convergent validity, three criteria were applied: factor loading, composite reliability (CR) and average variance extracted (AVE). The factor loading should be at least (0.40) (Hashmi et al., 2021; Khan et al., 2022), CR should not be less than 0.70 (Fornell & Larcker, 1981), and the AVE not be less than 0.50 (Alrazehi et al., 2021; Das et al., 2021). The summarized outcomes for mentioned above three criteria are presented in table 5. The summarized results suggest that the factor loading for all items is not less than 0.40. The AVE for each construct is more significant than 0.50, and the CR for each construct is also not less than 0.70 (Hashmi et al., 2021). Thus all adapted construct has no issue in convergent validity.

Table 5: Convergent validity

Construct	Items	Factor loading	AVE	Composite reliability(CR)
Internal information integration	III2	0.745	0.593	0.814
	III3	0.767		
	III5	0.979		
External information integration	EII1	0.820	0.573	0.801
	EII2	0.740		
	EII3	0.707		
Reactive supply chain flexibility	RSCF1	0.676	0.553	0.86
	RSCF2	0.739		
	RSCF3	0.760		
	RSCF4	0.841		
	RSCF5	0.691		
Proactive supply chain flexibility	PSCF1	0.700	0.535	0.821
	PSCF2	0.762		
	PSCF3	0.758		
	PSCF4	0.705		
Operational performance	OP3	0.785	0.631	0.837
	OP4	0.822		
	OP6	0.775		

#### 4.7.2 Discriminant validity

The discriminant validity has been ascertained to test the uniqueness of the measurement scales used in this study (Hulland, 1999). According to Fornell & Larcker's (1981) method, the square root AVE for each construct should be greater than the correlation among each pair of variables. Table 6 shows the summarized results for discriminant validity. The diagonal of the given above matrix shows the square root of AVEs. According to calculated results, the square root AVEs is greater than the correlation among each pair of constructs. Thus the discriminant validity stated was established.

Table 6 Discriminant validity

Construct	T_C	T_CO	T_IE	T_INT
External information integration	0.757			
Internal information integration	0.388	0.77		
Operational performance	0.350	0.480	0.794	
Proactive supply chain flexibility	0.293	0.417	0.50	0.732
Reactive supply chain flexibility	0.360	0.489	0.529	0.507

#### 4.8 Testing Overall Model SEM

The proposed, tested model has four independent variables, which are internal information integration (III) and external information integration (EII), reactive supply chain flexibility (RSCF) and proactive supply chain flexibility (PSCF). In contrast, there is one dependent variable: Operational performance (OP). The give below Figure 2 shows the SEM path model:

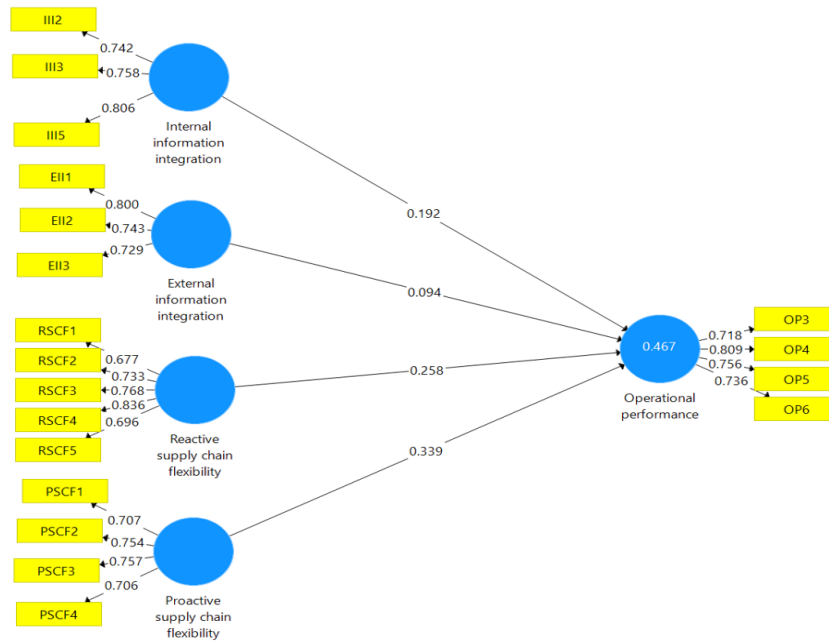


Figure 2: SEM path diagram

#### 4.8 Assessment of Significance of the Structural Model

The model has independent variables: internal information integration, external information integration, reactive supply chain flexibility, and proactive supply chain flexibility. In comparison, there is one dependent variable: Operational performance (OP). The significance of the relationship among these variables was tested by applying to bootstrap using PLS. The results presented that internal information integration (III) and external information integration (EII), reactive supply chain flexibility (RSCF) and proactive supply chain flexibility (PSCF) have a significant effect on operational performance (OP). However, the value of the adjusted R-square was (0.389), which means all predictors can predict a 38.9% variance in operational performance.

According to the calculated path coefficient values in table 7, internal information integration significantly and positively influences operational performance ( $\beta=0.207$ ,  $p\text{-value} < 0.05$ ), which supports the first hypothesis. External information integration positively and significantly influences operational performance ( $\beta=0.101$ ,  $p\text{-value} < 0.05$ , which supports hypothesis 2. Reactive supply chain flexibility also has a significant and positive relationship with operational performance ( $\beta=0.264$ ,  $p\text{-value} < 0.05$ ) that supports hypothesis three. The path coefficient results for Proactive supply chain flexibility also show that Proactive supply chain flexibility has a positive and significant relationship with operational performance ( $\beta=0.251$ ,  $p\text{-value} < 0.05$ ), which supports hypothesis four. Hence,  $H1$ ,  $H2$ ,  $H3$ , and  $H4$  are supported.

Table 7: Results of the structural model

	Path coefficient	T statistics	P-value	Hypothesis	Support (Yes/No)
III -> OP	0.207	2.761	0.006	H1	Yes
EII -> OP	0.101	1.982	0.048	H2	Yes
RSCF -> OP	0.264	4.117	0.000	H3	Yes
PSCF -> OP	0.251	4.075	0.000	H4	Yes

#### 5. Discussion

All the proposed hypotheses were tested and were found consistent with previous research studies as all the proposed hypotheses were retained. The recent results and outcomes of the research study are further discussed as hypothesis one, "Internal information integration has a significant effect

on operational performance", was retained. Moreover, answer to research question one: Does Internal information integration positively affect operational performance? Was it match with existing literature? For instance, Internal information management provides a capability to the employees to imagine and explore the opportunities for minimizing the level of variations in process management and time laps of the production process that ultimately result in enhancement of firm performance (Huang & Huang, 2020). Internal information system allows organizations to integrate their several process-related activities and functions like production, distribution of material and product, and supplier management; in that way, they allow the firm to enhance their level of improvement in their systems.

Hypothesis two, "External information integration has a significant effect on operational performance, " was retained and answered to research question two: Does External information integration have a positive relationship with operational performance? Was it match with existing literature? For instance, external integration is mainly known in which firms develop their association with their supply chain partners to develop various strategies, methods, practices, and behaviours into joint and manageable processes (Siagian et al., 2020). The external integration of firms includes associations with customers and suppliers mainly based on strategies (Alshurideh et al., 2019; Gu et al., 2017). The concept of external information integration can be distributed to two extents: customer information integration and supplier information integration (Gu et al., 2017). Whereas hypothesis three, "reactive supply chain flexibility has a significant effect on operational performance, " was retained and answered to research question three: Does reactive supply chain flexibility have a positive relationship with operational performance? Was it match with existing literature? For instance, reactive flexibility addresses the ecological uncertainty that occurs both external and internal, which is faced by the firm (Alikhani et al., 2021). The flexibility with proactive nature enables an organization to define the uncertainties of the market again or to define an impact that customers have come to imagine from a particular industry.

Hypothesis four, "Proactive supply chain flexibility has a positive relationship with Operational Performance, " was retained and answered research question three: Does proactive supply chain flexibility have a significant effect on operational performance? Was it match with existing literature? For instance, the concept of proactive supply chain flexibility states that a firm's capability to endure and sustain its functions like internal disturbance and external disruptions. On the other side, y applying a proactive strategy in the firm, organizations can persistent their functions and operations instead of disturbances and interruptions (Sharma et al., 2017), whereas the firm can easily adjust in significantly less time to deal with the uncertain and unexpected market condition through reactive strategies (Saenz et al., 2015; Töyli et al., 2013). In addition, due to the rapid increase in uncertain disruptions, the manufacturing organizations must have the capability and competency to make reactive & proactive strategies for dealing with the uncertain situation of the firm as well as environmental uncertainties (Kamalahmadi & Parast, 2016; Töyli et al., 2013).

## **5.1 Implications**

This particular research work highly participates in the literature on supply chain management in the following way: practitioners can easily understand the concepts and adopt them in their firm according to the requirement as organizations need to enhance and improve their competencies and capabilities to survive successfully in the vibrant working environment. Which highly requires the adjustment reactively and proactively in the firm processes (e.g. development & manufacturing of products, purchasing of materials and product distribution. The firm needs to enhance internal and external information integration to perform all processes well. The ERP system that is considered the technique of internal information integration can also play its role in making solid and flexible capabilities as its long-term influence still depends on whether the employees effectively coordinate with each other or only spend money on buying expensive hardware. In that way, the firms need to develop an information integration with external partners through the adoption traceability system to effectively integrate with their network members, further enhancing the organization's operational performance. Organizations with high uncertainties should develop the element of supply chain

flexibility in their firm. The managers and practitioners should also focus on the continuous changes in the external environment and improve their capabilities to proactively and reactively regulate their supply chain-related activities.

## **5.2 Limitations, Recommendations, Conclusion**

This particular research mainly focused on the manufacturing firms of Karachi, Pakistan. So to enhance this study, it is recommended to perform this research on another geographical region to test the validity of this research model. The variable of information integration is multi-dimensional as it also influences variably. In future studies, various other dimensions of information integration can be considered. The difference between supplier and customer information integration and their influence on operational performance can be discussed in detail. To enhance the strength and scope of this research, the future needs to increase the sample size in that manner; researchers can attain much reliable and accurate study results. To explore the mediating effect of this model, it is recommended for the future to add a mediating variable such as environmental uncertainty through which the influence of information integration can be tested on operational performance.

This particular research study was established to investigate the relationship between organizational resources and capabilities and how the organization benefits from the optimum synergy of resources and capabilities. This research was mainly based on the existing theories, such as the Resource-based view theory. The research model of this research was mainly applied to all of the manufacturing firms that are located in Karachi, Pakistan. A structured questionnaire was developed to collect the data through questionnaires from all of the employees that belong to the SC departments of the firm. Three hundred questionnaires were circulated among employees, but only 236 results of questionnaires were considered for analyses and obtaining results. The results are obtained through the SEM model & found that all of the proposed hypotheses are retained and have a significant and positive relationship with operational performance. It was confirmed that from all of the variables, reactive supply chain flexibility significantly impacts operational performance. This study mainly highlights the difference that exists between the aspects of internal and external SC information integration. The integration of information internally or externally that inconsistently influence the firm's operational performance. For example, the effect of external information integration is considerably weaker than the other type of information integration on the firm's operational performance. Therefore, through this study, policymakers and practitioners can understand the influence of firm capabilities and resources on operational performance. In that way, they can easily manage their issues and achieve competitive performance.

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