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Absorptive Capacity in Supply Chains: Does Responsive Strategy of a Firm Matter?

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Abstract- **The main purpose of the current study is to investigate the impact of absorptive capacity on supply chains. In addition to that, the study has examined the mediating role of responsive strategy in the relationship between absorptive capacity in supply chain and performance. This research is based on the analysis of absorptive capacity to be an organizational value making a firm able to gather, use, and implement the information from outside. The study demonstrates the association between absorptive capacity and responsive strategy. It has been analyzed the way in which absorptive capacity has been developed by firms through examination of curvilinear impact of responsive strategy. the study is among the pioneering studies on the issues. So, current study has used SEM-PLS as statistical tool to answer the research questions raised in this study and research objectives envisaged in the current study. The findings of the current study have provided support to with the hypothesized results. This study will be helpful for policymakers and researchers in examining the link absorptive capacity on supply chains, responsive strategy and performance.**

Keywords: *Absorptive capacity on supply chains, Responsive strategy, Performance*

1. Introduction

The concept of supply chain is related to the connection of firms based on the flow of product, finances, and information [1, 2]. This research is related to information flow among the organizations. Information is not instantly available for decision making by the management [3]. It has become crucial to use the available information in an effective way [4, 5]. Sourcing information is not the only requirement rather it is the need to implicate it in decision-making process [6, 7]. The importance of information processing has increased with the increased pressure of demand for innovative products by the customers [8]. Most of the information required for this purpose lies outside the firm to its suppliers and customers. One of the important concepts in managing supply chain is absorptive capacity [9, 10]. Absorptive capacity is regarded as the extent of acquisition, assimilation and transformation of information and its implementation for enhancing

performance [11]. Now days, suppliers are involved in the efforts for product development of a firm [12, 13]. Organizations become able to achieve higher responsiveness to customers through gathering information and applying it across the boundaries of firm through absorptive capacity [14-17]. The scholars of SCM studies have considered absorptive capacity to be an important concept [9, 17, 18].

An important attribute of organizational responsiveness is the absorptive capacity. However, there is very rare research in literature about this construct [19]. There is very low information on the development of absorptive capacity by the firms. This attribute has been shown by some firms [9, 17]. This research is based on the analysis of absorptive capacity to be an organizational value making a firm able to gather, use, and implement the information from outside. The study demonstrates the association between absorptive capacity and responsive strategy. It has been analyzed the way in which absorptive capacity has been developed by firms through examination of curvilinear impact of responsive strategy.

The data has been collected from two periods of IMSS (International Manufacturing Strategy Survey). Using IMSS data, the model has been tested and a sample of almost 677 firms over period of 4 years has been collected in IMSS V. It has been revealed through research that there are three contributions, which include performance of firm, absorptive capacity, and responsiveness. The responsive strategy of a firm motivates the absorptive capacity. The relation between firm performance and responsive strategy has been mediated by absorptive capacity fully. This reflects that it is a competitive ability of a firm, which is focused on making innovation in products for the customers. Moreover, the research has found a U-shaped relation between absorptive capacity and responsive strategy. It is reflected that the when firms try to mix the responsive and efficient strategies, this diminish their absorptive capacity.

The absorptive capacity has been studied as recommended by Zahra and George [11] as a construct of second order based on four dimensions of first order. The structure of research involves the introduction to topic followed with literature

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studies based on absorptive capacity [9, 17]. The research hypotheses have been developed. The methodology chosen for conducting research and results are presented. The study gives a conclusion along with practical implications for practitioners as well as its limitations and areas for study in future.

2. Theoretical Framework and Development of Hypothesis

It is stated by information processing theory (IPT) that the main activity of an organization is to cope with information to link it positively with the growth [20]. It has been suggested by one of AC tenets that an effective information flow is required and it must be acquired, used, and transformed in innovative way. In case, firms are following a RS due to uncertain environment, the need for AC is greater. According to Galbraith [20], a framework has been presented based on the way to organize an organization from setting rules and goals to achieving them. Goals are set to design the activities for employees resulting in improved business performance. In case of higher uncertainty, IPT is crucial because of increased information required by the firms to make decisions [20]. It is suggested in this highly complicated supply chains that decision makers are based in several distinct firms. The RS has been measured as set goals of the form in the research model of this study [21]. This is very crucial in the dynamic and uncertain external circumstances [22, 23].

The set goals can be achieved by organizations in four different ways [24]. These ways include the development of resources, setting tasks that are self-contained, making investments in information systems (vertical) and development of lateral relations. The need for processing information is reduced through creation of resources and setting tasks, which are self-contained. The processing of information is increased in lateral relationships of boundary spanning and investments to be made in information technology [20, 22]. The central tenet of AC is not to reduce the need for information processing. This fact is based on the focus of IPT on boundary spanning and information technologies. The world today is highly competitive, and marketplaces demand speedy actions for sustaining competitive advantage. It is expected that those firms are successful, which follow a RS [8, 23, 25-27]. Making investments in information technology increases the connection of a firm with its suppliers and customers [28, 29], which leads to improve its absorptive capacity [30]. Altogether, the firm experiences better performance [31, 32]).

The adoption of information technology for the acquisition of knowledge or information can lead to AC. This results in better responsiveness, information assimilation, and development of new products (NPD). The supply chain can be restructured by using information in innovative way [9, 10]. The four dimensions of AC are enhanced by use of information technology or making relationships based on boundary spanning [29]. The use of information technology is involved in acquisition of information for supply chain. Moreover, IT and activities of boundary spanning also improve the assimilation of NPD. The ability of an organization for processing information also improves [33, 34]. The goals of the firm are translated to enhanced growth and performance through the four dimensions of AC. A firm, which implement IT system and connects with the suppliers and customers can assimilate information and make its supply chain transformed. When operational application is not realized by a firm, this may not improve the capacity of a firm for processing information. The responsive strategy cannot be related to increase in performance in this case [35].

H1: Response strategy is in positive significant relationship with firm performance.

2.1. Absorptive Capacity and Responsive Strategy

According to Fisher [14] and Lee [15], uncertainty is increased by responsive strategy for a firm. Therefore, there is need for increased level of processing of information [20, 36, 37]. In literature, it is revealed that through innovation; RS can be implemented, which need the application and acquiring of information [27, 38, 39]. Acquiring knowledge through formation of external linkages, improvements can be seen in allocation of resources as well as other benefits on RS . Market base for the product is extended as well. A firm becomes able to establish a good understanding of the needs of customers through the relations of boundary spanning. In this way, resources can be organized for fulfilling the needs of customers that is important for RS execution that is customer focused. The successful RS execution cannot be attained through information acquisition using IT only [27]. There is need to overcome the barriers related to organization and behavior for assimilation and implementation of acquired knowledge in an effective manner [38, 40]. The acquisition of knowledge should be aligned with processing, assimilation, and implementing into the activities of firm to achieve positive outcomes. For innovation responses, there is need for decision making by different functionalities of the form that is supported by the acquisition of supply chain information [41]. A number of managers have recognized the benefits of establishing relations for making innovative products to fulfill the needs of

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customers and launch new products in reduced time cycle [42].

When a firm involves itself in different actions to make changes in supply chain, this leads to transformation of supply chain. These changes include altering of customer portfolios, development of customers and suppliers as well as effective flow of products through coordination. The quality performance, delivery of time and lead times are the changes in portfolio of suppliers, which include the selection of suppliers in a careful manner. The transformation of supply chain influences lead time and speed with reference to the complicated requirements of customers. By reducing lead time and time in delivery of suppliers, responsiveness can be attained. The main activities of a firm involve the alignment of distribution networks in a way to reduce delivery time for customers. Customer coordination enables the effective planning of procurement of parts of component [38, 43]. While executing a responsive strategy, the firm acquires information, use it for New Product Development, transform its supply chain, and implement to achieve the set targets.

The following research hypothesis has been developed based on the information above.

H2: The absorptive capacity is in significant relationship with supply chain information acquisition.

H3: The absorptive capacity is in significant relationship with NPD Assimilation.

H4: The absorptive capacity is in significant relationship with supply chain transformation.

H5: The absorptive capacity is in significant relationship with operational application.

2.2. Performance of Firm and its Absorptive Capacity

The basic purpose is to improve performance in financial term through execution of a responsive strategy [44]. It is known that uncertainty increases with RS and it is not easy to achieve better performance by firm, this reduces the stability in the environment of firm [27, 36, 37]. Benefits can be achieved by a firm by acquiring information and processing it and making use of customer relations with Information Technology [24, 45]. Because of variation in customer requirement, variations in product development increases as well and dependence of suppliers is enhanced [8]. The focus of suppliers on the requirements of customers is increased as well [46]. The operational capabilities of firm increase by the transformation in supply chain by improving performance of suppliers. It is required for improving the performance in financial terms as well [47]. The information processing activities lead to the implementation of RS and achieving its benefits in financial terms [24, 36, 37, 48]. This concept has been termed as a firm's

absorptive capacity [11, 49]. The financial performance of a firm cannot be improved without absorptive capacity. Therefore, the following research hypothesis has been developed:

H6: The supply chain information acquisition is in significant relationship with firm performance.

H7: The NPD Assimilation is in significant relationship with firm performance.

H8: The supply chain transformation is in significant relationship with firm performance.

H9: The operational application is in significant relationship with firm performance.

2.3. The mediating role of Responsive Strategy

In a responsive strategy, absorptive capacity is very useful. It promotes the performance of a firm and lead to several other benefits. There is difference in the abilities of a firm to product absorptive capacity Azadegan [9] and DomíNguez, et al. [17]. A clear understanding of the creation of AC by firms is required far from the linear relations between absorptive capacity and several other factors. The purpose of this study is to determine the influence of RS on the performance of a firm and that by the absorptive capacity. For this, a detailed examination of the existing literature has been done related to the impact of supply chain strategies on these activities [50-52].

While managing efficient strategy, AC can be very effective because of the advantages resulting from acquisition of information, transformation, and implementation of information. For reducing cost, the level of inventory is low for the customers expecting better quality and on time delivery of products [50]. When RS is implemented, AC is very effective as it makes a firm capable of acquiring, assimilating, and using information regarding the changes in the requirements of customers and lesser time cycle for innovation in products [51]. It is difficult to focus by considering the need components of responsive strategy to result in expected outcomes related to innovation, cost, and quality. According to Childerhouse, et al. [53], there is no supply and demand chain strategy, which serve all the requirements. The product segmentation based on its characteristics enables this focus.

It is difficult to implement the responsive or efficient strategy in an effective manner because of the need to use two different management approaches, which can be conflicting [52]. The factors including simplicity, homogeneity of task, experience, and repetition are reduced through implementation of a responsive strategy. The efficiency and performance of a firm in terms of innovation is positively related with the absorptive capacity [17]. The absorptive capacity requires the management of upstream and downstream activities in a different way, which makes it

difficult to be developed with a responsive strategy. The measurement of frequency of new product, innovation in product and wide range of products is involved in the operational concept of responsive strategy. It is indicated by the higher level of these aspects reflect that the focus of a firm is on the development of innovative products. However, the low level of these reflects the focus of firm on the provision of products, which are functional [51].

It is indicated by the scores of firms near the center of range that they focus on the provision of hybrid products and make use of responsive/efficient strategy [51]. Therefore, it is expected that the focus is on functional products, when the scores are low in frequency of new product, innovation in product and wide range of products and firm employees efficient strategy. On the other hand, when scores are high in frequency of new product, innovation in product and wide range of products the focus of the firm is on innovative products and it employs a responsive strategy. The value around the center reflects firms offering mixed or hybrid products. The following notion can be hypothesized based on the above factors.

H10: The supply chain information acquisition mediates the relationship between responsive strategy and firm performance.

H11: The NPD Assimilation mediates the relationship between responsive strategy and firm performance.

H12: The supply chain transformation mediates the relationship between responsive strategy and firm performance.

H13: The operational application mediates the relationship between responsive strategy and firm performance.

3. Methodology

For research analysis, the research has made use of SEM Approach, which refers to Structural Equation Modeling. This approach is now to be effective as the approach of simple and multiple regression analysis in which the variables assessed without errors. Factor analysis and multiple regressions are involved in SEM and it has greater effectiveness in estimation of variables concurrently. In this research, cluster-sampling technique was used for collection of data. Gay and

Diehl [54] presented five-technique approach through which sample size can be calculated. This technique has been implied for the calculation of this research. Sekaran and Bougie [55] proposed four distinct methods to be used in research for estimation of reliability. These include test retest, coefficient of Cronbach's alpha, split half and alternative form. According to Sekaran and Bougie [55], test retest, split half and alternative method is not sufficient for the reliability estimation rather they given weak estimation. Low score value are estimate due to changes in subject and higher expenses are involved in these tests. The division of items generates the coefficient of reliability. Therefore, these methods have not been adopted in this research study. The method selected in this research is Cronbach's alpha, which is employed to check the reliability. The weaknesses of the other three methods are overcome in this approach. The use of this method is extensive in the social science research studies. The total population for the study has been estimated after which the sample size is calculated using the table presented by Krejcie and Morgan [56]. For this study, the size of population came out to be 310. SEM approach is greatly employed in social science studies because of its ability to estimate multiple relations simultaneously [57]. Much emphasis has been given on approach based on co-variance and AMOS by the researchers in previous years. However, a good substitute is PLS-SEM because of its unique estimation features and methodology. There are several reasons for optioning SEM in this research. The first and foremost reason is its effectiveness in resolving the research problems that cannot be tackled by multiple regressions. PLS approach is considered useful when prediction is required by structural modeling for the constructs [57].

4. Results

In this research, PLS-SEM has been used because of its flexibility for sample size and its ability to estimate multiple relations simultaneously. Formative and reflective constructs are involved in model. The aim of the study is to make prediction among the variables. The use of PLS method has been supported by Hair Jr, et al. [57] because of the use of measurement and structural model in it.
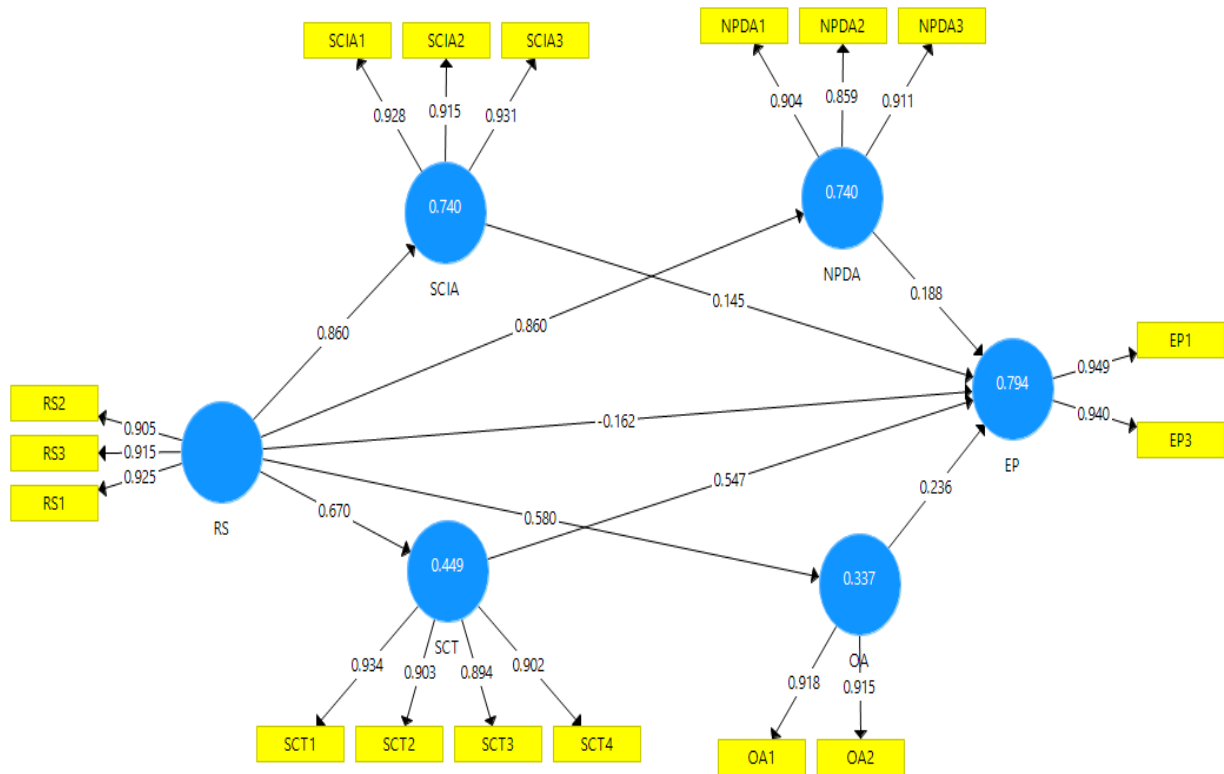
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Figure 1. Measurement Model

The relation between the observed and unobserved variables is shown by the measurement model. Variations occur in all the model items while the measurement model is estimated. It is expected that there is a strong relation among the variables and are put together to develop a construct. The validity of measurement model is also important, which reflects the representation of constructs by the observed variables. Therefore, strong correlation is expected to exist between variables and is combined to form a construct. For this, CFA analysis is done. In this analysis, the constructs having first and second order are measured. Separate analysis has been done for all the elements using formative, reflective, and structural modeling during the process of estimation.

Table 1. Factors loadings

	EP	NPDA	OA	RS	SCIA	SCT
EP1	0.949					
EP3	0.940					
NPDA1		0.904				
NPDA2		0.859				
NPDA3		0.911				
OA1			0.918			
OA2			0.915			
RS2				0.905		
RS3				0.915		
SCIA1					0.928	
SCIA2					0.915	
SCIA3					0.931	

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SCT1						0.934
SCT2						0.903
SCT3						0.894
SCT4						0.902
RS1					0.925	

For measuring the reliability, the study has chosen Cronbach's alpha coefficient. The level of measuring the proposed item to be intended is referred as the validity of content [58]. For items, a detailed literature review has been studied. Factor analysis has been used to load the items to their constructs in a correct way. In table 5.7, the measures of content validity have been shown. It is reflected that item loadings have been done in a significant manner to the related constructs. It is evident through table 5.7 and 5.8 that the content is valid. The degree of convergence by a set of variables in the estimation of a particular concept is referred as convergent validity [58]. Composite reliability, convergent validity, and AVE can be developed through use of simultaneous tests of factor loadings.

Table 2. Reliability

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
EP	0.879	0.884	0.943	0.892
NPDA	0.870	0.871	0.921	0.795
OA	0.810	0.810	0.913	0.840
RS	0.902	0.903	0.939	0.837
SCIA	0.915	0.917	0.946	0.855
SCT	0.929	0.930	0.950	0.825

According to the criterion of Fornell and Larcker [59] criterion, a power estimation that is adopted widely is of discriminant validity. The degree of relation among the reflective variables and constructs is estimated in discriminant validity. The variables included in the research model are operationalized through discriminant validity. The estimation of discriminant validity is based on this aspect. It is expected that the reliability value index is 0.70 or greater than this. Therefore, the value of cross-loadings and outer-loadings are same. The correlation is assessed by the cross loadings among the constructs. This research study has found the discriminant validity between the constructs and variables as presented in the table 3.

Table 3. Discriminant Validity

	EP	NPDA	OA	RS	SCIA	SCT
EP	0.945					
NPDA	0.695	0.891				
OA	0.833	0.660	0.917			
RS	0.628	0.860	0.580	0.915		
SCIA	0.654	0.864	0.585	0.860	0.924	
SCT	0.864	0.667	0.882	0.670	0.636	0.908

After the estimation of reliability and validity, the next step is to measure the structured relation among the variables. The relations can be measured simultaneously using the SEM-PLS method among the variables constructed in contrast to other approaches. The direct and indirect variable effects are analyzed in the structural model. The following is the structural model of the study.
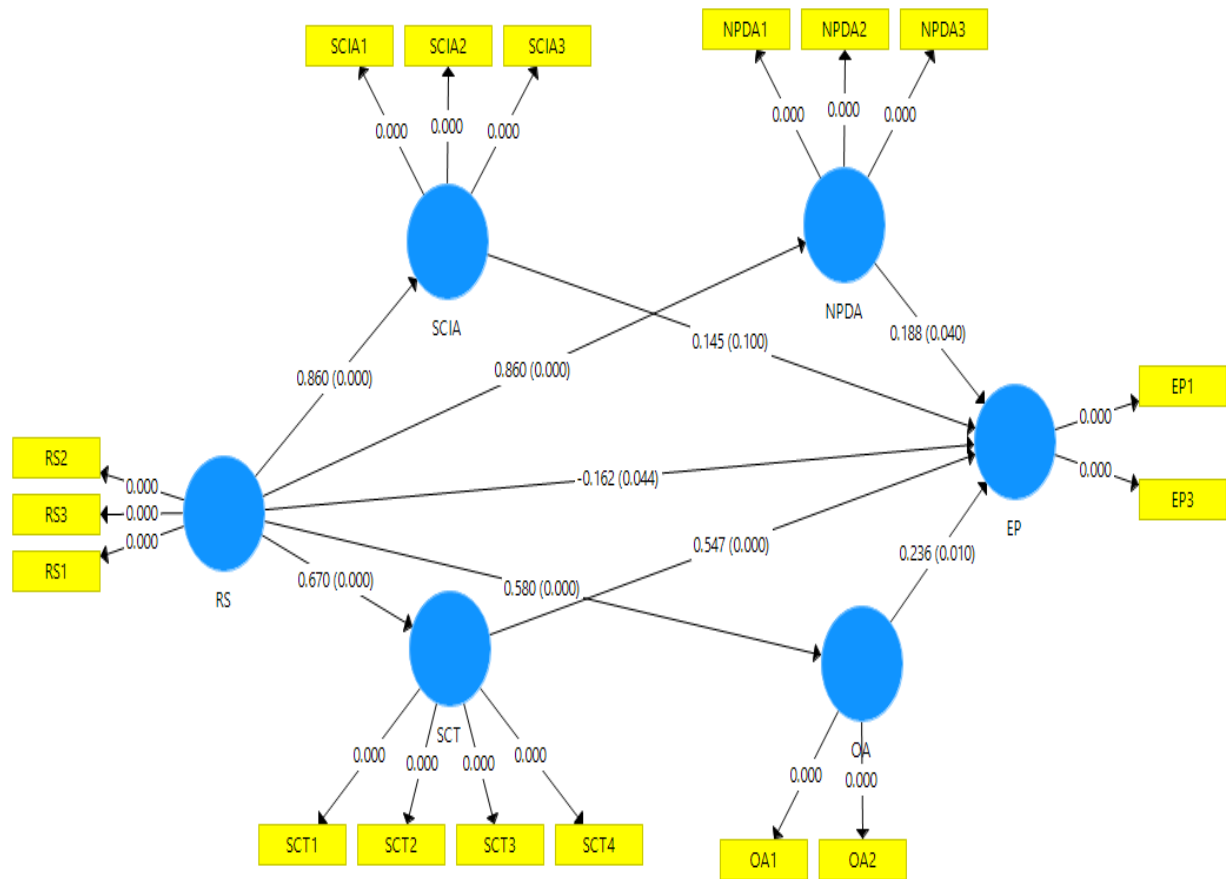
Figure 2. Structural model

The level of mediation is measured to analyze the direct influence of variable on the mediating variable. Moreover, bootstrap method has been used to assess the relationship significance. A sample of 1000 observations has been used for bootstrap analysis. The level of significance for p-value is below 0.05. The p-value is less than 0.05 for all the hypotheses. This reflects that the hypotheses are accepted. The mediating influence on the association of agile supply chain and external performance of supply chain by customer responsive has been shown in Table 4. It is indicated by the mediation results that the values of t and p are significant for both hypotheses. The t-test is greater than 1.96 and p-value is lesser than 0.05, which lead to the acceptance of all hypothesis.

Table 4. Direct relationships

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
NPDA -> EP	0.188	0.186	0.091	2.055	**0.040**
OA -> EP	0.236	0.241	0.092	2.578	**0.010**
RS -> EP	0.628	0.629	0.065	9.687	**0.000**
RS -> NPDA	0.860	0.860	0.025	34.991	**0.000**
RS -> OA	0.580	0.581	0.070	8.276	**0.000**
RS -> SCIA	0.860	0.860	0.025	35.077	**0.000**
RS -> SCT	0.670	0.672	0.069	9.654	**0.000**
SCIA -> EP	0.145	0.149	0.088	1.644	**0.100**
SCT -> EP	0.547	0.536	0.093	5.878	**0.000**

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Table 5. Mediation

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
RS -> NPDA -> EP	0.161	0.160	0.079	2.053	**0.040**
RS -> OA -> EP	0.137	0.140	0.057	2.401	**0.016**
RS -> SCIA -> EP	0.125	0.128	0.077	1.633	**0.103**
RS -> SCT -> EP	0.366	0.358	0.065	5.600	**0.000**

R^2 is the coefficient of determination that explains the amount of variation in the dependent variable through the exogenous variables. The value lies in the range of 0-1. When it is closer to 0, this means the coefficients are insignificant and when the value is closer to 1, it means the variables are significant. When the value is 0.75, it reflects substantial predictive power and it is moderate when the value is 0.50. However, the predictive power is weak when it is 0.25.

Table 6. R-square

	R Square
EP	0.794
NPDA	0.740
OA	0.337
SCIA	0.740
SCT	0.449

5. Conclusion and Discussions

Contributions have been made by this study to the concept of absorptive capacity within the framework of IPT (information processing theory) [20]. A better understanding of the flow of information is added by this research with the increase in product coordination, exchange of finance and information related to supply chain [1]. The flow of products has been studied greatly but there is need to conduct research on the approaches to information management related to supply chain [60]. The strategic drivers increasing uncertainty leads to absorptive capacity. Absorptive capacity is derived by response strategy and AC works as a mediator in the relation of performance and strategy. Controlling uncertainty for the external environment of the firm, these results were assessed that is related to the theoretical concepts of IPT, RS, and uncertainty in the literature. The model in which uncertainty was related to RS came out significant statistically as p came out less than 0.10. This is consistent with the findings of literature.

The findings of path model have extended the work of Gunasekaran, et al. [27], Storey, et al. [38], and Vonderembse and Dobrzykowski [48], which claimed that acquisition of knowledge is not sufficient for RS capitalization. Collection of information using the relations of boundary spanning boosts the activities transforming the information into the productions of products with innovation [61]. Transformation of supply chain reveals the expected value of information along with the operational implications [11]. It has been found by testing the factors of first order comprising absorptive capacity that there is positive association between RS and the four dimensions. The performance of firm is affected by the operational application only. An important augmentation has been providing through this research regarding, which involves the testing of second order construct i.e. AC. The way in which absorptive capacity affects performance is revealed by the study. Using the collected set of information, the estimates of path model were validated that are consistent with the model. It is important to know that the relation between AC and RS is revealed by IMSS V while measuring the level of structural invariance between the two models. Both the datasets reflects significant relation between AC and RS. It indicates that firms executing RS can experience increase in AC. Now days, AC is considered to be highly important as compared with the previous times [11]. Challenges in decision-making can lead to increase in processing of information with the development of big [62].

It has been identified through previous research studies about the causes of variance in the abilities of firms to develop AC but these have not been examined [9], These reasons or causes have been explored in this study by assessing the association between AC and strategy. The argument has been established based on the focus concept of Collings and Mellahi [63]. It has been found by the results that the focus of firm on responsiveness or efficiency is based on the level of its experience, simplicity, repetition, homogeneity of task, etc. [53]

Firms are able to stay away from the diseconomy of scales while using a mix of the two strategies in their supply chain. Efforts are required by the firm in developing absorptive capacity because of the hybrid responsive/ efficient strategy. This has been depicted in the previous sections that AC is an important mediator in enhancing the performance of firm through strategies. Important decisions taken by the managers related to product development such as cost, speed, quality, and variety are reinforced [14]. The activities of processing information are influenced by the dilemma of these trade-offs but the performance of firm is not influenced because RS has no direct impact on performance. Qi, et al. [52] recognized the challenges related to the execution of responsive and efficient strategy in the determination of positive effects on the outcomes in a direct way. The findings of this research go in line with this recognition.

This research puts forward a modern contribution of methodology to the approaches of measurement used in the literature related to AC. A comprehensive model of second order has been conceptualized and tested for measuring the absorptive capacity with the four dimensions.

The research of previous scholars using different measures such as simple to multiple item psychometric proxy measures has been extended by this research study [30]. The results of the study add to the previous literature, which were not able to measure absorptive capacity being the second order construct [17]. A better understanding of the relation of AC with other variables has been made by using it as a second order construct and the decomposed level first order.

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