Exploring A Strategic Links between Absorptive Capacity, Supply Chain Agility, It Capability and the Organizational Performance of Indonesian Manufacturing Firms

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Abstract- **The present research attempts to discover this supply chain management as an important issue of strategic management research. This study particularly examines two important IT capabilities which are expected to have influence on firm performance, these capabilities are 1) IT assimilation, the ability to synchronize and diffuse the applications of information technology under business structure, and 2) flexible IT infrastructure, a well-developed and carefully planned technological foundation which provides basis for present as well as future applications to be developed. Based on the dynamic capability's perspective and the view of a hierarchy of capabilities, the prime objective of the currents study is investigating the direct relationship between absorptive capacity, supply chain agility, IT capability and organizational performance in the Indonesian manufacturing firms. In addition to that the mediating effect of absorptive capacity and supply chain agility is also examined. Employing the survey-based methodology, the SEM-PLS technique is used to test the hypothesized relationships. Therefore, 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 study have provided support to the theoretical foundation and proposed hypothesis of the current study. Current study will be helpful for policymakers and practitioners in understanding the issues related to supply chain agility, IT capability, absorptive capacity and the firm performance. In author knowledge this is among very few pioneering studies on this issue.**

Keywords: *Supply chain agility, IT capability, Absorptive capacity, Indonesia*

1. Background

The top priority of firms has been shifting towards leveraging information technology for achieving competitive advantage [1]. Supply chain of a firm is required to incorporate Information technology (IT) capabilities to ensure effective and efficient change and knowledge management. Although, mixed findings are reported by previous researches regarding the influence caused by IT capabilities on the organizational performance [2]. However, the articulation and role of such mechanism is still vague [1]. Therefore, more empirical researches need to undertake on the area of influential IT capability mechanism, particularly under the context of supply chain.

According to the literature, both IT assimilation and flexible IT infrastructure are suggested to be rare, imperfectly imitable, and valuable information technology capabilities, which must be acquired by firms in order to flourish in the ever-changing business setting. In particular, firms tend to invest more in IT infrastructure, thus helping the information flow across the supply chain, consequently helping firms to improve their competitive advantage. Since markets have become volatile and quite uncertain, therefore, IT infrastructure has been developing by firms as an essential IT capability which helps attaining higher level performance. Resultantly, flexible infrastructure has gained great attention in terms of business value. Furthermore, prior studies indicated that investing solely on flexible IT infrastructure can prove to be insufficient, as alone it cannot facilitate firms in achieving its level of competitive advantage. Such as, in a study [2] reported that without IT assimilation, the performance benefits of investing in IT infrastructure cannot be fully achieved. Practically, with the rapidly increasing adoption of IT applications in business processes, it is essential to incorporate IT assimilation for successful business processes throughout the boundaries of firm, thus, help firm to obtain IT based value.

Recent studies raise questions about IT capabilities regarding their direct effects on organizational performance, suggesting that other capabilities mediate the direct effects. For instance, information systems using complementary associations among

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other capabilities and assets, poses their effects on the organization [3]. In addition, agility and knowledge management acts as mediators in developing nomological network for assessing the impact of IT capabilities. It has been further argued that IT capabilities usually influence the performance of organization by allowing business capabilities of higher order [4]. Based on this notion, the study employed dynamic capabilities view and attempts to investigate the mechanism of underlying IT capabilities. Following previous studies while formulating information technology capabilities as underlying organizational capabilities, shaping supply chain agility and absorptive capacity which would in turn influence the organizational performance.

An ability of a firm to assimilate, value, and implement newly received knowledge gained from the external resources namely, suppliers, alliance partners, and customers is referred as absorptive capacity. On the other hand, supply chain agility is the organizational ability of effectively collaborating and coordinating with SC partners to quickly respond to changing market conditions [5]. However, supply chain agility and absorptive capacity are considered to be essential direct sources in order to attain higher organizational performance under competitive business environment. Flexible IT infrastructure enable firms to align processes, achieve operation flexibilities, and share knowledge, on the other hand, IT assimilation influence business effectiveness and efficiency across and within the boundaries of organization, by incorporating IT applications in a business environment. Such as, in this study it is proposed that IT assimilation and flexible IT infrastructure supports the supply chain agility and absorptive capacity development, thus, affecting organizational performance. For present study, the collected data i.e. senior executives of Chinese companies, supports the research model [6].

The paper is arranged as follows: Section 2 includes the theoretical background and proposed hypotheses for this study. Section 3 presents the research methodology used in this paper. Section 4 includes the discussion about data analysis and the findings of the research. Final section presents the conclusion of this study.

2. Theoretical Framework and Hypotheses Development

The dynamic capabilities are a broadly used paradigm for explaining performance variance across the firms business competing organizations. Dynamic capabilities view embedded in resource-based view, suggests that higher organizational performance arises from operational and dynamic capability [7]. The basic difference among these capabilities is formulated in the literature. Where former is defined as the ways of achieving new resources in response to market changes, whereas, the latter refers to the means through which an organization operates or functions in order to survive [8]. Operational capability particularly defines as an ability to coordinate and execute various organizational tasks needed for executing operational activities, namely, marketing campaign and distribution logistics. It indicates the collection of routines or a higher routine level for acting against changing market conditions. With the increasing demand for cost-effective and timely service and product delivery, agility is essential for achieving superior performance. Supply chain agility considers the complex integration and coordination between various members, thus enabling organizations to alter practices of supply chain and become more responsive towards changes in market conditions [9].

Dynamic capability is the ability of integrating, developing, and reconfiguring external as well as internal competencies. It is considered to be a superior routine for adapting capabilities and operational routines in order to establish value-creating new strategies. Absorptive capacity is considered as a critical dynamic capability in the literature, which allows knowledge management. Absorptive capacity of a firm explains the organizational processes and routines allowing firms to gain, assimilate, exploit, and transform knowledge [10]. Hence, it enables to anticipate and capture those potential business opportunities which can directly influence the performance of organization.

Alternatively, on the basis of capabilities' hierarchy and higher-order capabilities, organizational capabilities are suggested to be formulated like a hierarchy and developing a higher-order capability using a lower-order series of capabilities. Therefore, supply chain agility and absorptive capacity in this view are considered to be higher-order capabilities, allowing organizations to use the available series of lower-order capability. Under recent IT value research, IT capabilities are regarded as capabilities of lower-order, thereby enabling higher-order capabilities development, namely knowledge management, agility, operational capabilities, and new product development.

IT capability of a firm describes the lower-order IT capability which can further be employed in developing higher capability, which brings sustained and significant performance gains [11, 12]. Similarly, IT capabilities considered as the antecedents of agility capabilities and knowledge management. Based on this reasoning, we propose that IT assimilation and flexible IT infrastructure can be employed as lower-order capabilities, for creating higher order capabilities, such as, supply

chain agility and absorptive capacity, which consequently influence the organizational performance.

2.1. Supply chain agility

As an operational capability, supply chain agility refers to the ability of executing operational activities along the partners of supply chain for rapidly responding or adapting to changes in occurring in a marketplace [13]. A supply chain usually includes a set of various interlinked activities, such as manufacture, design, and delivery of services and products. A firm is expected to coordinate and collaborate among the channel partners for efficiently and mutually performing such activities and manage market uncertainty for obtaining competitive advantage [14]. Supply chain agility is essential under such conditions, as it involves customer responsiveness. Therefore, it is critical to achieve competitiveness by the firm, since it allows efficient and effective actions in response to changes in operations, namely manufacturing, procurement, market promotion, and delivery [15].

The supply chain agility concept is a complex philosophy that does not accounts for procedures or rules that can be imitated or implemented easily, rather it reflects the integration and coordination between different members throughout the supply chain. Supply chain agility demands close supervision of the operational inter-connected parties that are legally separate, for instance, manufacturers, distributors, suppliers, to develop a coordinating and close association [16]. It explains that agility reflects how well organizations coordinate and collaborate with its partnering firms for generating knowledge sharing routines and complementary resources, thus efficiently managing the interconnected market changes. Hence, supply chain agility is an imperfectly imitable, valuable, and a rare capability, which is essential for improving organizational performance [17].

Specifically using information integration, agility facilitates in mastering changing marketplace conditions and in achieving customer responsiveness of higher level (Giannakis & Louis, 2016). Information integration allows sensing marketplace variations and enhances the supply chain visibility, consequently, minimizing the demand uncertainty cost. In addition, it enables organizations in coordinating among the partners with a clear vision on business processes and planning [18]. Such coordination minimizes opportunistic behaviors and potential conflicts arising in the supply chain, it also encourages organization to stock and deploy the available resources in order to improve delivery efficiency of services and products [19]. Therefore, supply chain agility helps in increasing profitability, reducing costs, and improving functioning of routine operations.

H1. Organizational performance is positively associated with the supply chain agility.

2.2. Absorptive capacity

Absorptive capacity is defined as the ability of a firm to acknowledge newly gained external knowledge and integrate and commercialize that knowledge. It takes into account a set of routines for managing the gained knowledge and effects of continuous process of learning within the organization [20]. Furthermore, on the basis of prior knowledge, rich communication, and effective learning, it also allows the creation of market knowledge. Scholars have recently mentioned absorptive capacity to be critical, as it concerns about generation and use of such knowledge during competition that could facilitate firms to obtain and sustain the level of competitive advantage. A higher absorptive capacity organization is susceptible to change by redefining and effectively exploiting the knowledge-based assets of organization, thereby, molding the firms' operational capabilities for superior performance [21].

With regard to dynamic capabilities view, the study propose that superior firm performance is significantly arises due to firms' absorptive capacity. In particular, a higher absorptive capacity firm is susceptible to utilize the newly gained knowledge that comes from suppliers, customers, competitors, and partners, which is then applied for discovering market opportunities for the business. For instance, a firm through absorptive capacity could effectively gain knowledge regarding technology innovation, preferences, and emerging markets.

Acquiring knowledge facilitates in understanding market susceptibility, capturing market opportunities, and sensing environmental volatility that are essential for enhancing firms' profitability and market share. Moreover, absorptive capacity also confirms the efficient processing of internal knowledge. In addition, it helps in developing informal and formal system for extensively sharing of knowledge across all departments. Hence, firms get the chance of learning how newly gained knowledge can be applied to improve and enhance services and products efficiency and to reengineer supply chain operations.

H2. Organizational performance is positively associated with the absorptive capacity of a firm.

2.3. IT capabilities

2.3.1. A flexible IT infrastructure

The term flexible IT infrastructure is an organizational ability of developing a technological resource set, thus providing basis for the IT application development. Specifically, it involves communication networks, a computing platform, key data processing applications, and shared data [22-24]. IT flexibility shows the point to which such elements are compatible, modular, and connective. A flexible IT infrastructure indicates 1) compatibility, i.e. ability of sharing and communicating information of any kind including video, text, image, data, audio and so on, within channel partners or an organization and across any part of information technology; 2) modularity, i.e. to add, redesign, and easily omit any infrastructural element without making any major effect; and 3) connectivity, i.e. the association or connection among IT and other components, with partners or within organization.

The absorptive capacity can be improved through a flexible IT infrastructure by improving knowledge richness and its reach. Specifically, it facilitates firm to update, standardize, and connect the components of information technology, thus helps in the data integration within as well as beyond the boundaries of a firm. More importantly, IT connectivity allows to efficiently exchange the knowledge and communicate with the partners, therefore, improving the knowledge reach of organization. Furthermore, IT connectivity disintegrate organizational deposits and allows it to share and reunite that knowledge across various functional departments. Additionally, IT components' compatibility allows knowledge sharing, having data richness, with partners or within organizational setting.

IT compatibility entitle firm to coordinate and share external knowledge through text, data, and document, and also shares implied knowledge using video, audio, and picture, thereby enhancing the organizations knowledge richness. In addition, IT modularity components helps in modifying IT infrastructure for satisfying various requirements regarding knowledge management, such as e-business, and confirms that firm is capable of sharing and processing knowledge even under low technological restrictions.

H3. Absorptive capacity is positively associated with flexible IT infrastructure of a firm.

The literature shows that dynamic capability stimulates the operational capability of an organization. A firm's dynamic capability can be taken as strategic options, allowing it to redesign the available operational capability during a new opportunity or in the time of need [25]. On the basis of available literature on absorptive capacity, it has been proposed that external knowledge is an important operational capability factor. On the other hand, literature on agility advances that it is the extent of richness and knowledge reach which determines the agility of a firm. Therefore, it expresses that the basis of competitive advantage of a firm relies in utilizing the firms' absorptive capacity for establishing agility [26].

H4: The absorptive capacity acts as a mediator in the relation among organizational performance and flexible IT infrastructure.

Higher supply chain agility can also be achieved through flexible IT infrastructure. Firstly, connectivity of the components of information technology facilitates in order to incorporate the flow of information to the channel partners, by integrating a technological interface. Such consolidation allows smooth information flow for the firms regarding orders, inventory, and products throughout the SC to enhance channel visibility [27]. In addition, it also assists firm to make knowledge, data, and information and assess its organizational boundaries.

Such compatibility enables firms to collaborate among the partners, since they are capable of achieving complex activities, such as, on demand forecast, product development, and joint planning, resultantly improving supply chain agility development. Finally, higher compatibility allows interoperability between the different components of information technology for assisting in the rapid new applications development [5]. This modularity enables firms to adapt with the IT applications as well as incorporate these applications in the systems of channel partners, which then allow firms to improve their supply chain agility through jointly responding against the changing market conditions.

H5: Supply chain agility of a firm is positively associated with its flexible IT infrastructure.

Consequently, the study proposes that the absorptive capacity of a firm is expected to be positively associated with the firm's supply chain agility (Meyer, 2018). Particularly, having superior absorptive capacity give firms the power to sense market variations and could help them learn from their own experiences [28]. Such capability facilitates in developing communication with the SC partners through rich knowledge, therefore improving the supply chain visibility [29]. Moreover, it helps in obtaining shared understanding by exploiting and transforming newly gained set of information. It can contribute in synchronizing resources, channel administration and tasks of the partners [30]. Finally, the newly gained knowledge would allow firms to fully interpret partners' values and opinions as well as market understanding, thus improving the shared values for ensuring SC agility throughout the supply chain.

H6: Supply chain agility acts as a mediator in the relation among organizational performance and flexible IT infrastructure.

3. Methodology

The current study has employed the survey-based methodology. The questionnaire is adapted from the previous studies. The four-item scale of IT infrastructure is adapted from the study of [22-24]. The IT assimilation in the form of four item scale is adapted from the studies of [22, 31]. The 12- item scale of [25, 32] is used to operationalize the absorptive capacity. The 3-item scale of supply chain agility is adapted from the studies of [33, 34]. The firm performance measure is adapted from the studies of [11, 12]. For sample collection, cluster-sampling technique was employed. Five-technique approach that was presented by [35], was used to calculate the sample size for present study. First step is to estimate total population, followed by the estimation of population sample size, using table presented by [36]. The population size turned out to be 710. In social sciences, SEM is considered as a powerful and commonly used tool since it can test number of relationships at one time [37]. Although, previously many researchers have emphasized much upon AMOS, a co-variance-based approach. However, PLS-SEM is a good alternative to the CB-SEM approach, having unique methodological features. The final sample comprises of 345 respondents. The manufacturing industry of Indonesia is chosen as population.

4. Results and Discussion

There are number of reasons which make PLS-SEM a popular approach among researchers. Several arguments about the reasons of employing PLS by researchers and scholars were assessed [38]. According to [37], PLS approach is useful especially when the sole purpose of using structural modelling is to obtain explanation and prediction about the constructs. For current study, PLS-SEM technique is employed assuming it to be more flexible, demands less in terms of sample size, and have an ability to handle multiple structural modeling. Moreover, the model is constituted of reflective and formative constructs. The study aims to reflect prediction between the constructs. Ref. [37] also supported the reasoning for employing Partial Least Square method. SEM-PLS approach involves two models i.e. structural model and measurement model. The measurement model of the current study is shown in the figure 2.

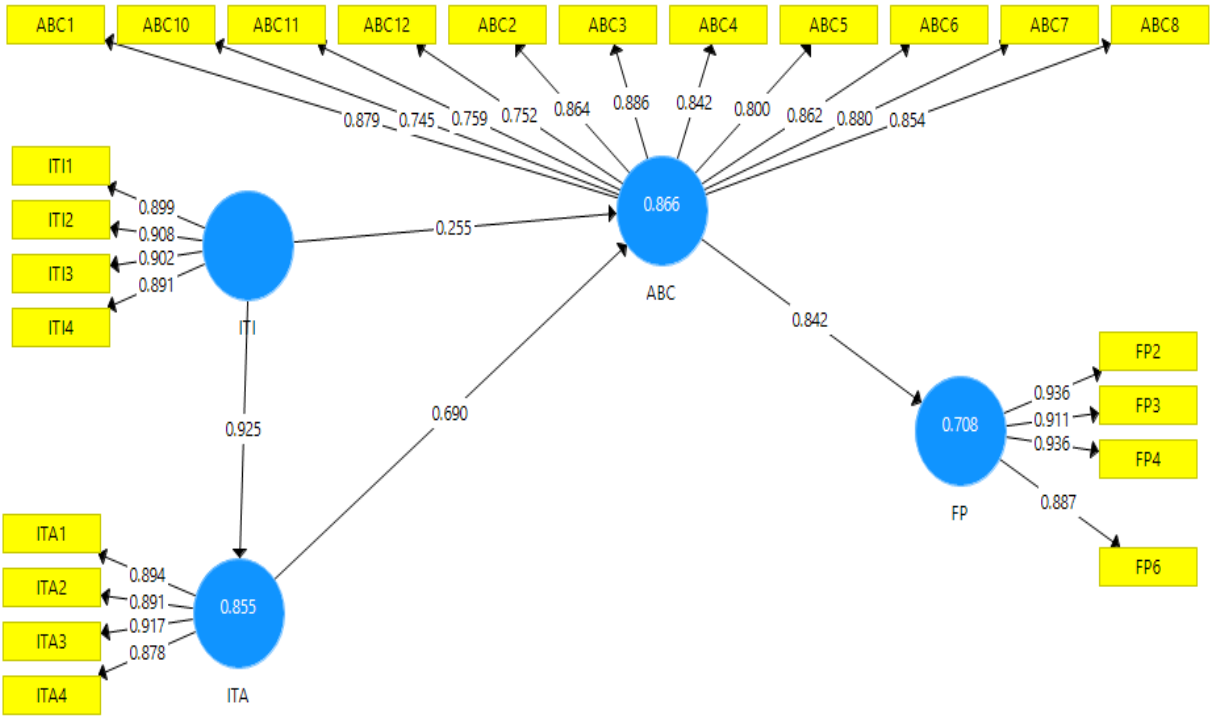

Figure 2. The measurement model

Measurement model shows the relation among the observed and the latent variables. In estimating the measurement model, changes occur in all items of the model. Therefore, strong correlation is expected to exist between variables and are combined to form a construct. In order to confirm the validation of measurement model i.e. how well the observed variables represent the constructs, Confirmatory Factor Analysis is done. Under CFA, first and second order constructs are estimated. During

estimation of the measurement model, all elements are separately analyzed using reflective, formative, and structural modeling. The factor loading of the item is shown in table 1 and the item with the loading with less than 0.60 are deleted.

Table 1. Factor Loading

	ABC	FP	ITA	ITI
ABC1	0.879			
ABC10	0.745			
ABC11	0.759			
ABC12	0.752			
ABC2	0.864			
ABC3	0.886			
ABC4	0.842			
ABC5	0.800			
ABC6	0.862			
ABC7	0.880			
ABC8	0.854			
FP2		0.936		
FP3		0.911		
FP4		0.936		
FP6		0.887		
ITA1			0.894	
ITA2			0.891	
ITA3			0.917	
ITA4			0.878	
ITI1				0.899
ITI2				0.908
ITI3				0.902
ITI4				0.891

In order to assess the internal consistency and convergent validity, factor loadings and average variance extracted [15] are estimated. Literature suggests that the values for AVE and factor loadings must be greater than 0.50. The values for both the measures are higher than 0.50 (see table 2)

Table 2. Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted [15]
ABC	0.955	0.955	0.961	0.691
FP	0.937	0.939	0.955	0.842
ITA	0.917	0.919	0.942	0.802
ITI	0.922	0.922	0.945	0.810

Fornell-Larcker criterion of discriminant validity is a powerful measure and has been widely used by the researchers in studies. Discriminant validity measures the association between reflective variables and their constructs. Generally, it operationalizes the variables that are involved in the model. Thus, the current study incorporated this as a threshold for assessing discriminant validity. Value for reliability index is expected to be 0.70 or above. Thus, the value for outer-loadings and cross-loadings turned out to be the same. Since cross loadings analyse the presence of correlation among the constructs, therefore, current study has examined the discriminant validity between the variables and constructs, as shown in table 3

Table 3. Discriminant Validity

	ABC	FP	ITA	ITI
ABC	**0.931**			
FP	0.842	**0.918**		
ITA	0.826	0.703	**0.895**	
ITI	0.893	0.665	0.825	**0.900**

The next step after checking the validity and reliability of instruments, is the estimation of structured relationship between the variables. Unlike other techniques, the SEM-PLS method observes the simultaneous examination of all the constructed variables. Therefore, in case of structural model it analyses the direct and indirect effects of variables. The structural model is also shown below.

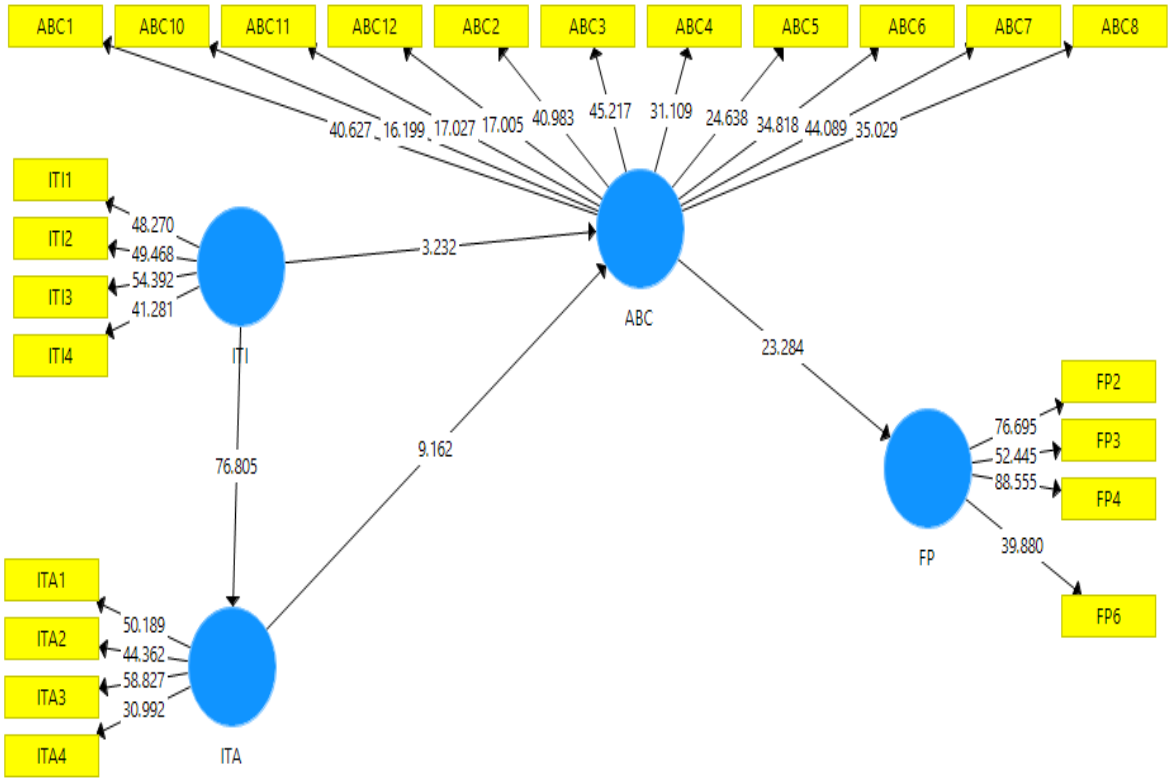

Figure 3. Structural Model

The direct relationship between variables is shown in the table 4. The results indicates that the all the hypothesis are accepted significantly.

Table 4. Direct Results

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
ABC -> FP	0.842	0.841	0.036	23.284	**0.000**
ITA -> ABC	0.690	0.695	0.075	9.162	**0.000**
ITI -> ABC	0.255	0.250	0.079	3.232	**0.001**
ITI -> ITA	0.925	0.924	0.012	76.805	**0.000**

For the purpose of investigating the indirect impact of variable or moderation level is estimated. In addition, to specify the significance of relationship, bootstrap analysis is employed on samples of 1000 observations. The significance level for the p-value is less than 0.05. p-values for all other hypotheses are less than 0.05, indicating the acceptance of hypotheses.

Table 5. Indirect Results

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
ITI -> ITA -> ABC	0.638	0.642	0.071	8.976	**0.000**
ITA -> ABC -> FP	0.581	0.584	0.066	8.791	**0.000**
ITI -> ITA -> ABC -> FP	0.537	0.540	0.062	8.642	**0.000**
ITI -> ABC -> FP	0.214	0.211	0.068	3.150	**0.002**

In structural modelling, coefficient of determination or R_2 explains the predictive power of endogenous variables. Closer to 0 value for path coefficients indicate insignificance of coefficients. Value for R^2 also lies between 0-1, value closer to 1 indicate greater predictive accuracy and vice versa. The value of 0.75 indicates substantial predictive power, 0.50 indicates moderate predictive power, while 0.25 indicates weak predictive power. The R-square value in our cases is above the threshold levels.

Table 6. R-Square

	R Square
ABC	0.866
FP	0.708
ITA	0.855

Overall the results of the study have shown great deal of agreement with our proposed or hypothesized results.

5. Conclusion

Researchers and practitioners regard information technology (IT) as a competitive tool. However, current knowledge on IT capability mechanisms that affect firm performance remains unclear. The present research attempts to discover this area of research. This study particularly examines two important IT capabilities which are expected to have influence on firm performance, these capabilities are 1) IT assimilation, the ability to synchronize and diffuse the applications of information technology under business structure, and 2) flexible IT infrastructure, a well-developed and carefully planned technological foundation which provides basis for present as well as future applications to be developed. Recent studies raise questions about IT capabilities regarding their direct effects on organizational performance, suggesting that other capabilities mediate the direct effects [39]. For instance, information systems using complementary associations among other capabilities and assets, poses their effects on the organization. In addition, agility and knowledge management acts as mediators in developing nomological network for assessing the impact of IT capabilities. It has been further argued that IT capabilities usually influence the performance of organization by allowing business capabilities of higher order [4]. Based on this notion, the study employed dynamic capabilities view and attempts to investigate the mechanism of underlying IT capabilities. Following previous studies while formulating information technology capabilities as

underlying organizational capabilities, shaping supply chain agility and absorptive capacity which would in turn influence the organizational performance. The absorptive capacity can be improved through a flexible IT infrastructure by improving knowledge richness and its reach. Specifically, it facilitates firm to update, standardize, and connect the components of information technology, thus helps in the data integration within as well as beyond the boundaries of a firm. More importantly, IT connectivity allows efficiently exchanging the knowledge and communicating with the partners, therefore, improving the knowledge reach of organization.

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