Does IT implementation affect Supply Chain Performance? An Empirical Analysis of Manufacturing Units of India

Dr. Sarang Narula

Assistant Professor, University School of Applied Management, Punjabi University, Patiala.

Roshanpreet Kaur

Research Scholar

Abstract

Literature has proved that proper implementation of Information Technology (IT) in the organisation has given overwhelming benefits the business units. Hence it plays an important role in managing the entire supply chain. However, it is important to see the results of IT-capabilities on the overall performance of the supply chain. Hence a research model has been tested which studied the impact of implementation of information technology on the performance of the supply chain. For this purpose PLS SEM has been used in order to test the model.

Keywords: *supply chain management, supply chain performance, information technology.*

1. INTRODUCTION

Businesses today work in a more complex environment than ever before. Due to liberalisation and globalisation many new emerging businesses are also entering into the market to mark their presence felt. To sustain the competition organisations are trying to bring more innovative products into the market with lowest possible cost. Due to increased use of technology the information can be transmitted from one part of the world to another easily. Customers now have their own choices which they want the business organisations to fulfil and provide products in a customised manner (Ellram, 1991). The businesses have entered into a fiercely competitive marketplace which is more complex, competitive and uncertain.

For the improvement in the business information technology plays a crucial role in to be ahead of the business challenges being faced by the companies. Supply chain management has been a great area of interest for researchers (Lovelace, Shapiro, & Weingart, 2017).It connects the suppliers to the customers. The new supply chains have entered into new complex chains of companies. Hence the use of information technology (IT) has been increased in past many years.

Studies have shown that information technology has played a major role in keeping any business at pace with the increasing competition by providing continuous movement of information to the business organisations thus making the supply chain more reliable (Bayraktar, Demirbag, Koh, Tatoglu, & Zaim, 2009). Better use of IT helps in making the

supply chain more flexible and also integrates it with all the departments of the organisation as well. This helps to connect the suppliers with the customers well by improving supplier performance and meeting the demanded needs of the customers. The dynamic enterprises maintain a healthy relationship with the suppliers, customers and also with the competitors which is also making its place in the market. Therefore, making the best use of technology in the increased competitive environment is crucial for attainment of best organisational goals. Without the proper integration of IT systems into the organisation, effective goals cannot be achieved. It also important to look into its pros and cons linking it with the organisation in which it has to be implemented.

The benefit derived from the implementation of IT system in the organisation largely depends upon the size of organisation. The large companies tend to have more benefited arising out of it (Levy, Powell, & Yetton, 2002). Diffusion of IT into the supply chain help in creating value for the organisation (Porter & Millar, 1985).

Supply chain management has been defined in different ways by different authors. It is a process which keeps various parties related to the organisation connected such as manufacturers, suppliers, warehouse keepers, customers etc. Supply chain management (SCM) helps the organisation in maintaining the correct level of stock and making available the right product at the right time (Simchi-Levi, Kaminsky, Simchi-Levi, & Shankar, 2008). In the increased competition, it is very important to have a close look at the competitors and also SCM is crucial for sustained growth and development (Singh, 2011).

The use of IT cannot be ignored in commercialised world as it helps in the creation of new business opportunities, giving a chance to other business organisations to showcase their products and increase their productivity so that they are able to sustain in the strong competitive world. (Premkumar, 2003). IT tools helps in adding infrastructural steadiness which

makes sure that relevant information is transferred without any hindrance at the right time and also that this information is transparent enough so that it is available to inter departments as well. Effective integration of IT with each partner in the supply chain enhances effectiveness (Bhagwat & Sharma, 2007).

Many manufacturing units have been making immense of information technology because of the agility and responsiveness it provides to the business. IT has also helped in reducing the lead time and overall improving the business cycle, thereby improving the performance of the business organisations and satisfying the customers by providing better services. However, it is not a guarantee that adoption of information technology will bestow organisations with improved performance. In this context, it is very important to understand the way in which the IT is impacting the supply chain of the business. Some organisations adopt technology because other organisations have implemented them. But the factors affecting the adoption of information technology for two companies cannot be the same (Brynjolfsson, 1993).

Advancement in IT has been defined as the organisation using most sophisticated and up to date technology (Kim, 2003).Thus businesses tend to have more latest technology than what their competitors are having and embedding the same effectively.

(Kim, 2003) also focuses on how effectively the advanced It solutions have been embedded into the organisation. The appropriate results of implementing IT into the organisation will be achieved only if the advanced IT has been used well and blended effectively into each part of the supply chain. it is not the advanced IT which gives the desired results, but it the appropriate use of IT which is more important.

Integrated IT helps firms to be capable of handling information flows and sharing the information with their supply chain partners. It also helps in planning for demand management, for the movement of physical product and with complex financial framework (Rai et al., 2006). Firms that use IT in their

supply chain share more detailed information, lower the total cost, reduced order cycle time, higher fulfilment rate, reduced demand uncertainty and helps in transacting with suppliers better.

The aim of this study is to attain the factors of supply chain performance also studying the impact of implementation of IT on supply chain performance. The concepts are drawn from the literature studying the resources of IT and measures of supply chain performance. The model has been tested by checking the reliability and validity of the constructs and the relationship amongst them.

1. LITERATURE REVIEW

The objective of this research is to look into the measures of supply chain performance and determine whether the implementation of IT helps in improving the supply chain performance. Considerable amount of research in this area has been reported. The details are shown in Table 1.

Author	Focus	Findings
(Fasanghari, 2008)	IT and Supply Chain Management	The impact of IT on SCM is much larger as it facilitates inter-organisational communication and in turn reduces cycle time and develops collaborative work. IT enhances team work and customer relationship management.
(Cuthbertson & Piotrowicz, 2008)	SCM and Performance	Identified some common measures reflecting performance improvements.
(Fasanghari, 2008)	Information technology, supply chain management, organisational performance	The study revealed significant positive correlation between information technology and all aspects of supply chain management and organisational performance.
(Steward, Wu, & Hartley, 2010)	Measures of supply chain performance	This study identified certain factors which have resulted in improving the overall performance of the organisation in terms of cost reduction and improving the performance of supply chain. These factors are improvement in the quality of product, more responsive to

		the changes, improving sales and after sales services.
(Qrunfleh & Tarafdar, 2012)	Information system, supply chain performance, firm performance	This study gave the results of positive relationship between performance of supply chain and the performance of firm as the mediating role of supply chain information.
(Sukati, Hamid, Baharun, & Yusof, 2012)	Supply chain strategies, supply chain performance	Supply chain strategies such as resource management, output management and flexibility have positive impact on improving the performance of supply chain.
(Farshchi & Haghigh, 2015)	IT, supply chain management, performance	The implementation of IT into the supply chain helped in improving the performance of the organisation.
(Yeniyurt, Wu, Kim, & Cavusgil, 2019)	IT, supply chain capabilities, business performance	Effective IT usage in the business organisation enhances the business performance.

Table 1: Relationship between IT, supply chain performance and organisational performance

2. A MODEL OF IT AND SUPPLY CHAIN PERFORMACE

Many studies have been highlighting the impact of information technology on supply chain management and its performance. Advances It solutions and aligning them effectively into the supply chain helps the organisations in have a competitive advantage (Kale, Banwait, & Laroiya, 2010).

3. HYPOTHESIS DEVELOPMENT

Advanced IT

The proactive adoption of latest and upgraded IT solution is important so as to have competitive edge amongst the competitors and providing better customer services. In order to have better internal skills, the businesses tend to adopt more of IT solutions. However, implementing more of IT does not necessarily provide better results to the organisations (Booth & Philip, 1998). Often more expenditure in this context does not promise better use of resources (Tippins & Sohi, 2003). Yet, many studies have also shown the positive impact of using IT on the form's performance by enhancing their effectiveness of using the resources (Mukhopodhyay, Rajiv, & Srinivasan, 1997). Many authors argue that the adoption of IT should be majorly dependent upon the nature and size of the firm so that the effective utilisation of the IT solutions can be done in a better way (Tippins & Sohi, 2003). Using advanced IT solutions increases the possibility of having some differential benefits from those who are not using the latest or upgraded IT. Thus advanced IT is the reflection of firm's decision of using most advanced

technologies to stay ahead of the competitors (Philip & Booth, 2001).

By using the advanced IT the organisations get the benefit of improved speed, quality and quantity of information that is being shared across the organisation. The improvement in the quality and speed of information sharing helps in availability of information to the right person at the right time (Booth & Philip, 1998). Also with the improvement in sharing of information improves coordination among the people and also inter department which directly effects the improvement of performance of the supply chain (Tippins & Sohi, 2003). Easy flow of information from supplier to customer helps in enhancing the overall working of the supply chain and improves the entire supply chain network. Since the demands of the customers are ever changing, there is uncertainty in the market. Implementation of advanced IT also helps in overcoming this hindrance and provide better customer services (Stank, Crum, & Arango, 1999).

H1: Advanced IT solution affects supply chain performance.

Aligned IT

The success of the business not only depends upon how advanced the IT is, but it is also dependent upon how well it is integrated into the business and entire supply chain. It is the extent to which it is it is well-suited with its supply chain partners. The coordination and alignment of the channel partners plays a crucial role in driving the desired results from the implementation of IT (Philip & Booth, 2001).

Both advanced IT and aligned IT are important for the business, but integrating the technology well into the business process is difficult to achieve and it require cooperation, commitment and coordination from the channel partners. It is one of the biggest challenges of the managing the supply chain. (Farshchi & Haghigh,

2015). Many softwares related to supply chains are offered by the professionals but how to implement that in the entire supply chain is the biggest question to answer because failure of doing so many result into the waste of expenditure being done in this context. Also in order to have aligned supply chain, various parties in the entire chain need to share the responsibility of incurring the cost and implementing the same effectively (Yu & Jacob, 2017).

H2: Aligned IT affects supply chain performance

4. RESEARCH METHODOLOGY

A total of 553 supply chain personnel were requested to participate in the survey across the country out of which 315 responses were received and out of which 200 responses were filled properly and analysis was done by Partial Least Square Structural Equational Modelling (PLS-SEM) in Smart PLS software. The data was collected from the manufacturing units set up in India. Online survey was conducted using probability simple random sampling technique. The constructs of IT advancement and IT alignment have been adopted from (Wu, Yeniyurt, Kim, & Cavusgil, 2006).

5. RELIABILITY OF THE COSTRUCT

Reliability can be defined as consistency of the instrument which generates dependable results over a due course of time. For measurement of reliability of inter-item consistency, Cronbach's Alpha (α) is used (CRONBACH, 1951). The value of cronbach's alspha is considered good if the values lies within the range of 0-1 and is considered best when it is nearer to 1. When SEM is used, composite reliability along with cronbach's alpha is studied. Also, (Joreskog, 1973) CR (composite reliability) is premeditated as a reliability estimate for reflective construct with multiple indicators in investigated (Dijkstra & Henseler, 2015).

	Cronbach's Alpha	Composite Reliability
Advanced IT	0.859	0.899
Aligned IT	0.934	0.95

6. VALIDILTY OF THE CONSTRUCT

After checking the reliability, the next step is to measure the validity of the construct. It measures the degree of relationship of numerous items towards the construct based upon the theoretical background and literature review (Hair, Hollingsworth, Randolph, & Chong, 2017). The convergent validity is measured through Average Variance Extracted (AVE) for the related items of the construct. The AVE must be higher than the value of 0.50 in order to explain fifty percent the variance of the items of the construct.

In this study the AVE is fully established in the measurement model and is in accordance to the suggestions by Hair et al., (2010, 2013), and mentioned in table below:

Measurement item	Standard factor loading	AVE	CR
AA1	0.706	0 .643	
AA2	0.831		
AA3	0.886		
AA4	0.86		
AA5	0.707		0.899
AA6	0.828	0.791	
AA7	0.888		
AA8	0.918		
AA9	0.903		
AA10	0.906		0.95

7. FORNELL AND LARCKER CRITERIA

Measurement of discriminant validity is the next important step which studies how much one construct is different from another. Statistically, the square root of AVE must be higher than the inter construct correlations to establish discriminant validity of the variables under the study. In the present study, the Fornell and Lacker (1981) is fully acceptable to establish discriminant validity as mentioned in table below:

	Advancement in Information Technology	Alignment of Information Technology	Performance of Supply Chain
Advancement in Information Technology	0.802		

Alignment of Information Technology	0.736	0.889	
Performance of Supply Chain	0.514	0.526	1

While applying PLS SEM it is also important to study the cross loadings which explains that indicator must have a greater loading in its own construct as compared to other constructs**.**

|	IT Advancement	IT Alignment
(AA1)	0.706	
(AA2)	0.831	
(AA3)	0.886	
(AA4)	0.86	
(AA5)	0.707	
(AA6)		0.828
(AA7)		0.888
(AA8)		0.918
(AA9)		0.903
(AA10)		0.906

8. HTMT CRETERIA

Although the Fornell and Larcker criteria and the cross loadings have been established, they are not sufficient to determine the discriminant validity. Therefore, Heterotrait-Momotrait (HTMT) criteria needs to be established as provided by (Henseler, Ringle, & Sarstedt, 2015). The value of HTMT ratio must not be more than 0.90 (Gold, Malhotra, & Segars, 2015). Findings of HTMT criteria is as below:

|	Advancement in Information Technology	Alignment of Information Technology
Advancement in Information Technology		
Alignment of Information Technology	0.837	
Performance of Supply Chain	0.548	0.541

MEASUREMENT MODEL
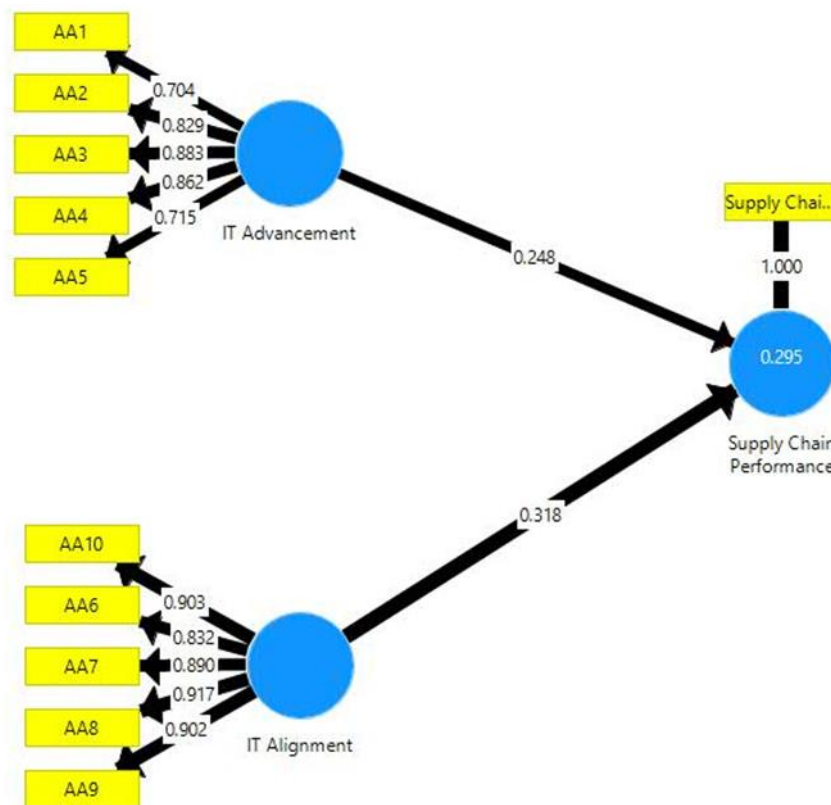
The findings of the measurement model clearly states that the organisation have this realisation that only investing in more advanced information does not give the desired results to the business. In order to have full attainment of results, it is very crucial that the business pay more attention in integrating the information technology solution to each and every part of the supply chain, so that the required information can be transmitted from one place t another without any discrepancies, the suppliers should be able to work more efficiently, the manufacturers be able to produce the products in the most innovative form which can be possible, the customers are having more advances, customised products and be able to have more after sale services.

STRUCTURAL MODEL

After the model being tested as reliable and valid through the measurement model, the next step is to confirm the model through Structural Equational Modelling (SEM). The first stem is check the constructs are free from the problem of multi-collinearity. For this purpose the VIF value are being checked. The model to be free from multi-collinearity, the values of VIF must not be more than 5.
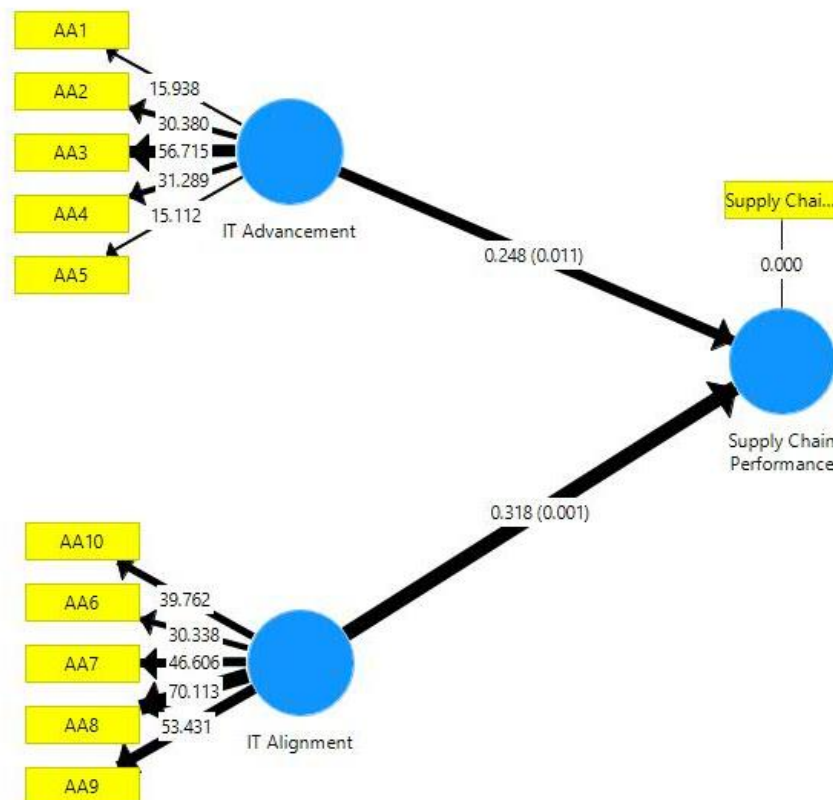
9. HYPOTHESIS TESTING

H1: Advanced IT affects Supply Chain Performance.

H2: Aligned IT affects Supply Chain Performance.

The relationship between IT advancement and supply chain performance is significant with B=0.248 and t value=2.542 at 5% level of significance has positive significant impact on supply chain performance. The relationship between IT alignment and supply chain performance is also significant with B=0.318 and t value=3.221 at 1% level of significance has positive significant impact on supply chain performance. Thus, we can conclude that companies which have more aligned IT in their organisation have more impact of supply chain performance rather than using the advanced IT solutions (Kaur & Narula, 2019).

Test of relation between variables	Original Sample (O)	T Statistics (|O/STDEV|)	P Values	Hypothesis	Results
IT Advancement -> Supply Chain Performance	0.248	2.542	0.011**	Ha1	Accepted
IT Alignment -> Supply Chain Performance	0.318	3.221	0.001***	Ha2	Accepted

***p<0.01; **p<0.05

CONCLUSION

This study focused upon studying the relationship between IT resources and performance of supply chain. Thoroughly embedding the IT into the chain of supply chain can bring many fold benefits to the organisation. It helps in having better relationship

with its suppliers, manufacturers, customers etc. This helps in improving the coordination in the entire supply chain. IT advancement for supply chain is defined as the extent to which a firm adopts the most sophisticated technology. It measures the degree of proactive adoption and implementation of advanced IT to find customer solutions ahead of competitors. Firms increasingly invest more resources in their SCCS and IT departments in an effort to develop the internal skills necessary to make full use of advanced technologies (Booth & Philip, 1998).

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APPENDIX A: MEASUREMENT SCALES USED

Construct 1 IT Advancement

Our organisation uses most advanced IT solutions (AA1)	7 point likert scale	(Wu, Yeniyurt, Kim, & Cavusgil, 2006)
The IT used by our organisation is always state-of-art (AA2)		
Our IT is more advanced as compared to our competitors (AA3)		
Our organisation is always the first to use advanced IT solutions (AA4)		
Our organisation is treated as the front-runners of IT in the industry. (AA5)		

Construct 2: IT Alignment

Our organisation has had well embedded IT with the channel partners (AA6)	7 point likert scale	(Wu, Yeniyurt, Kim, & Cavusgil, 2006)
In order to align with the channel partners, adequate investment in IT is done by our organisation (AA7)		
The supply chain partners takes responsibility to invest in IT in order to align with the organisation (AA8)		
All the members of the supply chain and the organisation		

work together for the alignment of IT (AA9)		
For the better performance of the supply chain IT is well aligned with the channel partners (AA10)		