

Mathematical Analysis of Supply Chain Implementation on Indian Automotive Sector: An Information Communication Based Approach

Sumit Chandak^{1*}, Amit Chandak²

Abstract

Technology is rapidly and continually evolving. Implementation of E-Business Processes (EBPR) within Supply Chain Practices is required in order to maximize revenue and customer satisfaction. Adoption of technical instruments in Information-Technology (IT) inside the Supply-Chain Process (SCP) is necessary to acquire competitive advantages. In order to obtain a competitive advantage, supply chain professionals must use cutting-edge technology technologies. Supply chain managers are now under pressure in every industry to increase profits and please customers. As a consequence, Supply Chain managers can improve Supply Chain performance and gain a competitive edge by implementing E-Business Operations and IT tools. Adoption of IT tools improves supply chain performance (SCPR), and also client satisfaction and SCP costs. Due to the cost savings, the product could be provided to clients for a fair price. India's automobile industry has been steadily expanding for the past two decades, but also confronting increasing worldwide competition. As a result, in order to compete globally, they must offer products at a fair price that are of high quality. Implementing E-Business processes in SCP will boost SCPR and give Indian automobile manufacturers a competitive advantage (IAI). Companies may readily obtain the most up-to-date information within SP thanks to the use of IT tools. This research examines how EBPR affects SCPR in the context of IAI. As an independent variable, increases in operational excellence, inventory control, logistics, supply chain, and supply chain are tested.

Keywords: Supply chain management, e-business process, information technology, supply chain process, supply chain performance.

***Author for Correspondence**
Sumit Chandak

¹Associate Professor, Department of Mechanical Engineering, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Ujjain Road, Indore, Madhya Pradesh, India

²Associate Professor, Department of Mechanical Engineering, IPS Academy, Institute of Engineering & Science, A.B. Road, Indore, Madhya Pradesh, India

Received Date: May 10, 2022

Accepted Date: July 18, 2022

Published Date: July 28, 2022

Citation: Sumit Chandak, Amit Chandak. Mathematical Analysis of Supply Chain Implementation on Indian Automotive Sector: An Information Communication Based Approach. E-Commerce for Future & Trends. 2022; 9(2): 7–17p.

INTRODUCTION

Since the previous two decades, India's contribution to the global economy has been recognised as important. Due to improvements in government laws, India has attracted a large flow of FDI since 1991. After 1991, the Indian government implemented liberalisation programmes. Since 1991, there have been several mergers and investments in India. Indian industry have seen a lot of growth as a result of FDI. IAI has developed tremendously as a result of these developments, and India will overtake the United States as the world leader in vehicle production in the future years. In India's manufacturing sector, particularly in IAI, a fundamental shift has occurred. However, as a result of economic

globalisation, Indian enterprises are experiencing increased rivalry and problems, as well as a plethora of possibilities (OCED 2004) [1].

According to Humphrey and Schmitz (2002) [2], every firm is always faced with problems in order to achieve competitive advantages and strengthen SCPR. Because technology is rapidly evolving, SC practitioners must accept new IT technologies in order to acquire a competitive advantage. Manufacturing industries' SCPs are more complex than service industries' SCPs. When we examine the SCP of various manufacturing industries, we can see that the SCP of the automobile industry is considerably more complex due to the high number of components required. Many worldwide concerns confront supply chain professionals. Because the cost of SC is so high in the automobile sector, supply chain practitioners face numerous obstacles in lowering costs so that automobiles can be manufactured at a reasonable cost while maintaining appropriate quality. Because India's domestic market is so large, foreign corporations are focusing their efforts there. The Indian vehicle market will have enormous potential in the next decades. IAI is under constant pressure as a result of the entry of global players. As a result, in order to attain performance and obtain competitive advantages, (EBPR) must be implemented in SCP. The next century has generated significant opportunities for IAI to circulate around the world while also putting sectors under pressure. Incorporating innovative components is necessary to raise quality and operational effectiveness. There has been a massive transformation in IT technology during the last 20 years. This technological improvement will not slow down in the near future, but instead accelerate significantly. As a result, EBPR implementation in SCP with modifications is required in order to acquire competitive advantages and reach the worldwide market. Since the last 20 years, technology has been rapidly changing, and the entire world has been witnessing a huge uprising in computation, telecommunications, and IT, with no indication that this uprising will slow down any time soon. These rapid fluctuations inspire forerunners amongst corporations to consider first-best strategies to accept knowledge modification in an efficient way in order to improve the SCPR (Moayyad 2013) [3]. EBPR will serve as a backbone for most businesses in order to increase profits, gain competitive advantages, and please customers. IT serves as a backbone for practically all businesses because they all require accurate information delivered on time. "At all stages within the organisational environment, getting the correct information in a timely manner to enhance the judgement process is critical" (Caldwell 2013) [4]. SCM was effectively combined with logistical activities through the application of EBPR, resulting in an overall improvement in SCP. The use of EBPR in the logistics process is required to boost cost-effectiveness. As a result, corporations and their SC practitioners must employ EBPR and IT tools in order to develop a strong SC network and improve overall SCPR (Fasanghari) [5].

IAI are the most in-demand manufacturing industries in the current worldwide market. IAI will gain a competitive edge by implementing EBPR. It is necessary for Indian businesses to transition from conventional SCP to ecological SCP. As a result, adopting IT and EBPR is a must if you want to be a world power, that not only manufacturing industries, but also customers, are becoming more concerned about the environment [6].

Problem Statement

It was recognised that the use of EBPR and IT had a significant impact on SC management, as well as a new viewpoint among SCM practitioners to embrace more commanding and transformed SCM, i.e. a transition from classic SCM to modernised technology SCP (Zhu 2004) [7]. In manufacturing automobiles for the global market, it is necessary to meet the continuously shifting demands of the client, which necessitates the use of complicated and innovative design. As a result, SC becomes increasingly complicated. The use of EBPR is required to make these complicated SC designs effective and efficient, as well as to meet obstacles. Gaining profit from a complicated SC is difficult and challenging. "Long order-to-delivery lead times, fluctuating production plans, surplus inventory throughout the supply chain, long demand planning cycles, and a lack of visibility of suppliers need increased focus and a new direction to manage the situation" (Chandak 2019) [8]. As technology

evolves, so must supplier coordination. EBPR must be adopted by both the company and the supplier, and there must be two-way communication. The current economy is much more innovative than previous ones. Since the last few decades, there is been a significant shift in both technology and design. As a result, the economy will differ in terms of comprehension, IT, new-design implementation, originality in manufactured items, individualised merchandise and local-services, value addition and imports, public-services, hostile promotion, devious methods, and flexibility.

IAI requires raw materials from a variety of sources. IAI must adopt smart manufacturing and Industry4.0 in order to compete in the global market. “In the supply chain, E-business processes and information technology have demonstrated to have a huge impact on supply chain performance and the development of a strong system of relations”. ERP, RFID, MIS, Mobile Technology, bespoke applications, and supply chain management (SCMS) were employed in e-business process and data technology to accomplish supply chain tasks (Chandak 2019) [9].

OBJECTIVE OF ARTICLE

The purpose of this report is to pique the interest of SC practitioners in EBPR. This page not only statistically validates the results, but also provides a wealth of material for practitioners to use in order to enhance their company’s SCP. It has been noted that there is a scarcity of literature in this topic. As a result, this essay was written to pique the attention of Supply Chain professionals in EBPR and IT. Scholars and specialists stressed that EBPR and IT must be used to streamline SCP and processes through improved exchange methods. The increasing importance of EBPR demonstrates a considerable volume of articles detected by E-SCM, as well as articles linked to EBPR and SCP. IAI is a major contributor to the Indian economy and, to a lesser extent, the global economy (Chandak 2019) [9]. Global bazar continues to present challenges to IAI.

Main Aim

The major goal of this article is to determine the impact of EBPR on IAI’s SCP.

Specific Goals

To determine the impact of the main parameters on the performance of the Indian Car Industry’s Supply Chain (Cost Reduction and Customer Satisfaction):

- To determine the influence of the E-Business process on supply chain operational efficiency.
- To determine the influence of the E-Business process on supply chain inventory management.
- To determine the influence of the E-Business process on supply chain logistics performance.
- To see how the E-Business process affects supply chain flexibility.
- To see how the E-Business manage all aspects supply chain integration.

LITERATURE REVIEW

To investigate the impact of EBPR and IT on IAI SCPR, a comprehensive literature review was done. The current work examines the effects of EPPR on SCP for IAI, as well as SC measures, in order to provide a framework for SC researchers and practitioners to enhance SCPR for IAI. Since last ten years, the Indian automobile industry has seen substantial expansion. Many global firms are eyeing the Indian market. Many global corporations are interested in establishing facilities in India because of the lower labour costs and huge market. Companies can extend their business in both the domestic and foreign markets with proper SC & IT administration. Practitioners of supply chain must transition from traditional supply chains to sustainable supply chain management in order to survive in the global market (Chandak 2019) [9]. To maintain sustainability, SC practitioners must adopt and incorporate EBPR and IT, and businesses must invest in technology at the outset in order to achieve competitive advantages. EBPR provides businesses with the chance to compete successfully in the global marketplace. “As internet technology advances, data transfer gets faster and at a lower cost, resulting in an increase in supply chain management practices”. As a result, the manufacturing sector is enthusiastic about establishing the concept of e-Business.

The goal, according to Auramo 2002; Golicic 2002; Gubi 2003, [10, 11, 12] is to measure the effects of EBPR on IAI SCPR. Since the previous 20 years, it has been seen that SCP is progressively being moulded for a lean key to enhancing SCPR. The goal is to lower the overall cost of SC. To increase productivity and cut costs, many Japanese practises are adopted. “In light of this, supply chain practises have evolved toward more lean process approaches in the last two decades, in order to increase efficiency of the supply chain (minimise costs and eliminate inefficiencies). Notions such as JIT; supplier base rationalisation; outsourcing; virtual inventory; individualised and worldwide systems; minimization of material, capacity, and time buffers; and reductions of the network of distribution facilities have all led to performance improvements” (Croom 2005; Intaher 2011) [13, 14].

Because no one can please customers without an efficient SCP, SCM has become a vital feature for every firm in order to achieve a competitive edge and lead in the global market.

Supply chain (SCM) has been identified as a growing management field that can assist businesses in improving supply chain (Lynne 2007) [15]. The movement of items, the flow of information, budgeting, buying, and the integration of manufacturers, suppliers, logistics agencies, and finally end users are all part of supply chain management. Since the last 20 years, there has been a shift from intra- and inter-organizational collaboration to modern business-based long-term collaboration that provides increasing flexibility and thus more economic edge (Bensaou 1997; Scott 2000) [16, 17]. Supply Chain examined a change and upgrade that will enlighten as a concealed development proposed to move forward with remarkable efficiency (Saad 2002) [18]. Apart from training the company’s privileged efficiency, the focus is on reducing excess and calculating value across the Distribution Chain (Harland 1999) [19].

SC managers, according to Tan (2001) [20], are aiming to enhance inventory management, reduce production costs, and advance production planning, leadership of work-in-progress inventory, and efficiency at the end of the 20th century. The mechanisms of this protracted mind fullness, according to Gentjan Mehmeti [21], halted the display of Authorized Distributor Growth. This is supported by an examination of IT and EBPR. SC’s expansion accelerated in the mid-1990s as a result of the creation of a new gadget called Enterprise resource planning, which aided in the connection of buyers and subcontractors. “Although EDI - Data Exchange systems were primarily concerned in inter-organizational integration, ERPS were primarily concerned with intra-organizational assimilation”, as according Gentjan Mehmeti [21].

In the 20th century, evolution continues with the creation of increasingly advanced IT solutions (internet-based solution systems) that address both cross and intra-organizational integration. Furthermore, the buyer-supplier relationship has progressed from a simple partnership to a long-term connection and strategic alliances during this time. The primary idea of build making was happening at the turn of the twentieth century, using idea procedures of processing of assemblage. It will reduce the time it takes for a product to be delivered. Member of staff time and duration of merchandises drive drops noticeably as producing and technical development. At the conclusion of the 19th century, the principle of lean work, MMRP, ERP, and JIT played a major influence in the administration of SC all over the world. Appropriate Inventory Rheostat reduces the quantity of investment and flexibility in SCP. Womack (1990) [22].

Automobile firms are facing fierce rivalry in the modern period as a result of technological advancements. As a result of this circumstance, many businesses are turning to mergers and acquisitions to ensure their existence. To be competitive, auto manufacturers must focus on a few goals. These goals include cost cutting, quality improvement, client satisfaction, delivery time, and improved after-sales support, as well as the use of technology, communications networks, increased productivity, and improved quality. “Supply Chain (SCM)” plays a crucial role in attaining such objectives in order to keep up with fierce competition that manufacturers face.

RESEARCH MODEL

IAI's current market is transitioning from domestic to international. IAI must create vehicles in response to changing client demand in order will compete in the market. The demands of the young population are changing rapidly, necessitating rapid modifications in the architecture of cars and their components in order to fulfil an ever demands of customers. The SC of the vehicle sector is becoming increasingly complex as a result of the shifting demand. Use of Mnemonic device and IT technologies is required to overcome this difficulty in today's world, vehicle life cycles are becoming shorter. As a result, SCM managers must pay attention to SCP administration in order to meet the organization's long and short term goals. To stay competitive, SCM created a thought-provoking job for the majority of businesses (Christopher, 1998) [23]. Current production plan in product offerings is essential to achieve evolved building via good production at a lower cost and higher item superiority. As a source of growth, companies are paying more attention to present automobile geographies. Certain current topographies exist as shadows. Build strategy of the Automobile:

1. The automobile's ingrained security structures.
2. The automobile's interior.
3. Organizations in the fields of acoustics and cinema.
4. Maintain control over the opening arrangement.
5. In-depth knowledge of GPS.
6. Suspension Arrangement with added luxury.
7. Hydraulic straddling equipment to reduce overall machine size.
8. Hydrographical vacancies are number eight.
9. Contrary or informal bays have a back television camera.

Because SCP takes to arrangement through a plethora of car supplemental contractors, the above chapter describes are required for additional complexity in Organization SC. Prior to buying the car, the buyer conducts extensive research and study. As a result, corporations are attempting to meet the majority of customer demand by providing the majority of necessary features at the lowest possible price per car category. Thousands of pieces are necessary for an automobile. Figure 1 depicts the automotive industry's generalised supply chain.

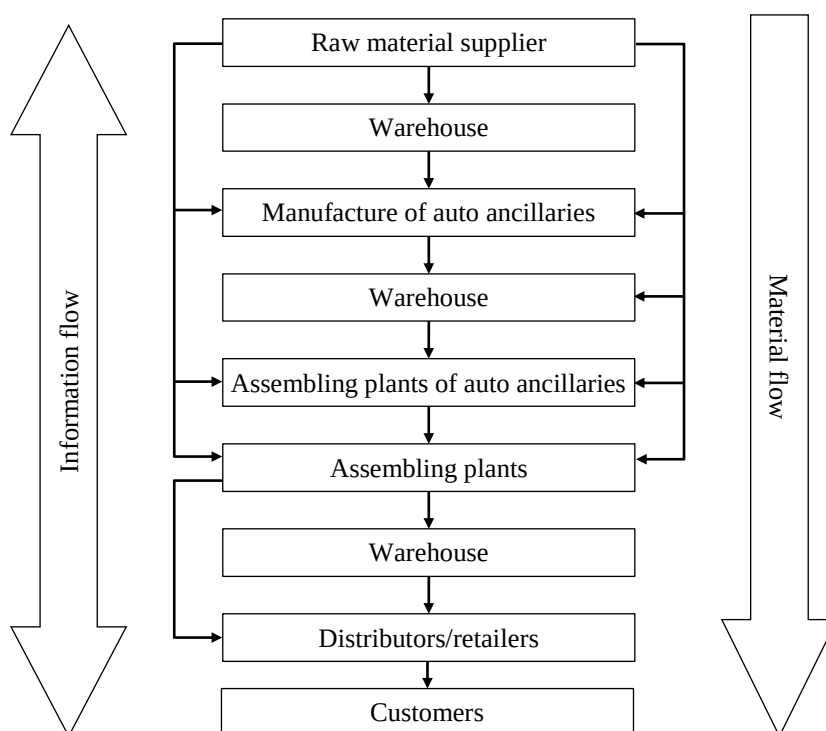


Figure 1. The automobile industry's standard supply chain (Chandak, 2019) [8].

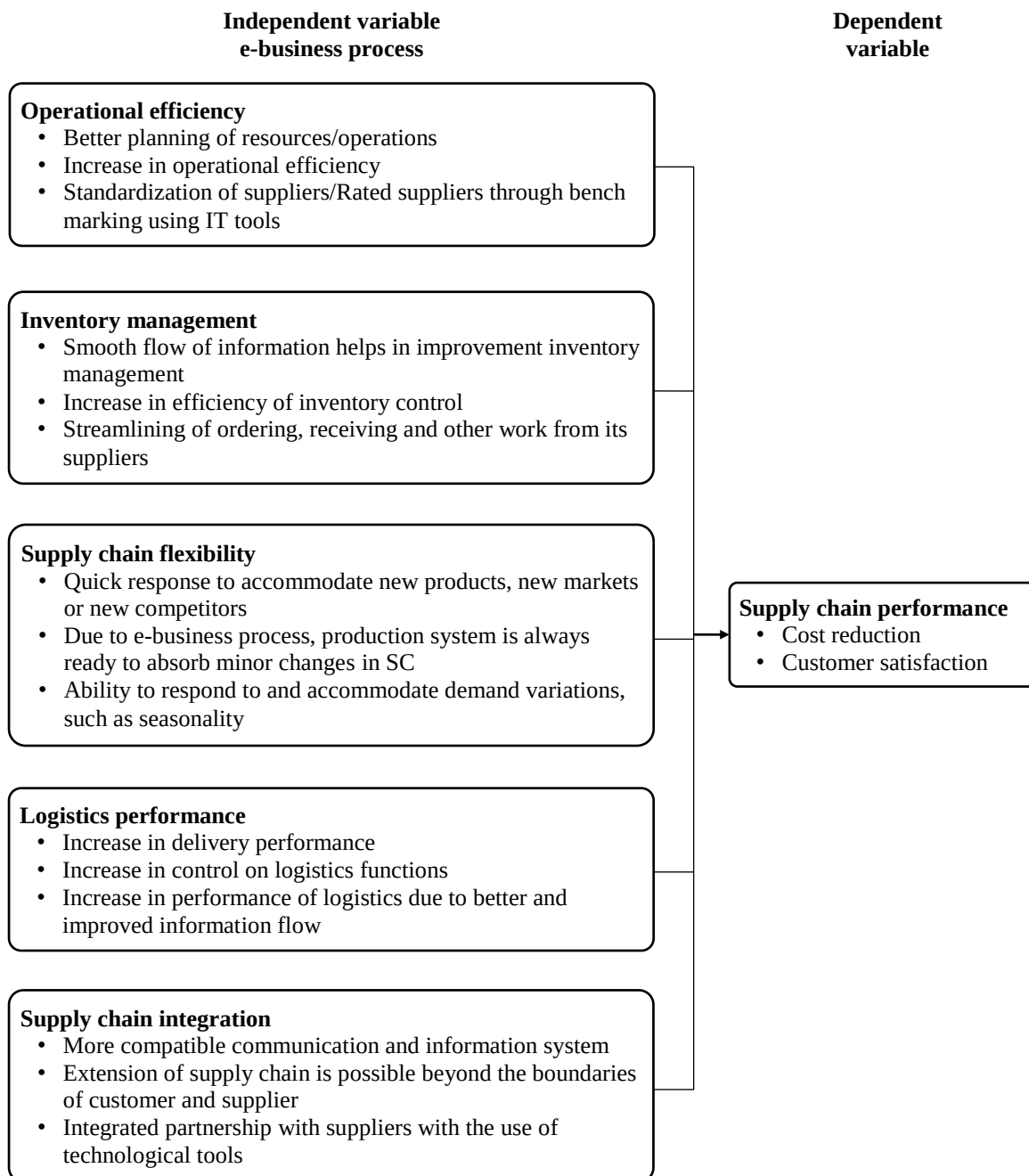


Figure 2. Conceptual frame work (Chandak, 2019) [8].

Figure 2 depicts a theoretical prototype in which SCP equally supports inconstants (Cost Reduction and Customer Satisfaction) and autonomous inconstants (Operational Efficiency, Inventory Management, Logistics Performance, Supply Chain Flexibility, Supply Chain Integration) to authorise research. Present archetypal elasticities powerful construction of recital amount accomplished original arrangement using the most observes. The current context is being used to look into the impact of Mnemonic device on the display of SCP for IAI. The constraints on quantity SCP are Cost Reduction and Customer Satisfaction. The benefits of archetypal willpower in reformation for SC progress are presented, as well as an explanation of upgrading SC development. “Through a systematic method, this research intends to investigate the operational effectiveness of E-business processes and information technology tools in the Indian Automobile sector by contrasting E-business and pre-e-Business tools practises in supply chain management (SCM).”

QUESTIONS TO PONDER

- What effect does inventory management have on e-business process supply chain performance?
- What effect does supply chain flexibility have on e-business process supply chain performance?
- What effect does logistics performance have on supply chain management practices when implementing an e-business process?
- What effect does supply chain integration have on e-business process supply chain management practices?

METHODOLOGY

Using an expressive research technique, the current paper examines and establishes the influence of EBPR on SCP in the context of IAI. The current paper is based on an information examination compiled after an investigation based on feedback from respondents as a mechanism for obtaining information in order to demonstrate the impact of EBPR on SCP on IAI. This is reinforced by (Gall et al, 2003) [24], who argue that this type of proposal requires to become data with sufficient correctness so that hypotheses may be verified in an appropriate way.

Population and Sample

The authenticating inquiry study is completed based on the literature survey, professional dialogue, SC expert questioning, and IT professional questioning. SC Administrators and their helpers (total 120) working as middle level administrators for Nominated IAI compiled the information. We obtained a total of 120 responses from a population of 180 people, with a reply percentage of around 66.66 percent. As a result, the sample procedure castoff is goal-directed, as answers are constructed based on a specific set of responses.

Measures

Five-point Likert scales were used to measure all parameters as shown in Table 1.

Table 1. Likert scale.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

Statistical Methods

On behalf of the exam information compiled by organised opinion poll, SPSS22 is available to fulfil the aims of study research of expressive digits. The mean, standard deviation, and frequency distribution are the major components of these descriptive statistics. Deterioration representations are used to imagine the relationship between inconstant and outlooks among features under inquiry. 5 autonomous variable quantities (Fully operational Competency, Records Admin, Logistic Presenting, SC Suppleness, and SC Integration) are cast-off in this article, and their link by the sponsored inconstant (SCP) is studied by a variety of deterioration investigations.

Following deterioration prototypical is secondhand for this investigation.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Where;

X1 = Functioning Competence;

X2 = Record Administration;

X3 = Logistics Presentation;

X4 = SC Elasticity;

X5 = SC Incorporation;

ε = Fault stretch;

β_0 = Persistent;

β_1 - β_5 = Deterioration constants (modification encouraged in Y by individually X).

RESULTS AND DISCUSSION

In this section, we have discussed the results of our work.

Correlation Analysis

Statistics that can be used to make inferences the research variables were investigated using Pearson's product moment correlation analysis as shown in Table 2. Pearson's product moment correlation was used in the survey as an assessment gauge cast-off to investigate the relationship between research inconstants. This article looked at an association study that found a strong link between Functional Competence and SCP, with an association constant of 0.900 and a p-cost of 0.000. Through an associating constant of 0.889 and a p-cost of 0.004, research discovered that there is a good association between Record Administration and SCP. Investigate further if there really is a positive relationship between Logistics Presentation SCP and the connection constant of 0.885 and the p-cost of 0.000. Further research shows there is a positive relationship between SC Elasticity and SCP, with a coefficient of correlation of 0.900 and p-cost.

Table 2. Correlation of the study variables.

		Supply Chain performance	Operational Efficiency	Inventory Management	Logistics Performance	Supply Chain Flexibility	Supply Chain Integration
SCP	Pearson Correlation	1					
	Sig. (2-tailed)						
Functioning Competence	Pearson Correlation	0.900**	1				
	Sig. (2-tailed)	0					
Record Administration	Pearson Correlation	0.889**	0.913**	1			
	Sig. (2-tailed)	0.004	0				
Logistics Presentation	Pearson Correlation	0.885**	0.730**	0.927**	1		
	Sig. (2-tailed)	0	0	0			
SC Elasticity	Pearson Correlation	0.900**	0.832**	0.911**	0.855**	1	
	Sig. (2-tailed)	0	0	0	0.001		
SC Incorporation	Pearson Correlation	0.903**	0.832**	0.911**	0.855**	0.9021**	1
	Sig. (2-tailed)	0	0	0	0.001	0	

Regression Analysis

To regulate the connection amongst SCP and 5 self-governing variables, a manifold deterioration investigation was directed. The deterioration prototypical cast-off for study was:

The deterioration prototypical was; $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \varepsilon$.

Whereby;

β_0 = Constant;

β_1 - β_5 = Regression coefficients (change induced in Y by each X);

Y is the dependent variable (Supply Chain Performance);

X1 = Functioning Competence

X2= Record Administration

X3 = Logistics Presentation

X4 = SC Elasticity

X5 = SC Incorporation

ε = Fault span

SPSS22 was used for dimension of multiple deteriorations aimed at the study. The variations in the sovereign flexible resolve touch the reliant adjustable up to that gradation or proportion of disparity will be elucidated by the amount of fortitude. 5 sovereign variables secondhand for study explained that 91.9 % of SCP in the background of IAI as embodied by familiar R rectangular. This specifies that other adjustable or strictures that is not intentional by this study underwrite 9.2 % of EBPR on SCP in the context of IAI (Table 3).

Table 3. Model summary.

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate
1	0.911 ^a	0.822	0.833	0.37
<i>a. Predictors: (Constant), Functioning Competence, Record Administration, Logistics Presentation, SC Elasticity, SC Incorporation</i>				

On the base of Table 4 that is fashioned by SPSS22 tool the calculation:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \varepsilon$$

Suits:

$$Y = 0.029X_1 + 0.056X_2 + 0.005 X_3 + 0.351 X_4 + 0.024 X_5 + 17.669$$

Table 4. Deterioration constants.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	18.79	9.2		1.9	0.070
	Functioning Competence	0.030	0.031	0.066	1.051	0.029
	Record Administration	0.060	0.030	0.131	1.800	0.080
	Logistics Presentation	0.0049	0.333	0.001	0.031	0.099
	SC Elasticity	0.361	0.035	0.800	15.263	0.000
	SC Incorporation	0.025	0.054	0.033	0.641	0.068
<i>a. Reliant Variable: SCP</i>						

Self-governing inconstant converts nothing afterward the conceivable cost of Y is 18.79 (Table 4). The Statistics outcomes likewise studied that through possession all self-governing inconstant nil, SCP will upsurge by 0.30 on a component upsurge Functioning Competence. This displays nearby is a noteworthy connection amongst Functioning Competence & SCP since p-value is 0.029.

The Statistics consequences also studied that by possession all autonomous inconstant nil, SCP will upsurge by 0.060 on a unit upsurge in Record Administration. This demonstration nearby is a noteworthy connection amongst Record Administration and SCP since p-cost is 0.080.

The Statistics consequences also examined that by possession all self-governing inconstant nil, SCP will upsurge by 0.0049 on a unit rise in Logistics Presentation. This demonstrations there is a noteworthy connection amongst Logistics Presentation and SCP since p-value is 0.099.

The Information consequences also examined that by possession all self-governing inconstant null, SCP will upsurge by 0.361 on a unit rise in SC Elasticity. This displays there is a substantial connection amongst Supply Chain Flexibility SC Elasticity and SCP since p-value is 0.000.

In the end, the Information consequences also studied that by possession all self-governing inconstant null, SCP will increase by 0.025 on a unit rise in SC Incorporation. This displays there is a

noteworthy affiliation concerning SC Incorporation and SCP since p-value is 0.068. This shows that SC Elasticity disturb the SCP maximum tailed by Record Administration, Functioning Competence, SC Incorporation, and Logistics Presentation.

CONCLUSION

Supposition of this article is to examine influence of EBPR on SCP for IAI through numerous verdicts. On the basis of historical involvements, the mechanisms of the EBPR remained depend to have a confident impression on the SCP on IAI. Conclusion since study opinion available that nearby is a momentous confident connection amongst the restrictions of SC that is Functioning Competence, Record Administration, Logistics Presentation, SC Elasticity, SC Incorporation with SCP on IAI. The study likewise displays that EBPR is appropriately cast-off by IAI to advance SCP. This study based on EBPR as the zone of examination and attention on EBPR and practice of IT tools in SCM that has expanded noteworthy consideration in current centuries. Present study is imperfect to the Influence of EBPR on presentation of SCM of IAI. Though, this study on a baggier measure specially through esteems to the grouping of organizations through additional SC associates for leisurelier statistics and data allocation is desirable.

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