

## Improving Supply Chain Visibility Capabilities of a Firm

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### Abstract

The concern of supply chain visibility is crucial for the organizations that are involved in delivering the essential services such as electricity. Asset visibility of a firm effects supply chain practices of a firm. Through the research paper the researchers had tried to understand the factors that could affect supply chain visibility. The said effect has been studied with reference to material and product supply chain. An integrated model for supply chain visibility for firm performance is developed. Established causal relationship has been translated in the form of hypotheses. Hypotheses has been tested using standard multiple regressions. The study looks at asset visibility and supply chain visibility as a perspective field of research and presents new insight into the existing supply chain process and systems. The research gives an insight to relationship of IT infrastructures for Supply Chain Integration (ITSCI), Supply Chain Process Integration (SCPI), Focal firm-3PL relational orientation (SCRO) and Internal Integration (II), with Supply Chain Visibility (SCV).

**Keywords:** Supply Chain Visibility, Asset Visibility, Supply Chain Practices and SCV.

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### Introduction

At present business scenario supply chain is considered as a source of achieving performance excellence. Supply Chain Management (SCM) has evolved as business concept that integrates existed business functions and operations (Chan, 2003)(Harland et al., 1999)). Businesses are operating in volatile environment where uncertainty adds up risk to supply chain functions of a firm. At present supply chains are no longer linear where all value may be added at a single point. However supply chains are no more linear and value is being added at dispersed locations. Supply chains now constitute of a major component of value addition external to the firm, which

gives a look of virtual organization. An expectation from supply chains has been extended to the level of delivering a single customized service or product with decreased lead time. These all has added complexity to the structure of supply chains and hence the risk is increased. In such cases business organizations will be highly benefited if they are able to get information regarding the status of assets. This status may be at stores, or movement of materials/assets along the supply chains. This ability in supply chain may be termed as supply chain visibility. The concept may not be confined to internal operation of the firm, but it may be applicable to the activities external to the boundaries of the organization. Hence it is applicable from sourcing to manufacturing and delivery of goods to customers. Under visibility the activities across the supply chains will become more transparent, which in turn will increase customer experience, improve asset utilization, lower down cost and increase profit. If a firm is able to access real time data across the supply chain, the decision it may take will be more effective. However this will require huge investment in IT infrastructure and process integration. In terms of performance high expectations are from stakeholders, customers and regulatory bodies.

The materials and goods flow across whole supply chain is complex in nature and become alarming in multitasking operational level therefore progressive supply chain visibility (SCV) is required to connect the assets visible at operational levels (Klueber & O'Keefe, 2013). The concern of supply chain visibility is crucial for the organizations that are involved in delivering the essential services such as electricity. This study concentrated on asset visibility within RTA management, practices as an important factor to increase SCV and in turn performance, with reference to a case of Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited (UPRVUNL), in the state of Uttar Pradesh in India.

The research paper is focused at asset visibility capabilities in qualitative exploration and checking their effect on SCV on performance of a firm. A in-depth case study is conducted with support of field-expert and semi-structured interviews. cross-validation of the research results is conducted through triangulation. A quantitative examination is performed using an on-line survey of these capabilities and their influence on SCV at the focal stage.

This study seeks to expand a perception of the factors affecting supply chain visibility with focus on material and product supply chains. The study helps in developing an integrated model for supply chain visibility for firm performance. In the study various constructs has been translated into the form of hypotheses and the relationship between them has been tested using causal relationships.

The study focuses on the current supply chain practices, that influences visibility aspect in supply chain. The study is focused basically on asset visibility. This study does not intend to study the impact from time to time perspective hence cross sectional approach is the most suited. The study is conducted over a time frame hence longitudinal study is not undertaken.

### **Review of Literature and Formulation of Hypothesis**

Based on the critical review of the literature, it was observed that the research on supply chain visibility was focused on both theoretical development and empirical examinations.

In order to outline the impact of asset management visibility on supply chain dynamics, a study found that there was a reduction of 45% in the global inventory and reduction in the amplification of patterns by 58% in the supply chain(Christopher & Towill, 2001). The factors that enable virtual teaming are process, people and technology(Gunasekaran & Ngai, 2004). Sharp et al. (1999) developed a theoretical model that enables agility in supply chain. The authors mentioned that information technology was an enabler of supply chain agility(Kumar Sharma & Bhat, 2014). In summary, the focus was on developing the theoretical models that enables the supply chain visibility through asset management in supply chains (Ngai et al., 2021).

Many studies in past focused on the identification of key success factors to attain supply chain visibilitythrough asset management visibilitythat enable supply chain agility(Syazwan et al., 2014).The importance of asset management visibility in supply chain visibility was highlighted by (Alzoubi & Yanamandra, 2020)and a theoretical model was proposed with the elements of uncertainty in supply chain. In summary, the focus was on proposing the theoretical success factor models for supply chain visibility.

The research in supply chain focused mainly on developing the asset management capability to develop agile organizations with embedded supply chains(Baker, 2008). It is also suggested that to develop the agile infrastructure communication with the supply chain partners, managing data and the effective use of information technology is needed(Lau et al., 2003). (Ngai et al., 2021) examined the impact of information technology inenabling visibilityin supply chain with the help of a case studies. The results highlighted that collaboration and flexibility are the prerequisites for supply chain agility(Um, 2017).

Further, the focus of the researchers shifted towards SC process integration in supply chains, developing agility index and scale to measure supply chain visibility, improving or building the supply chains using simulation and case study(Charles et al., 2010). A study developed theoretical frameworks highlighting the importance of supply chain integration in the supply chain visibility through technology adoption(Chang & Chen, 2020).

Over the period in late first decade of twenty first century the focus shifted to handling complexity in supply chain integration and supply chain visibility. Barriers for the adoption of supply chain integration in the supply chains of Canadian small and medium enterprises was analyzed by conducting a questionnaire survey(Archer et al., 2003).

It is stated that dependence of focal firm on dominant firm may have an impact on focal firms' e-SCM adoption intention(Huo et al., 2013), if it was initiated by the dominant firm. Mimetic pressure, i.e.; the benefits derived by the competitors' may have an impact on focal firm's e-SCM adoption intention. Firm size, especially for large firms the availability of resources may have an impact on focal firm adoption intention(Liu et al., 2019).

Usage of Information Technology helps the firms to plan the activities and forecast the demand through right sharing of information in the right time(F. Wu et al., 2006). IT enables collaborative planning and forecasting and IT integration construct stated by authors does not take into consideration Collaborative Planning and Forecasting among the supply chain partners(Harris et al., 2021). Supply chain collaboration was found to be an important pre requisite for supply chain integration and supply chain visibility(Barratt, 2004).

The role of information technology in the supply chain visibility has been discussed by most of the researchers in past literature. Studies have examined impact of information technology integration on Supply chain visibility and flexibility, further investigated whether supply chain visibility and supply chain flexibility will enhance performance(Francis, 2008)(Caridi et al., 2014). A study examined the factors that enable or inhibit the adoption of IT in auto ancillary SMEs(Kannabiran & Dharmalingam, 2012). It is established that perceived benefits and perceived competitive pressure enables adoption of IT by SMEs in India. Small scale operation, lack of in-house IT competency and lack of financial capacity inhibits the adoption of IT by SMEs in India. However, Changes in business environment, IT experience of owner and Information linkage with customer does not show any impact on IT adoption of SMEs in India. Some studies also examined the antecedents of supply chain agility and its impact on supply chain performance(Gligor & Holcomb, 2012)(Blome et al., 2013). It was found that firm's IT capability and operational collaboration were positive and significant predictors of supply chain visibility (Dubey et al., 2021). SC agility had shown a significant positive impact on cost efficiency(Gilaninia et al., 2011). Cost competency developed by firms had a significant positive impact on performance of the firm. All three control variables were found significant. However, information sharing does not show any significant impact on supply chain visibility.

Focal firm-3PL has a key role in facilitating supply chain integration and relational orientation. A few studies in past examined the factors that affect the adoption of Focal firm-3PL relational orientation on supply chain visibility(Kurnia et al., 2009). The variables under study were quality orientation and sustainable supply chain performance. The impact of these factors on supply chain visibility and post adoption of asset visibility was studied(Kurnia et al., 2015). It is indicated that the focal 3PL had shown significant impact on supply chain visibility(Kaynak et al., 2005).

A study examined the impact of internal integration on supply chain visibility of firms(Almajali et al., 2016). Further, the impact of supply chain visibility was examined on firm performance through internal integration (Wu & Chuang, 2010). The internal integration of the organization is found to have a significant positive impact on the supply chain visibility(Lin, 2014)(Giménez & Lourenço, 2008). On the basis of above comments the following hypotheses are framed:

**H1:** There is positive relationship between asset management Capabilities and SCV

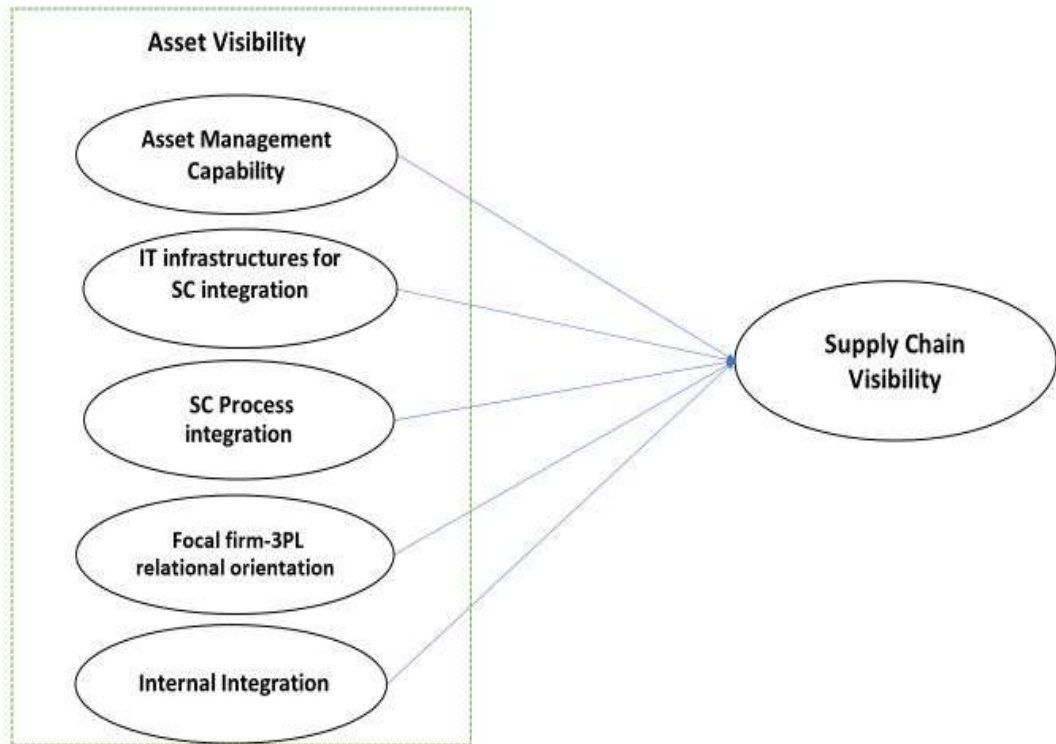
**H2:** There is positive relationship between ITSCI and SCV

**H3:** There is positive relationship between SCPI and SCV

**H4:** There is a positive relationship between SCRO and SCV

**H5:** There is a positive relationship between II and SCV

**Figure 1.1: Proposed model and hypotheses**



### **Research Methodology**

A sequential exploratory approach is taken for data collection in this research. The probability sampling method has been used to collect the data, using a structured questionnaire. The sample size is taken as 129 in this research. Multiple regression analysis technique has been used to analyze the data.

### **Results and Discussion**

In order to analyze the impact of five components of asset visibility on supply chain visibility, the multiple regression analysis has been used for the purpose of investigating the research hypotheses. The results of regression model are presented as-

(1) Supply chain visibility (SCV) is taken as the dependent variable.

(2) SCV regressed against the predictor variables. The regression model and its significance has been analyzed. Each individual predictor has been assessed in its relationship with supply chain visibility and sustainable competitive advantage.

The fitted regression model was:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + e$$

Y = Supply Chain Visibility (SCV)

Whereas  $X_1$  - Asset Management Capability (AMC)

$X_2$  - ITSCI

$X_3$  - SCPI

$X_4$  - SCRO

$X_5$  - II

$b_1, b_2, b_3, b_4$  and  $b_5$  are the regression coefficients of the independent variables,  $a$  - Intercept and  $e$  - Error term

**Table No.1: Regression model**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.70 <sup>a</sup>	.86	.867	.29265

a. Predictors: (Constant), AMC, ITSCI, SCPI, SCRO and II

**Table No 2: ANOVA**

Model	Sum of Squares	Df	Mean Square	F	Sig.	
1	Regression	65.628	3	22.543	163.852	.000 <sup>b</sup>
	Residual	80.997	596	.138		
	Total	145.625	599			

a. Dependent Variable: Supply Chain Visibility (SCV)

b. Predictors: (Constant), AMC, ITSCI, SCPI, SCRO and II

**Table No 3: Coefficients**

Regression Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.517	.158		3.274	.001
Asset Management Capability	.14	.024	.476	15.333	.365
IT infrastructures for SC integration	.169	.028	.284	8.898	.000
SC process integration	.434	.032	.216	6.916	.000
Focal firm-3PL relational orientation	.150	0.21	.117	5.92	0.00



Internal integration	0.248	0.32	.216	7.19	0.00
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a. Dependent Variable: Supply Chain Visibility (SCV)

Source: Computed from the Primary Data

As shown in Table No1, the coefficient of correlation i.e. r square is 0.70, which shows that there is positive relationship between the SCV and the five components of asset visibility. The results of multiple regression model showed there is insignificant relationship between ASM and SCV management capability and supply chain visibility ( $\beta = 0.14, p > 0.05$ ). Thus, the hypothesis H1 is not supported.

Also, a positive relationship is identified between ITSCI and SCV ( $p < 0.05$ ). The model identifies that 16.90 % ( $\beta = 0.169$ ) of the variance in SCV through ITSCI capability. This result suggested that the variables in hypothesis H2 are related positively. Thus, the hypothesis H2 is true.

SCPI is significantly related and SCV capability ( $p < 0.001$ ). The model has been competent to infer 43.40% ( $\beta = 0.434$ ) of the variance in SCV. A significant relationship is established between firm SCRO and SCV ( $p < 0.05$ ). 3PL relational direction fruitfully explained 15.00 % ( $\beta = 0.150$ ) of the variance in SCV as the principle variable. Therefore, the hypothesis H3 and H4 are supported.

The assessment of relationship between II capability and SCV has discovered the worth of this association ( $p < 0.001$ ). Through internal integration capability the model effectively explains 24.80% ( $\beta = 0.248$ ) of the variance in SCV. In isolation, the linked research hypothesis (H5) signifying a relationship setting between the stated variables. Thus the hypothesis H5 is proved to be true.

As per the result of regression, it is observed that the four independent variables (X2, X3, X4, and X5) have considerable impact on SCV. However it is also observed that the independent variable X1 does not impact any way SCV. This result as expected confirms the associated hypothesis.

### Findings, Conclusions and Suggestions

Supply Chain had attracted the attention of business houses as it has been realized that the survival and success can't be achieved without strengthening the supply chain. Various researches has proved that supply chain visibility is do impacts the performance of supply chain. Information technologies and its integration with the internal supply chain do impact SCV. Therefore, firms should invest in IT infrastructure creation and at the same time, internal and external entities should be integrated. Inter-functional and intra-functional integration facilitates smooth flow of materials and information, and hence it would be easy to track the components. The evidence from the study do proves that visibility will increase if the processes are integrated.

This integration may be internal or external which may be selective. Logistics and internal processes are required to be integrated to increase visibility in supply chain and the same has been proved in the research. As per the research outcomes SCV capabilities are not influenced by asset management capabilities. However ITSCI influences 16.90%, SCPI influences to 43.40%, SCRO influences 15% and II influences 24.80 % to the SCV capabilities of organizations. The five capabilities whose relationship has been tested can be further classified as technological and non-technological capabilities. The technological capabilities may include ITSCI however the non-technological capabilities SCPI, SCRO and II may be treated as complementary capabilities. Managers responsible to manage supply chains needs to focus on both the technological and non-technological capabilities. As per the above outcomes he may give priority to the variables on the basis of their capabilities influence to supply chain visibility capabilities.

### Future Course of Studies

The research looks at asset visibility and SCV as perspective field for additional research and may present new insights into existing supply chain processes and systems. Since internal and external nodes in the supply chain is to be covered in the SCV capabilities, the impact of relationship and infrastructure available with suppliers may be studied.

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