

# End to End (E2E) Supply Chain Visibility—A Dynamic Capability View

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In order to get a better understanding of supply chain visibility for creating strategic value, this paper uses a dynamic capability lens to reveal the nature of supply chain visibility. This paper identifies the importance of supply chain visibility in driving supply chain reconfigurability and consequently improving supply chain strategic performance. Empirical evidence shows that visibility has direct impact on supply chain strategic performance. It also supports that visibility is important for enhancing supply chain reconfigurability, thus creating strategic value in supply chains. Supply chain visibility therefore enables firms to reconfigure their supply chain resources for better competitive advantage. From the perspective of practitioners, the results display several insights into how managers should create strategic value from supply chain visibility. Prominently, managers or decision makers need to take advantage of supply chain visibility in order to use and recombine resources in value creation manner.

*Keywords:* supply chain visibility, strategic performance, competitive advantage, resource mobilization, information system

## Introduction

As businesses become increasingly global in scope, supply chains become more complex and subject to greater risks (Tao, 2020). For global supply chains to be successful it is the key that they are globally integrated, interconnected and intelligent. Globally integrated supply chains rely heavily on their suppliers and their sub suppliers for products. This increased reliance and dependence requires that an extended supply chain have an effective supplier quality management system that provides visibility into this complex system. Essential in this system is the ability to provide an end to end (E2E) visibility which involves the process in its entirety, beginning with the procurement of materials from suppliers and ending when the product reaches the customer (Pearsall, Steele and Zulpa, 2011). Supply chain visibility can determine how the physical and cash flows are carried out, and thus is central to effective supply chain decision-making (Lejeune & Yakova, 2005). However, whether this visibility can be translated into strategic value for supply chain partners, especially in turbulent environments, remains unclear. Supply chain visibility (SCV) has been viewed as the degree to which supply chain partners have access to information related to supply chain operations and management which contributes to reaching mutual goals at the strategic level (Barratt & Oke, 2007). For supply chain stakeholders to minimize uncertainty, improve coordination, and enhance customer satisfaction real time strategic information is essential.

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(Barua, Konana, Whinston, & Yin, 2004). Specifically, the well-timed sharing of information along the supply chain can significantly reduce demand distortion, which is labeled the “bullwhip effect” (Ouyang, 2007). Furthermore, outbound distributors have inventory commitment that they are unable to meet for their retail customers. Consequently, the product never makes it to retailers’ shelves and consumers choose competitive brands. In this example the

Root cause of the problem could be the lack of information sharing and insight into inventory levels among suppliers and sub suppliers. However, if there was sufficient visibility of inventory levels throughout the supply chain partners, this problem could have been detected earlier and enable supply chain managers to redesign their resources to deal with the situation and potentially create strategic advantage to enhance supply chain performance. Empirical studies in the information system (IS) literature have examined the effect of IT on information sharing and subsequent improved performance through visibility (Subramani, 2004; Wang & Wei, 2007). However, there is a lack of research which considers the supply chains ability to build and reconfigure operations and management which can lead to this better performance. Therefore, to cover this gap, this study aims to examine how E2E supply chain visibility can provide strategic advantage by reconfiguring resources along the supply chain in turbulent environments. The structure of this paper is organized as follows. The next section initially explains the conceptual background based on the dynamic capabilities view, in the next section I discuss the research constructs, develop the hypotheses, and present my research model. Finally, the paper concludes with a summary of the contributions and implications of this research.

### **Supply Chain Visibility—A Dynamic Capabilities View**

From a dynamic capability view, whether organizational capabilities can generate competitive advantage in rapidly changing environments has been of interest to researchers (Teece, 2007). Dynamic capability perspective focuses on utilising internal and external firm specific capabilities and developing new ones to address changing environments (Teece, Pisano, & Shuen, 1997). Extending capabilities and reconfiguring organizational resources are two important aspects to achieve new kinds of competitive advantage. Dynamic capabilities are the unique methods to integrate, reconfigure, gain, and release resources (Teece, Pisano, & Shuen, 1997; Eisenhardt & Martin, 2000). A supply chain management (SCM) process which incorporates new resources into the firm from external sources can therefore be looked as an important dynamic capability because it can create the need to adjust certain operating procedures in both the buying and the supplying firms. Besides, dynamic capabilities depend on real-time information to quickly recognize and anticipate the changing situation and adjust actions accordingly (Eisenhardt & Martin, 2000). Therefore, effective SCM typically involves better SCV and the importance of SCV in SCM can be understood from the dynamic capabilities angle. The aim of this paper is to get a better understanding of the possible strategic value creation of supply chains through E2E visibility using a dynamic capability perspective framework. Therefore, the key research question is whether E2E supply chain visibility achieved by dynamic capabilities help reshape the supply chain and ultimately improve supply chain strategic performance. In terms of theoretical background, a dynamic capability lens is used to understand concepts that are related to SCV that are helpful in increasing the ability to reshape the supply chain and consequently improve supply chain strategic performance. In addition, “E2E supply chain visibility” (achieved through dynamic capabilities) is used as an independent variable. “Ability to reshape supply chain” (achieved through dynamic capability) and “Performance” are considered as the mediating and dependent variables. Based on ideas borrowed from previous literature I hypothesize that greater

E2E supply chain visibility can provide firms capabilities to redesign their supply chains which will lead to better performance. Dynamic capabilities can be looked at as a specific set of processes (Eisenhardt & Martin, 2000; Zollo & Winter, 2002; Pavlou & El Sawy, 2006). In his paper Teece implied that Dynamic capabilities can be broken down into the capacity to sense and shape opportunities (Teece, 2007), to grasp opportunities, and to sustain competitiveness through reforming firm's assets. Learning, Coordinating, and reconfiguring are processes that help sensing, seizing, and managing threats (Teece, 2007). Reshaping is the goal process to achieve new shape and this can be facilitated by sensing the environment and coordinating activities of resources (Pavlou & El Sawy, 2006). Accordingly, these factors can establish supply chain visibility: visibility for sensing and visibility for coordinating. Sensing is important for determining opportunities and threats in Teece's (2007) framework and coordinating is critical for seizing opportunities. These constructs are important and determine the ability to reshape the supply chain.

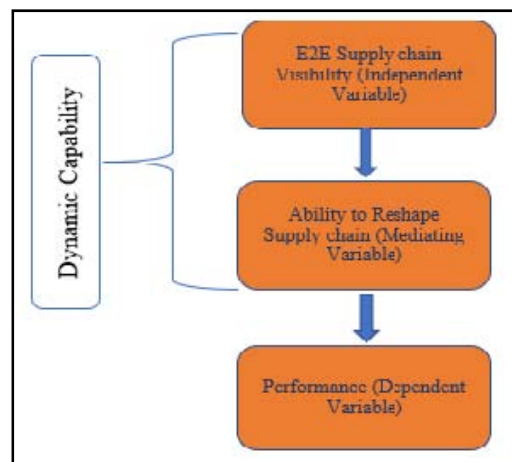


Figure 1. Research model1.

*Visibility for sensing* is important from the dynamic capability view as it represents the ability of the firm to acquire real-time external information and rapidly recognize changes in the environment. In order to respond to these changes, partners in the supply chain have to be able to simultaneously sense information about external events and information about supply chain change (Gosain, Malhotra, & El Sawy, 2004). One of the most if not the most important external information in supply chains is market intelligence about customer needs (Wei & Wang, 2010). Market trend and customer demand information is critical for responding to market adjustment and developing new opportunities. Sharing changing information is necessary to enable firms to sense the needs of its partners and also communicate its own needs to the partners (Gosain, Malhotra, & El Sawy, 2004). Companies that involve in broader information exchanges with current partners, including product changes, customer preferences changes, and demand changes, are likely to be aware of new opportunities and may be able to sense and adapt to key supply chain events (Wei & Wang, 2010).

*Visibility for coordinating* is essential for making decisions in supply chains (Sahin & Robinson, 2002). More accurate information to support supply chain decision making can better support the decisions for achieving global system goals and provide the needed visibility for coordinating the product flows in the supply chain (Simatupang, Victoria, & Hari, 2004). Therefore, visibility for coordinating should provide critical information for managing different dependencies in supply chain relationships. Managing prerequisite dependency is the most common coordination in a supply chain. The upstream flows of customer orders and

downstream flows of shipping notices coordinate the operations of supply chains (Christiaanse & Kumar, 2000). For example, managing transfer dependency about storage can be done by sharing information regarding when certain items are delivered and used such as the just-in-time practice (Malone & Crowston, 1994). An alternative way is to establish certain levels of inventory stock to buffer between two dependent activities. Therefore, planning-related information like material requirement plans, order forecasts, production schedules, and transportation schedules can help manage transfer dependency. For usability dependency, organizations must recognize what features customers want. This can be achieved by market analysis (Malone & Crowston, 1994). In this process suppliers can get useful information such as customers' preferences as well as product required information.

### **Supply Chain Compleitive Advantage**

*Supply chain reconfigurability* can be seen as fundamental dynamic capability in a supply chain for creating competitive advantage in unpredictable environments. Reconfigurability is the ability to reorganize resources efficiently and in a timely manner in order to implement a new configuration that matches the new setting. A new configuration of capabilities relates to the new redeployment of current resources and their original combination into new applications. Hence, different supply chain configurations can display different levels of operational efficiency and market knowledge creation (Malhotra, Gosain, & Sawy, 2005). In order to address shifted market opportunities it is important for a supply chain to quickly reconfigure resources within the system into a better combination. Recently, a lot firms have adjusted to new supply chain exercises to supply better products or services to customers, such as delayed differentiation, virtual integration, just-in-time purchasing, vendor managed inventory, forecasting, and replenishment programs (Van Hoek, 1999). These practices reconfigure supply chain processes as a whole by merging physical and information flows of collaborative firms (Wei & Wang, 2010).

*Supply chain performance* has been the centre of attention in research related to SCM. Different characteristics of time-based performance, such as delivery speed and reliability, product development time, lead-time, fill rate and customer responsiveness, are proposed as the critical supply chain benefits (Jayaram, Vickery, & Droge, 1999). However, for the purpose of this study the supply chains customer fill rate is used to represent the supply chain performance. Supply chain fill rate refers to the percentage of customer demand that is met by immediate stock availability, without backorders, stockouts or lost sales (Commerce, 2017). Basically, it's a signal of how well you're able to satisfy customer demand at any given time. Therefore, it's a good indicator of supply chain performance.

### **Theoretical Framework and Hypotheses**

The dynamic capabilities view provides the main theory base for my research model as illustrated in Figure 1. Supply chain visibility is suggested as an important enabler of supply chain reconfigurability which is an important dynamic capability for supply chains. From the dynamic capabilities' perspective, firms need to respond to uncertain environments by reconfiguring supply chain resources. In the supply chain context, environmental turbulence arises mainly from market turbulence, the unpredictability in market demands, customer needs, and competitor strategies (Wei & Wang, 2010). Numerous studies of supply chain dynamic indicate the critical role of supply chain visibility in dealing with environmental turbulence (Sahin & Robinson, 2002). To get a better picture of how E2E supply chain visibility can help reconfigure supply chain activities

and operation to react to changing environments and consequently create better supply chain strategic performance let us consider company X.

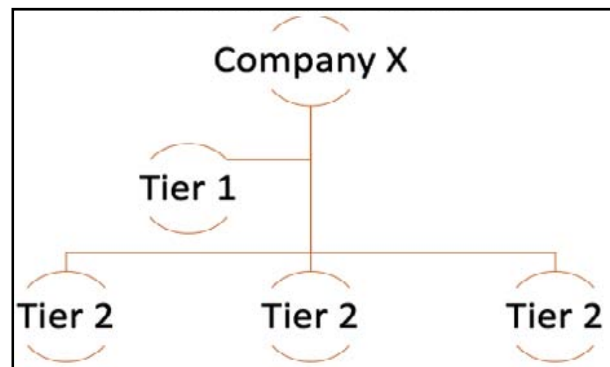


Figure 2. Supply chain of company X.

As shown in figure 2, Supply chain of company X consists of a number of suppliers. Each supplier is responsible for supplying components to the following stakeholder up the supply chain. If for instance one of the tier 2 suppliers suffers an equipment malfunction preventing it to meet its production targets then it will be unable to supply the tier 1 supplier, tier 1 suppliers has commitments to company X which they are also unable to meet. As a result, company X can't produce its product on time and is left with unsatisfied customers. However, had there been an E2E visibility allowing company X to broadcast real time inventory information across as many supply chains tiers as possible, potential upstream problems such as production stoppages among higher tier suppliers can be quickly detected. Early detection allows time to involve backup suppliers, preventing supply chain disruptions and delays from propagating further downstream and hence improving supply chain performance. We can consider another example from a different angle. Company X directly interacts with costumers and needs to forecast demand ahead of time. Say Company X is in the fashion industry. This industry is characterized by large portfolio of products, short product life cycles and continuous change in fashion trends. The short life cycle of products which come and go as both seasons and trends change make demand difficult to predict. Company X must be able to react quickly to these characteristics in order to manage its supply chain. In order to do this, they must have accurate forecasts and visibility through all its supply chain members. This way information can be shared in a timely manner and the supply chain can reconfigure its resources to react to the changing demand. Thus, my research model links supply chain visibility, reconfigurability, and performance. A good real-life example is IKEA, it transformed from a small Swedish mail-order furniture operation to the world's biggest retailer of home furnishing by reconfiguring roles, relationships, and structural practices of the furniture business (Norman & Ramirez, 1993). The customers transport and assemble the high-quality and low priced products themselves instead of the manufacturers and retailers, which is usually the case. This innovative business system is sustained by providing detailed information to customers and sharing market information, learning information and business goals amongst suppliers.

### Supply Chain Visibility and Supply Chain Strategic Performance

In order to reconfigure their resources, organizations need to scan the environment, assess markets and competitors, and rapidly accomplish reconfiguration and transformation before competitors (Teece, Pisano, &

Shuen, 1997). Visibility is the prerequisite of the capability that organizations can quickly adjust to change (Gosain, Malhotra, & El Sawy, 2004). The wide range and scope of market information provided by supply chain partners can accelerate the possibilities of reconfiguring the supply chain to respond to customer's demand for value (Christiaanse & Kumar, 2000). Visibility has been proposed to be a strategic resource (Hult, Ketchen, & Nichols, 2003), which replenishes a firm's knowledge base required for using and reconfiguring existing resources (Zahra & George, 2002). Exchanging experiences among supply chain partners can extend their current knowledge bases to create new ones that enable the development of new resource configurations. Furthermore, sharing ideas in supply chain meetings can clarify many uncertainties for producing supply chain performance, and consequently result in adaptive modifications to the existing configuration or more basic reconfiguration for more fundamental changes (Zollo & Winter, 2002). In order to allocate and use disperse resources in a supply chain effectively, visibility can help partners understand the value of their current resources and match their activities in new configurations (Iansiti & Clark, 1994). Current IT, which provides a broad range of channels for communication and coordination, facilitates supply chain redesign (Christiaanse & Kumar, 2000). For example, thanks to IT, it is possible to separate information

Flows from physical flows, thus allowing firms to anticipate and prepare for the arrival of a physical shipment. Therefore, firms can generate numerous different new ways of quickly reconfiguring supply chains to respond to market under a broader solution space expanded by greater visibility. For developing new supply chain configurations, visibility can also help build a shared understanding, create a common ground of knowledge, and develop new perceptual views in a supply chain. Therefore, it contributes to the attainment of consensus and shared goals among partners at the strategic level, and therefore facilitates supply chain reconfigurability (Wei & Wang, 2010). Accordingly, my first hypothesis is:

***H1: Supply chain visibility is positively correlated with supply chain reconfigurability.***

Supply chain visibility not only increase supply chain reconfigurability but also directly improves supply chain strategic performance. The advantages of visibility could be important, particularly in reducing the bullwhip effect, supply chain cost, and lead time (Sahin & Robinson, 2002). Across continuous information channels from and to suppliers, the purchasing firm can align its planning effort with the information of the suppliers' production capacity, quality condition, inventory level, and delivery capability, thus minimizing the uncertainties with transactions. Likewise, suppliers can benefit from the buyer's early release of product or order information to optimize the allocation of production capacity, consequently reducing time to market (Rabinovich, Dresner, & Evers, 2003). The lead time and quality of product of both the buyer and its suppliers can be jointly improved. Firms would have better performance if their network relationships maximize diverse information access (Baum, Calabrese, & Silverman, 2000). The flexibility built from new knowledge obtained from partners can improve supply chain performance because it gives the supply chain the capability to handle customized orders, quickly adjust production capacity, and to respond to target markets (Jayaram, Vickery, & Droge, 1999). These new knowledge sources prevent firms from overemphasizing on existing knowledge and caught up in limited organizational actions (Zahra & George, 2002), thus enhancing the creativity of the partners. Therefore, my next hypothesis is:

***H2: Supply chain visibility is positively correlated with supply chain strategic performance.***

Rapidly changing environments leave firms no choice but to respond quickly to the changing competitive priorities (Handfield & Bechtel, 2002). Time-based capabilities are critical to capture the benefits of flexible response to changing conditions (Hult, Ketchen, & Nichols, 2003). Firms that are able to respond quickly to

changes often depend on new strategies such as just-in-time delivery, vendor management inventory and postponement. All these strategies usually require supply chain redesign and resource reconfiguration. From the dynamic capabilities angle, supply chain reconfigurability allows firms to recombine their current resources into better configurations with desired changes. This creates favorable innovations to better match market needs and prevent supply chain configurations from being inflexible (Pavlou & El Sawy, 2006). As a result, supply chain reconfigurability can offer firms the capability not just to add value but also to reinvent value. This provides firms with the competitive advantages of understanding customer needs, creating innovative products or services, and even building up new business opportunities more rapidly (Wei & Wang, 2010). Therefore, my final hypothesis is:

**H3:** *Supply chain reconfigurability is positively correlated with supply chain strategic performance.*

From the perspective of practitioners, the proposed hypotheses display several insights into how managers should create strategic value from supply chain visibility. Prominently, managers or decision makers need to take advantage of supply chain visibility in order to use and recombine resources in value creation manner. As managers must be very adaptable in order to prepare for environmental changes, supply chain visibility should not be limited just within the transaction-related information. Many firms may direct their effort mainly on improving coordinated information exchange, which is just part of the overall supply chain visibility that a firm needs to respond to environmental changes. Managers can examine their current needs and status of the different aspects of supply chain visibility and invest in the areas that they need to improve. From the perspective of academia, my research introduces the dynamic capability view in SCM, providing a different view to investigate the improvement of supply chain strategic performance. To understand how visibility can enable competitive advantage in turbulent environments (Sambamurthy, Bharadwaj, & Grover, 2003) and how SCM capabilities can create value in response to uncertain environments, the proposed model places the footing for exploring the role of supply chain visibility as a potential driver of competitive advantage in turbulent environments through dynamic capabilities. Furthermore, the proposed hypotheses extend the dynamic capabilities view beyond the traditional firm level, in the sense that dynamic capabilities can also be interorganizational in nature and serve as the basis of competitive advantage in a collaborative relationship such as complex supply chains.

## Conclusion

In an unpredictable and fast paced competitive environment, managers find ways to reinvent value as the basic logic of value creation is also changing. As a result, firms need to exchange information with their suppliers and customers to create value together through the reconfiguration of roles and relationships in the value-creating system. In this paper, I claim that supply chain visibility can provide firms capabilities to reconfigure their supply chains and create strategic value. For achieving this strategic value, this study proposes that E2E visibility thoroughly encompass the rich information needs in a supply chain. In doing so, this study overcomes the vagueness of supply chain visibility and opens new avenues for research in SCM in turbulent environments. Additionally, the dynamic capabilities view provides a theoretical foundation to investigate the role of supply chain visibility in obtaining superior performance and reveals that it can improve performance not only directly but also indirectly through supply chain reconfigurability. Overall, I claim that supply chain visibility is critical for creating supply chain strategic performance, especially through enhancing supply chain reconfigurability.

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