

# IT and Lean Practices Empowering Lean Competence & Supply Chain Resilience



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*The concept of lean management competency depends predominantly on the expertise acquired by the lean professionals, or the top and middle level managerial entities. These competencies are enabled by many factors, and key factors in the rapidly changing market being: innovations in Information Technology (IT) or improvements in Lean Practices. The different facets of lean management competency are affected by these enablers eventually contributing to innovation and implementation of IT and Lean Practices. The study explores the reciprocity of the lean competency and its enabler, aiding in risk mitigation in a supply chain leading to a resilient supply chain.*

## 1. Introduction

The supply chain and the various levels of the echelon has been affected by the widespread invasion of information technology (IT) and its resources. IT's integration into the business processes and operations of organizations in various industries has led to a volatile and dynamic supply chain (Liu et al., 2013). Large industries have installed state-of-the-art IT tools and resources to fully utilize its potential to gain advantage over its competitors and to cater to the volatile market environment. While, the SME's and small-scale suppliers have fallen short in implementing and utilizing the most basic IT tools and resources effectively (Pavlovic et al., 2019). This may be due to the financial or operational constraints based on argument based on RBV studies stating that 'greater IT investments or managing IT resources would lead to improvements in organizational performance'. IT innovation (ITI) has created a stir in the competitive market, since it gives the organization an upper hand to capture new market or in introducing a new product (Chege et al., 2019). The fusion of new information technologies and lean management practices (LMP) leads to competitive advantage and rapid responses to variations in customer demand, creating superior flexibility (Pavlovic et al., 2019).

Today's supply chain has become larger and more complex, thus making it susceptible to risk (Namdar et al., 2017). The disruptions in the supply chain have escalated since firms have adopted capabilities related to agility and resilience to reduce risk (Mandal, 2018). Studies also indicate towards implementation of lean practices leading to an increase in the susceptibility of the supply chain to risk (Jain et al. 2017; Ivanov 2017; Fan and Stevenson, 2018). Whereas, few studies indicate that IT and LMP can improve business performance (Ghobakhloo and Hong, 2014; Pillai et al., 2014).

This paper consists of three parts:

1. Conceptual model based on literature
2. The influence of ITI and LMP on Lean Management Competency (LMC).
3. The study also explores the combined effect of ITI, LMP and LMC on Supply chain resilience.

## 2. Conceptual Framework and Propositions Development

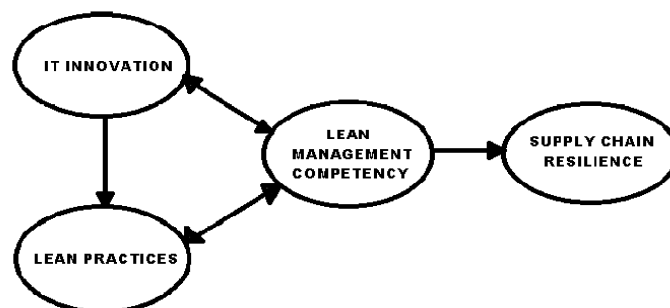


Figure 1 Conceptual Model

### 2.1 IT Innovation

Innovativeness was defined by Hult et al., (2004) as "capacity of introducing new ideas, products, or processes in an organization". Luppacini (2005) defined IT Innovation as the systematic application of organised knowledge towards organizational performance. IT innovations provide opportunities and foundations for business endeavours. Innovative ideas are inclusive of IT usage in order to establish new markets and achieve a competitive advantage by means of unmediated communication between clients and partners, increased interactivity, and cheaper transactions clients (Hoque et al., 2016;

Zhu et al., 2018; Chege et al., 2019). The adoption of IT by the firms has led to advantages due to information as well as synergistic benefits attained through IT innovation, thereby providing a competitive advantage and innovation to the firm (Wu et al., 2006; Yenyurt et al., 2019).

The companies, both large and small, need to integrate the lean practices with the already existing and operational technology platform. This integration of new technologies with lean practices provide a competitive advantage over its competitors and increased flexibility of its processes (Pavlovic et al., 2019). But, SMEs in developing countries are faced with impediments such as retarded growth, decreasing trend in technological innovation, and a high failure rate. The SME's also encounter problems in relation to IT innovation related to size of the firm or uncertain business environments (Wayumu, 2015; Chege et al., 2019).

Erratic market conditions have steered firms towards increased reliance towards IT in-order to retain and attain improved productivity, competitiveness and thrive in dynamic market conditions (Yunis et al., 2018; Chege et al., 2019). The resources and investments associated with IT has gained importance in organizations as the digitization has picked up its pace and is getting fiercer and rampant in the supply chain (Uslay and Yenyurt, 2018; Yenyurt et al., 2019). The use of IT in recent times by the firms, prioritize on achieving firm performance and manage supply chain processes (Liu et al., 2013; Lindgreen & Di Benedetto, 2018; Yenyurt et al., 2019). The declining price of IT resources in the last few decades has led to an increase in the affordability and availability of IT innovations. The firms can avail latest infrastructure or applications for a price lower than what is being offered by the leading IT firms to install and operate them (Chae et al., 2018). IT contributes to risk mitigation through information sharing with suppliers related to production. This leads to a decrease in probability as well as the severity of supply disruptions and congestions in production processes in the supplier end (Micheli et al., 2014; Chaudhari et al., 2015).

A study conducted by Ghobakhloo and Hong (2014) reveals that IT and LMP are mutually dependent and if there is a larger degree of lean practices already implemented, then the value invested in IT can be converted into improvements business performance. Similarly, Pillai et al., (2014) drew the conclusion that IT and LMP complement each other and together they improve business processes.

Based on the above theory we propose that:

**P 1:** IT innovation has a significant effect on Lean Management Practices

**P 2:** IT innovation has a significant effect on Lean Management Competency

## 2.2 Lean Management Practices

Recent studies of lean literature witnessed more researches on lean manufacturing and also in lean services, hence the authors justified the term "Lean Management Practices" (LMP). The lean concept is a multi-dimensional management domain which focusing on a set of principles and practices (Shah and Ward, 2003). Lean management practices and concepts evolved based on learning from Toyota Production System (TPS). Many authors believed that the lean concept is mainly inspired by TPS. According to Ohno (1978), Toyota motor company draw attention after the first oil crisis in the fall of the year 1973, followed by a recession, affected government, business, and society the world over. Ohno who was started his career in 1949 with Toyota motor company as a machine shop manager and retired as Executive vice president in 1975. Ohno wrote a book in 1978 "Toyota Production System: Beyond Large-Scale Production." In this book, Ohno explains that the basis of the TPS is the absolute elimination of waste. The two pillars needed to support the system. First one is Just-In-Time (JIT), and the second one is automation or automation with a human touch. The first pillar of JIT means that, in a flow process, the right parts needed in the assembly that reach the assembly line at the time they are needed and only in the amount needed. A company establishing this flow throughout can approach zero inventory. Monden (1983) familiarized the JIT ideas to a wide-ranging practitioner in USA highlighting the significance of small lot sizes, product variety, multiskilled workforce, preventive and autonomous maintenance, JIT and on time delivery from vendors sources and to customers.

Many scholars and practitioners have focused on the implementation of LMP to increase the value creation for the customer (Stone, 2012). Customer value can be maximized by developing and improving value-added activities, i.e., activities that the customer is willing to pay for while eliminating non-value-added activities. A critical point in lean thinking is the focus on value, but, most of the lean literature forgets the process of value creation and its focused value as equal to cost reduction. In detail, there are two avenues to create value; the first avenue is value identified by eliminating the non-value-added activities. TPS and LMP are frequently used interchangeably in most of the existing literature (Yadav et al., 2017). The term "lean" was first introduced by Krafcik (1988), but "The Machine that Changed the World" a book written by Womack et al. (1990) popularized LMP in manufacturing. In early 1990s LMP was perceived as an alternative to traditional manufacturing model which was founded by Ford (Womack et al., 1990).

Womack and Jones, (1996) identified five "lean principles":

- **Specify Value on Customer Perspective**
- **Identify the Value Stream:** The value stream is the set of actions that transform a product or service.
- **Make the Value Flow:** By using lean tools increasing the flow of value to customer and eliminate the non-value-added activities as waste.
- **Let the Customer Pull:** Processes or products are to be manufactured and supplied based on-demand from the immediate customers.
- **Pursue Perfection:** Through sustaining the above four principle, perfection in value adding to customer can be attained.

Based on the above theory, we propose that:

**P 3: Lean Management Practices has a significant effect on Lean Management Competency****2.3 Lean Management Competency**

In the perspective of industry and academia, researchers studied more on internal lean transformations of manufacturing processes and impact of supporting toolsets, For example, Value Stream Mapping (VSM), Single Minute Exchange of tools & Die (SMED), five “S” and so on. Moreover, focus on the shop floor and in-house process management has carried many positive outcomes. But it largely ignores the first lean principle, how practitioners or academicians can accurately identify customer value is key factor moving the authors to study on competency theories.

Competence can be defined as the ability to do something successfully or efficiently. In organizational perspectives, Prahalad and Hamel’s (1990, p. 82) definition explains as “Core competencies are the collective learning in the organisation, especially how-to co-ordinate diverse production skills and integrate multiple streams of technologies”. Literature shows that core competencies are the sum of the intangible and tangible, physical and non-physical assets of the organisation. Prahalad and Hamel (1994) categorized three comprehensive types of core competencies. First one is market access competencies which focusing skills that help place a firm in close proximity to its customers. For example, management of brand, sales and marketing, distribution and logistics, technical support. Second one is integrity-related competencies which refers to skills that allow a company to do things much more quickly, with greater flexibility or with a higher calibre of reliability than competitors. For example, competencies such as, quality, cycle time management and Just-In-Time. Third one is the functionality-related competencies which urge the skills enabling the company to invest its services or products with unique functionality, which invest the product with distinctive customer benefits, rather than merely making it incrementally better. In previous literature, different understandings of “competence” have been identified (Baker et al., 1997; Coyne et al., 1997). Table 1 provides the various competencies and its relevance with LMP and IT innovations. This competency characteristic has a strong resonance with the lean principles, particularly considerations of customer value and synchronizing resources to allow value to flow. Moreover, IT innovations enables the value flow to customers.

**Table 1** Lean Management Competencies and their Relevance with Lean Management Practices and IT Innovation

S. No	Competency	Relevance with LMP and IT Innovations
1.	Strategic Competence	LMP implementation strategy - a company's business strategy to face the external competitive environment
2.	Distinctive Competence	LMP and IT Innovations may create a set of core skills and technologies, which enhancing the enterprise with its competitive advantage.
3.	Functional Competence	LMP with unique practices for specific problems may create a firm's competitive priorities and IT innovations and strengthening a particular function such as manufacturing or marketing
4.	Individual Competence	Lean leadership - The set of skills and knowledge that an individual need in order to perform effectively a specified job.
5.	Competitive Competence	LMP and IT innovations enable the organizations to compare with their competitors to measure up the core business processes of an organization.
6.	Capability competence	LMP and IT innovation creating a capability to every individual of an organization.
7.	Congruency Competence	Implementation of LMP and IT innovations helps to reduce the gap of organizational requirements and its ability.
8.	Insight/foresight competencies	LMP would create a learning environment in organizations that create reflections of employee behaviour might resulted in technical or scientific knowledge that enhance the innovations in all process.
9.	Frontline execution competencies	LMP with standard operating procedures for all process ensures the quality of an end product and services.
<i>Source: (Gilgeous &amp; Parveen, 2001)</i>		

The risk is an organization, might be related to operations or due to the decision made by managers (Iqbal and Shalij, 2019). The application of lean approaches in an organization by focussing on efficiency can increase the vulnerability of the supply chain (Fan and Stevenson, 2018). The current supply chains are more prone to risk disruptions, since they are larger, complex and lengthier (Merzifonluoglu 2015; Scheibe and Blackhurst 2017; Namdar et al., 2017). The organizations which have shifted their focus on formulating a “leaner” supply chain, have worsened the severity of the disruptions (Jain et al. 2017; Ivanov 2017; Namdar et al., 2017). Due to the alternating focus to improve efficiency of the supply chain and overall performance; the supply chains are now faced with unexpected volatility and an escalation in disruptions (Merzifonluoglu 2015; Namdar et al., 2017).

Investments on IT resources are easily duplicated by any firm, but the downside is they lose on the potential competitive advantage which could have been gained through implementation of an appropriate IT resource which complements the firms functions and business acumen (Yeniyurt et al., 2019). Studies have also cautioned, that before automating business activities which are vital to the firm; it is essential to adopt the lean management competencies and practices which improve the firm’s efficiency, so that there can be further improvements on the benefits achieved due to implementation of lean practices (Bortolotti& Romano, 2012; Pavlovic et al., 2019).

Based on the above theory we propose that:

**P 4:** Lean Management Competency has a significant effect on IT innovation

**P 5:** Lean Management Competency has a significant effect on Lean Management Practices

**P 6:** Lean Management Competency has a significant effect on Supply chain Resilience

## 2.4 Supply chain Resilience

Supply Chain Resilience (SCR) is an organizational concept that has been defined as “the ability to respond to sudden disruptions and re-establish normal supply network operations” (Namdar et al., 2017). SCR is widely accepted as a dynamic capability that supports in the firms in the supply chain to re-establish the operations successfully during or after a disruptive event (Hohenstein et al., 2015; Bellow, 2016; Mandal, 2018). Organizations which are resilient are in a position to manage disruptions as well as achieve a higher sustainable competitive advantage during occurrence of disruption (Namdar et al., 2017).

## 3. Discussion

The above-mentioned propositions are shown as proposed relationships in Fig.1, the conceptual model. The conceptual model can be further investigated to verify the significance of the relationships through a survey or by conducting an expert interview based on the measures provided in the literature for the respective constructs.

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