



ISSN 2278 – 0211 (Online)

ISSN 2278 – 7631 (Print)

Framework for Managing Innovations in Supply Chains of ICT Products

Vishal Gupta

Jaypee Business School, JIIT University, Noida, India

Professor Naseem Abidi

Jaypee Business School, JIIT University, Noida, India

Dr. Asit Bandyopadhyay

Jaypee Business School, JIIT University, Noida, India

Abstract:

Information and communications technology (ICT) industry has transformed the lives of many across the globe in ways that one would have never conceived of a decade ago. One of the fundamental reasons for the growth in the ICT industry is attributed to innovation. The survival and growth of ICT companies are affected by extent they adapt innovation to provide newer and wider variety of product. Due to the innovative nature of ICT products and competitive nature of the industry, products have shorter life cycle, which further increases unpredictability of demand and risk of obsolescence. In addition, the ICT product companies have started competing on global scale through their supply chain, which requires not only being efficient and responsive, but also innovative. For ICT companies the innovations are crucial not only at the product level, but also at the process and supply chain levels. The innovations in supply chain should not be restricted to the focal firm, but would stretch to suppliers, channel partners as well as retailers. Firms having effective management of innovations in their products and also in supply chain will lead the industry and will have global outreach. This paper examines the literature and explores the various innovative practices followed by the ICT companies to establish the relationship between innovation and its management across the supply chain. The paper provides a conceptual framework for managing innovations in the supply chain of ICT products.

Key words: Innovation, Supply Chain, ICT, Sustainable, Collaboration.

1. Introduction

Innovation drives the industry to achieve new finished products, ingredient technologies and packaging. But the seemingly simple task of generating ideas and making them a reality becomes increasingly complex as a company grows. Because of this, more emphasis has to be placed on maintaining and nurturing the idea-generation process, which hinges on observation. These ideas are the foundation for innovation, where the entire process starts. (Christensen, 2003)

The benefits of being able to offer innovative products have become more prominent across industries where firms compete on the grounds of new products with new features, new design, and new functions. Competitive firms no longer keep offering similar products or just compete on traditional grounds such as price and quality. For technical firms especially, the inevitable trend is to differentiate product offerings by innovation in order to gain a competitive advantage over competitors. (Khin, et al. 2010).

To maintain a competitive advantage, companies also must strategize with an effective supply chain in mind. Clear communication between the marketer, the manufacturer, the retailer and all the suppliers in between can be the difference in beating a competitor to the marketplace or successfully implementing a product concept. Innovation is the key to future long term success (Christensen, 2003). In high-tech industries such as the Information and Communication Technology (ICT) industry, there is a clear difference in terms of organizational performance between firms that innovate and those that do not. The advantages of product innovation are numerous and have been well acknowledged empirically by numerous studies. (Khin, et al, 2010). The current international business environments require innovation, not only in products and their features but also across the entire business processes.

2. Literature Review

The importance and widespread effect of innovation are always recognized by society and business. This can take place within processes, products, services, organizational structures, management strategies etc. Broadly it can be classified under continuous improvement or discontinuous and radical shifts in technology or ways of approaching a problem (Rogers, 1995) (Cooper, 1999)

(Kahn, 2001). Changing business environment and technological advancements increased the level of competition and also the need for innovation for survival and growth. Innovation can be focused on cost improvements, process improvements, product or service line extensions, new uses/reuse, new markets and customers or new technologies. Christmann (2000) suggested that the organizations having capabilities for process innovation and implementation will be leaders in sustainability.

Today's business environment has undergone radical transformation due to globalization and outsourcing. Organizations have to deal with intense competition in ever changing markets with greater use of information and technology to meet ever increasing expectations of consumers. The liberalization of economic policies across the globe and increased focus on environmental and social issues has made the business environment more dynamic and complex. The focus has shifted from a single organization to a network of organizations collaborating together to provide real-time solutions. Integration of business activities and collaboration with upstream and downstream partners has become an integral part of doing business. The realization of importance of integration and collaboration among the partners for efficient and economic utilization of resources leading to better profit margins among all partners; and customer service lead to an innovative idea of Supply Chain Management (SCM).

The modern idea of a supply chain is attributed to the pioneering research conducted by Jay Forrester at the Massachusetts Institute of Technology (MIT) in the 1950s. Forrester (1961) in his industrial dynamics model (widely known as Forrester effect), suggested that five flows of any economic activity namely – money, orders, materials, personnel and equipment – are interrelated by an information network, which is now called a supply chain. In the early 1980s, the concepts of transportation, distribution and materials management began to merge into a single, all-encompassing term: supply chain management. The term apparently first appeared in print in 1982, and is attributed to Keith Oliver, a consultant with Booz Allen Hamilton (Ayers, 2006). Organizations have realized that effective and efficient management of supply chains is essential for present and future survival (Olhager, et al., 2002).

Due to the short life cycle of products, companies are forced to introduce a steady stream of newer innovations (Fisher, 1997). The innovations can be incremental in nature; viz. making processes more efficient or eliminating wastes, or they may be radical like redesigning the entire supply chain. Innovation as a term is not only related to products and processes, but is also related to marketing and organization. The different types of innovations can be categorized under, new products, new methods of production, new sources of supply, exploitation of new markets, and new ways to organize business.

2.1. Innovation in Business Management

Eric von Hippel in his work, "The Sources of Innovation" in the year 1988, discussed from where in the value-chain innovations came in different industries, the customer, the manufacturer, the supplier or the third party innovators such as universities, research laboratories, etc. (Philipson, 2011). He observed that the firm itself was of course the innovator in many cases. However, he identified customer involvement as key issue in successful innovation. As consumers, or other firms, start using the innovations, they often adapt or improve them, or relay information on how to do so back to the innovating firms (von Hippel, 2005). Suppliers may contribute to firm innovation by performing research and development (R&D) of its own and thus absorbing some of the R&D costs the buying firm would have to normally incur. Moreover, suppliers often have valuable knowledge of production and fulfillment processes that influence a firm's performance. Also, suppliers can transfer ideas for better products and features that could enable the buying firm to enhance products (Corsten & Felde, 2005). In some industries, he identified third parties, such as inventors, universities and independent research laboratories, as sources of innovation (Philipson, 2011). In the OECD Oslo Manual (2005), four different innovation types are introduced. These are product innovation, process innovation, marketing innovation and organizational innovation. Product and process innovations are closely related to the concept of technological developments (Gunday, et al., 2011).

Product innovations involve significant changes in the capabilities of goods or services. Both entirely new goods and services and significant improvements to existing products are included. A product innovation is the introduction of a good or service that is new or significantly improved regarding its characteristics or intended uses; including significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics (OECD Oslo Manual, 2005) (Gunday, et al., 2011).

Practitioners, policymakers, and funders likewise distinguish between innovation as process and innovation as outcome. From the point of view of process, practitioners need to know how to produce more and better innovations. Likewise, policymakers and funders need to know how to design contexts that support innovation. And from the point of view of outcome, everyone wants to know how to predict which innovations will succeed. To be considered an innovation, a process or outcome must meet two criteria. The first is novelty: Although innovations need not necessarily be original, they must be new to the user, context, or application. The second criterion is improvement. To be considered an innovation, a process or outcome must be either more effective or more efficient than preexisting alternatives. To this list of improvements we add more sustainable or more just. By sustainable we mean solutions that are environmentally as well as organizationally sustainable—those that can continue to work over a long period of time. For example, some solutions to poverty might entail natural resource extraction, such as oil drilling or fishing, which would be inherently limited by the constraints of the resource (Phills, et al., 2008).

To define social innovation more clearly, we first take a closer look at what innovation means, and then examine what social denotes. Innovation is both a process and a product. Accordingly, the academic literature on innovation divides into two different streams. One stream explores the organizational and social processes that produce innovation, such as individual creativity, organizational structure, environmental context, and social and economic factors. The other stream approaches innovation as an outcome that manifests itself in new products, product features, and production methods. This branch of research examines the sources and economic consequences of innovation. (Phills, et al., 2008). A social innovation can be a product, production process, or technology (much like innovation in

general), but it can also be a principle, an idea, a piece of legislation, a social movement, an intervention, or some combination of them. Indeed, many of the best recognized social innovations, such as microfinance, are combinations of a number of these elements. (Phills, et al., 2008).

A process innovation is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software. Process innovations can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products (OECD, 2005). A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing (OECD, 2005). Marketing innovations target at addressing customer needs better, opening up new markets, or newly positioning a firm's product on the market with the intention of increasing firm's sales. Marketing innovations are strongly related to pricing strategies, product package design properties, product placement and promotion activities along the lines of four P's of marketing (Kotler, 1991). Organizational innovations refer to the implementation of new organizational methods. These can be changes in business practices, in workplace organization or in the firm's external relations. Marketing innovations involve the implementation of new marketing methods. These can include changes in product design and packaging, in product promotion and placement, and in methods for pricing goods and services (OECD, 2005). Thus, organizational innovations are strongly related with all the administrative efforts of renewing the organizational routines, procedures, mechanisms, systems etc. to promote teamwork, information sharing, coordination, collaboration, learning, and innovativeness (Gunday, et al., 2011).

2.2. Innovation in Supply Chain Management

The supply chain environment is characterized by globalization, increased customer responsiveness, channel integration and advances in Information and Communication Technologies (ICT). The firms increasingly rely on their supply chain partners for innovation. Firms with the ability to better manage their supply chains should experience superior supply chain innovations. Key to successful supply chain management is coordination within an organization and between its suppliers and customers (Modi, 2006). Collaboration in supply chains is important for innovation as partners realize the various benefits of innovation such as high quality, lower costs, more timely delivery, efficient operations and effective coordination of activities. (Soosay, et al., 2008).

Supply chain and logistics managers play a role in innovation in at least two ways, i.e., one by developing innovations in supply chain management processes that themselves help create a differential advantage for firms and ideally supply chains and two, by superior execution in support of product innovations developed by OEMs (original equipment manufacturers) (Flint, et al., 2008).

An intra-organizational innovation might be the application of new technologies for planning and forecasting, whereas an example of inter-organizational or market innovation might be the application of integrated product development in which suppliers and customers become part of the product development process (Santos & Smith, 2008). The degree of newness may be related to both technological innovations (new products or processes) and non-technological innovations (organizational innovation or market innovation) (Bigliardi & Dormio, 2009).

Storer & Hayland, 2009 proposed that the supply chain, like the firm, uses innovation to provide unique value adding solutions for the supply chain that provides a market competitive advantage (Storer & Hyland, 2009). Supply chain innovation has a potential role in a firm's effort to develop new products. Employing a supply chain's innovation capacity indicates the willingness of groups of actors within the supply chain to take steps, or perform activities that ultimately produce output that improves or changes current activities to meet a market need or new trajectory (Storer & Hyland, 2009). The importance of supply chain management has grown over a period of time and various planning models have been put into practice by organizations across the globe. In the competitive global environment, performance of an organization can no longer solely be determined by the decisions and actions that occur within a firm; rather it will depend on the execution of decisions and actions taken in its entire supply chain (Naslund & Williamson, 2010). The introduction of new products and services, or entry into new markets, is likely to be more successful if accompanied by innovative supply chain designs, innovative supply chain management practices, and enabling technology (Jan Stentoft, et al., 2011).

Recently much attention has been paid to innovation as a way for industry and policy makers to achieve more radical, systemic improvements in corporate environmental practices and performance. Many companies have started to use eco-innovation or similar terms to describe their contributions to sustainable development (Machiba, 2009). Eco-innovation represents innovation that results in a reduction of environmental impact, no matter whether that effect is intended or not. Eco-innovation is thus seen as an overarching concept which provides direction and vision for pursuing the overall societal changes needed to achieve sustainable development. (METI & OECD, 2010). Innovation has long been seen as central to economic performance; it is increasingly recognized as a significant driver of social welfare.

Supply chain processes involve exploitation of natural resources as well as the human capital. Supply chain management aims for efficient utilization of resources and cost reduction, and various innovations have been introduced in the way the supply chains are managed. With an increased focus on environment issues, "green" thinking was introduced in supply chain management. Numerous innovations in eliminating or minimize waste (energy, emissions, chemical/hazardous, and solid wastes) were introduced. They involved changes in green design (marketing and engineering), green procurement practices (e.g. certifying suppliers, purchasing environmentally sound materials/products), total quality environmental management (internal performance measurement, pollution prevention), environmentally friendly packaging and transportation, to the various product end-of-life practices such as reduction, reuse, remanufacturing & recycling (Hervani, et al., 2005). Reverse logistics plays a major role in ICT products which have a shorter life cycle. ICT companies have introduced schemes to encourage recycling of e-waste materials and have used innovative methods to decrease its hazardous effects. Many forward thinking IT companies have introduced innovations in products, packaging, distribution,

recycling and infrastructure that help them become more profitable as well as to minimize environmental hazards. Gupta, et al., as per their study found that though major Indian IT product companies have taken initiatives for environmental compliance, mid and small-size companies and customers at large are not even aware of such initiatives. The government policy for e-waste management and handling is facing challenges ranging from awareness to technology and skills, preparedness to mitigation, promotion to reward, and corruption to fair and transparent implementation of rules (Gupta, et al., 2013a).

Another innovation in supply chain management was introduction of concept of sustainability. This concept of sustainability corresponds with the Triple Bottom Line (TBL) perspective given by Elkington (1998) which states that, at the intersection of social, environmental, and economic performance are activities that an organization can engage in which not only are beneficial from a social and environmental standpoint, but that also make economic sense and result in competitive advantage for the firm (Elkington, 1998). The concept of sustainability in supply chain is attributed to New (1997) who argued that supply chain management in industrial society should explicitly consider ethical, political and economic implications. Organizational capability to innovate and positive management orientation towards sustainability are a precursor to sustainable supply chain management (Pagell & Wu, 2009). Gupta, et al., (2013) proposed sustainability in supply chain can be achieved not only by its economic accomplishment but also by successfully addressing the environmental and social issues through innovations. So the various supply chain actors while deciding their supply chain performance should not only consider efficiency and effectiveness but also their performance on innovation, environment and social through all levels of management, i.e. operational, tactical and strategic (Gupta, et al., 2013b).

3. ICT Industry in India

The ICT industry in many countries is one of the upcoming industries with newly emerging product clusters, and it demands product innovation, which in turn creates new markets and stimulates industry growth. The rapid emergence of the Information and Communication Technology (ICT) sector has placed India on the global stage during the last one-and-a-half decades. ICT can be broadly viewed under two sectors, Information Technology (IT) and Communication Technology. India is one of the fastest-growing IT markets in the world. The Indian IT sector is broadly categorized into IT services and software, IT Enabled Services-Business Process Outsourcing (ITeS-BPO), and IT hardware products segment (OECD, 2010).

The market size of information technology in India is expected to touch US\$ 44.8 billion in 2014 as compared to US\$ 35.1 billion in 2012, as per International Data Corporation (IDC). The Indian market for IT products and services is expected to consolidate its growth achieved in 2011 and increase from US\$20.3 bn in 2012 to US\$38.7 bn by 2016 (India IT Report, 2012 by Business Monitor International). India's IT services market forecast was around US\$8.5 bn in 2012 and projected to grow to US\$17.5 bn in 2016. The Indian software market should continue to grow strongly, with software spending compounded annual growth rate (CAGR) for 2012-2016 projected at 20%. The share of hardware in total IT spending is expected by Business Monitor International (BMI) to remain above 50% during the 2012-2016 forecast period. BMI forecasts that the Personal Computer (PC) market will grow at a CAGR of 22% between 2012 and 2016. Overall, the hardware market is predicted to grow from an estimated US\$9.3 bn in 2012 to US\$16 bn in 2016, with PC sales, including accessories, projected to rise from an estimated US\$7.6 bn to US\$13 bn over the same period. The annual PC sale is expected to rise to more than 30 million units by 2016.

4. Methodology

The research paper uses integrative literature review approach to propose a framework for Managing Innovations in Supply Chains of ICT products. An integrative literature review is a form of research that reviews, critiques, and synthesizes representative literature on a topic in an integrated way such that new frameworks and perspectives on the topic are generated (Torraco, 2005). Perhaps the most important distinction of an integrative literature review is that it can be considered, in and of itself, a form of research that can stand alone (Yorks, 2008). Although not empirical per se, an integrative literature review does a systematic and replicable study of the literature. Since integrative literature reviews are distinctive because they systematically trace many (almost all) of the literature on a selected topic back to its roots, authors used it to review innovations which are used in business and supply chain management to propose the following framework.

5. Framework for Managing Innovations in Supply Chain

There are two broad classification of supply chain, one is based on functional process i.e. procurement, production, distribution and sales, while the other one is based on factors such as supplier, manufacturer, channel partner, dealer/reseller, retailer and the customer. The functions of procurement, production, distribution and sales are termed as the value chain. The paper proposes a framework for managing innovations in supply chains using both the levels i.e. functional as well as actors.

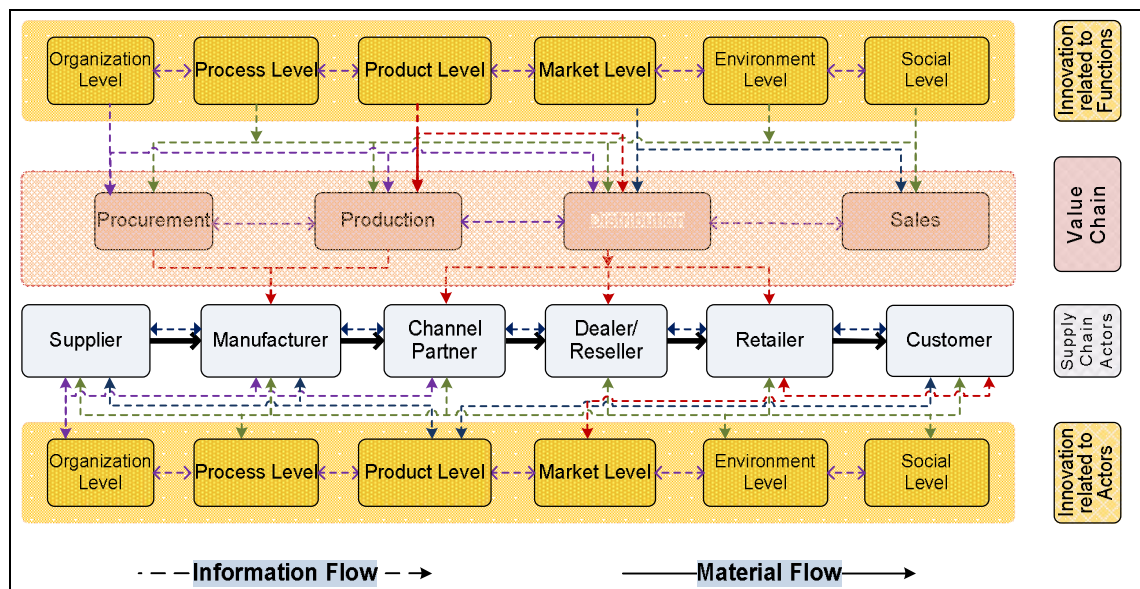


Figure 1: Framework for Innovation in Supply Chain Management

Authors have followed the Fleischmann et al. (2002) classification which divides the supply chain into four main stages or processes. Procurement involves the operations directed towards providing the raw material and resources necessary for production. Production is the next process in the chain. In this process the raw materials are converted into intermediary and/or finished products. Thereafter, distribution includes the logistics taking place to move the products either to companies further processing the product or to distribution centers, and finally to retailers. The sales process deals with all demand planning issues including customer or market selection, pricing strategy, forecasting and order promising policies.

The actors in a supply chain of ICT products generally include the supplier, manufacturer, channel partner, dealer/reseller, retailer and the customer. In general SC actors embrace innovations which increase profitability, whereas they need to be innovative to be more effective and efficient. To achieve sustainability, the innovations may take place at organizational level, process level, product level, market level, environmental level and social level. The diagrammatic representation of the framework is shown in figure 1.

In the ICT industry, innovation isn't only about new technology, instead it makes innovation an integral part of its entire operation. Innovations at organizational level may consider organizational structure and management systems. Product level innovations may consist of introduction of new product or a significant qualitative change in an existing product. Innovation is not only applied to products, it is valued in process and execution innovations. Process level may include introduction of a new process for making or delivering goods and services. Innovations at market level may comprise of dealing with competitors and customers, or for sales promotions, sales schemes and delighting the customer. Environment level innovation may spread across the supply chain, including steps taken by suppliers (reduced packaging), manufacturer (reduction in hazardous substances, energy efficient processes), distributors (reduced packaging, efficient transportation) and customers (reuse and e-waste disposal) (Gupta, et al., 2013). The social and environmental innovation capabilities are sometimes clubbed together to be named as eco-innovation which is an integral component to the dimension of sustainability to address environmental and social concerns of the SC actors. These also include the legal and policy regulations applicable for the particular industry, or a particular region/country etc.

Since the supply chain processes are spread across from the suppliers to the customers, the probability of introducing innovations is equally high across it. The organizational level of innovations is primarily introduced by the focal firm. The supply chain processes encompass involvement of all the actors including customers. These processes are under constant review and best practices are continuously introduced by way of new ideas and innovations. Similarly, changes in a product or its innovative uses can be introduced across the chain. The framework also identifies that the eco-innovation per se is a responsibility of all the SC actors. Innovation has long been seen as central to economic performance; it is increasingly recognized as a significant driver of social welfare.

6. Conclusion

There is no doubt that the ICT industry is one of the fastest growing industries in many countries and has a bright future ahead. But all the organizations in the ICT sector face the same challenge to remain competitive, deliver customer value, make profit, and ultimately survive and grow. And the answer lies in their capabilities to manage the innovations. These innovations are broadly categorized in product and process innovations. The product innovation can be associated with new product and or significant changes in the existing product features to address use, quality, environmental and social issues, while process innovation deals with components of value chain i.e. procurement, production, distribution and sales.

Proposed framework for managing innovation in supply chains of ICT products suggest six levels of innovations into two categories, i.e. value chain and supply chain. It shows that how these levels of innovations are interlinked with different actors of supply chain

and different functions of value chain. The framework shows and emphasizes on interrelationship and systems approach to management of innovations. The role of each actor in the supply chain for respective levels of innovations needs to be identified, incubated and managed professionally to exploit the benefits for growth and success of the organization. This is a conceptual framework for better understanding of managing innovations in the supply chains of ICT products, and it requires to be verified with practitioners in the industry.

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