

## **A Study on Innovation Capabilities and its relationship with Firm Competitiveness: A Conceptual Framework**

**Prof. R.K.Mittal\***

**Swadha Agarwal\***

---

### **Abstract**

In today's rapidly changing environment, firms have to adapt to the dynamic conditions and be open to innovations in order to survive. Having a competitive advantage in the market, has become imperative and innovativeness is vital to achieve that status. Technological innovation capabilities make it possible for firms to response to changes rapidly and to acquire technological innovation strategies and innovative outputs. Innovation capability is defined as a comprehensive set of characteristics of a firm that facilitates and supports its technological innovation strategies. An audit to evaluate the ICs of a firm may trigger improvement in its future practices. Such an audit can be used by the firm for self-assessment or third-party independent assessment to identify problems of its capability status. This study aims at developing a conceptual framework for innovation capabilities within a firm and how the firm can capitalise on these capabilities. The extensive literature review is undertaken to identify the key innovation capabilities that a firm must target to focus and strengthen on for better firm competitiveness.

***Keywords:*** Innovation Capabilities, Firm Competitiveness

---

\* University School of Management Studies, Guru Gobind Singh Indraprastha University

## 1. Introduction

Recent developments of World Trade Organization and alternative international trade agreements have forced industries worldwide to face a brand new era of intense world competition. With the rise in competitive pressure, the necessity to adapt, develop and innovate has become a basic building block for organisational excellence. If businesses don't innovate in a very dynamic environment, they can have an inclination to stagnate in their growth and eventually go out of business. Several studies have shown that technological innovation may bring positive impacts, enhancing the competitiveness of companies (Dierickx and Cool, 1989; Guan, 2002). So far we've seen a growing interest from business, academics and governments on how to well manage the innovations. For instance, the UK Department of Trade and Industry (DTI) sees technical innovation as the key drivers of national competitiveness and explores ways to encourage corporations to develop and improve their innovation management processes and performance.

During the central planning era of China, analysis was conducted by research institutes; resultant merchandise were factory-made by factories, and then distributed by distributors. Manufacturing companies had neither the mandate nor incentive to introduce innovation and alter (Naughton, 1990). Over the past 20 years, the transformation of the Chinese financial system from a centrally planned to a free economic system has had tremendous impact on the Chinese innovation system (Brockhoff and Guan, 1996; Liu and White, 2001a,b). The Chinese government compared to its peers, has created tremendous progress towards a simpler and economical national innovation system underneath its central designing. The transformation enclosed reforming the R&D funding system, dynamic government legislation and its administrative system, changing the evaluation system, and redistributing innovative activities among actors (i.e. research institutes, manufacturing companies, universities and government departments). The economic and enterprise reforms over the last twenty years have considerably improved the development, diffusion and implementation of technological innovation in Chinese companies (Guan and Ma, 2003). A serious thrust has been the attempt to co-locate R&D activities with implementation, i.e. for manufacturing companies to undertake R&D. The central government provides several lucrative incentives to companies to ascertain in-house R&D departments, and these units have magnified dramatically, from 7000 in 1987 to over 24,000 by 1998 (China Science and Technology Statistics, 1992, 1998). In 1999, 242 large-scale research

institutes, that were present were directly controlled by the State Economic and Trade Commission, one of the foremost powerful entities within the State Council, became S&T-intensive enterprises (China S&T Development Report, 2000). After 2000, over 5000 applied research institutes, previously financially supported by the Chinese government, no longer received any funds from the govt for their operations. These results are the emergence of a brand new 'national innovation system' that integrates government S&T efforts with the business activities of industrial enterprises (Liu and White, 2001b). The formation of this new innovation system has greatly magnified China's all-time innovative capability to develop and capitalize on technology, together with its capability to assimilate and improve upon technology transferred from the advanced economies (Lu and Lazonick, 2001).

However, the inheritance of decades of top-down, central government control over all aspects of the economy still impacts the business philosophies of many corporations. The success or failure of the innovation system in place doesn't solely rely upon a firm's innovation capabilities, but conjointly on its financial allocation and selections of the planning authorities and its political priorities. To improve the technological innovation management processes and performance, there needs to be present an audit that could trigger improvement in a company's practices.. Such audits are often utilized by corporations for self-assessment or third-party freelance assessment to spot the gaps and find the issues of their capability status and processes. This paper aims to develop such AN auditing framework for companies which will facilitate to see the delicate links between innovation capabilities and firm competitiveness; and to alter the auditor to see whether or not a good practice is in place.

## 2. Review of Literature

### 2.1 Innovation capabilities (IC)

Technological innovation capabilities are considered one of the key factors of competitive advantage (Guan & Ma, 2003; Yam et al., 2004). Technological innovation capabilities are skills to adapt to sudden technological amendment, develop new merchandise and use new technological processes so as to satisfy current and expected future desires (Adler & Shenbar 1990). Wang, Lu and Chen (2008) outline technological innovation capabilities as a multidimensional concept. Technological innovation capabilities outlined as firm's special

assets Guan and Ma (2003) that develop, facilitate and support firm's technological innovation methods (Burgelman, 1996). According to Adler and Shenbar (1990), four types of ICs are known, including: (1) The capability of satisfying market demand by developing new merchandise; (2) The capability of producing these merchandise by using appropriate applicable technologies; (3) The capability of satisfying future desires by developing and introducing new products and new process technology; (4) The capability to respond to an unanticipated technology activity caused by competitors and unforeseen circumstances.

According to Peteraf (1993), a firm's multi varied resource portfolios (including human, capital, and technology resources) are liable for observed variability in its capital returns. These are a firm's specific competencies that contribute vastly to the sales growth and competitive advantage. There would ought to be a causative association between a firm's resources and performance. Dierickx and Cool (1989) point out that companies ought to either decide to imitate high-performing resources or to specialize in developing different resources that would give similar results. Thus, improvement of IC as key firm's resources are often useful to a firm (Guan and Ma, 2003). For instance, Lawless and Fisher (1990) found that successful technological innovation helps companies to achieve market position and realize additional long-run returns. Yam et al. (2004) acknowledged that IC is positively associated with new product introduction and innovation sales.

Burgelman et al. (2004) defines IC as a comprehensive set of characteristics of a company that facilitates and supports its technological innovation methods. These are special assets or resources that embrace technology, assets or data, product, experience, and organization (Guan and Ma, 2003). Lall (1992) defines IC as the skills and data that are required to effectively absorb, master, and improve existing technologies, and conjointly to form new ones. Evangelista et al. (1997) regards R&D activities as a central element of the technological innovation activities of companies and as the most significant intangible innovation expenditure. Not solely will successful technological innovation rely upon technological capability, but it also requires alternative innovation capabilities within the space of R&D, manufacturing, marketing, organization, strategy, planning, learning, and resources allocation (Yam et al., 2004; Romijn and Albaladejo, 2002).

The researchers outlined technological innovation capabilities in a variety of ways and as a multifaceted and complex construct. Christensen (1995) used asset approach. According to his study research asset, product innovative assets, process innovative asset and aesthetic design assets are explained as the components of technological innovation capabilities. Chiesa, Coughlan and Voss (1996) used two ways to assess the innovation capability of a company – a process audit and a performance audit. The process audit targeted on the individual processes necessary for innovation which incorporates concept generation, process innovation, product development, technology acquisition, leadership, resourcing, system and tools. He used process approach to indicate that technological innovation capabilities involve organisational process and activities. Technological innovation capabilities are shaped by concept generation capability, product development capability, process innovation capability, technology acquisition capability, leadership capability, the preparation of resources capability and capability in effective use of systems and tools.

## 2.2 A study framework for innovation audit

We drew on existing research in innovation management to develop the content of the audit of technical innovation. Studies that showed known characteristics of technically progressive companies and factors related to success or failure in innovation contributed to the audit framework to be developed. Cooper (1980) advised 3 variables that are associated with the context of innovation—the nature of the merchandise, the market surroundings and therefore the existence of potential product–technology synergy. Rothwell (1992) provided an honest outline of key factors that emerged in several innovation management studies, that are highlighted below.

- Smart internal and external communication.
- Treating innovation as a company wide task.
- Implementing careful designing and project management procedures.
- Potency in work development and prime quality production.
- Robust market orientation.
- Providing smart technical service to customers.
- Presence of certain key personnel as technological gatekeepers.
- High quality management.

Cooper (1996) additionally established 3 essential success factors for drivers of new product performance:

- Prime quality new product process
- Adequate resource commitment.
- A transparent and well-communicated new product strategy.

Various researchers and establishments adopted numerous components to audit a firm's TICs. As an example, the innovative capabilities audit framework projected by Burgelman et al. in 1988 (2004) enclosed 5 audit dimensions:

- Resource accessibility and allocation.
- Capability to know competitor's innovative strategies and business evolution.
- Capability to know technological developments.
- Structural and cultural context.
- Strategic management capability.

Christensen (1995) classified TICs into science research quality, process innovation asset, product innovation quality and esthetics design quality. Bobe and Bobe (1998) adopted a list methodology for benchmarking innovation and practices in 3 EU countries, namely, Germany, the united kingdom and France. Similar to that advocated in the OSLO manual (OECD, 1997), the strategy addresses:

- The national innovation systems context.
- Innovation and firms' strategy.
- Organisational structures and therefore the structure moves linking production, selling and design.
- Origin of technological resources.
- Management of human resources.
- world innovation trends.

Chiesa et al. (1996) developed a model for auditing a firm's innovation capability that introduces 2 strategies to assess an organization—a process audit and a performance audit. The process audit focuses on the individual processes necessary for

innovation and therefore the extent to which the best practice is in place. The performance audit focuses on the effectiveness of the individual methods and of the general process of innovation, in terms of their impact on competitiveness. Supported by an intensive literature review, Chiesa et al outlined the subprocesses and components that created up the innovation process. The total set of subprocesses is summarized as idea generation process, product development process, production method, technology acquisition method, leadership method, resource provision method and systems and tools provision method. In the performance audit, performances of every of those processes as well as the global results of the innovation process are measured. Equivalent to the Chiesa's approach, our innovation audit model includes both a capability audit and a performance audit. Summarising the findings of relevant literature mentioned above, activities, or processes, or characteristics that are found to be related to innovation success and failure are advanced as audit components. These components are then sorted amongst seven capability dimensions.

The functional approach is adopted in every dimension, except learning capability, which represents a separate function of the organization—R&D, manufacturing, marketing, organising, resource allocation and strategic planning. In a comparatively backward economy like China, wherein most corporations are far from the updated management frontier, practitioners would notice the asset concept (Christensen, 1995) or process concept (Burgelman et al., 2004; Chiesa et al., 1996) troublesome to understand. The functional approach so has 2 benefits. initial it's easy to comprehend, and second, it facilitates the multi-informants approach for the survey. Learning is an additional dimension that has not been examined extensively in previous innovation capability analysis. Learning capability was outlined as 'the capability to get ideas with impact, across multiple boundaries, and thru specific management initiatives' (Yeung et al., 1999); and 'the ability of a company to evaluate the lesson of its experience and to pass those lessons across boundaries and time' (Ashkenas et al., 1995). Innovation could be a fragile and vulnerable activity and a few organizations suffer from an inability to sustain innovation in the future. The capability to sustain innovation has been related to organization learning (Senge, 1990; Leonard-Barton, 1992, 1995). Learning hence has a crucial role to play in technological innovation.

### 2.3 Capability audit

The technological innovation capability (TIC) is the multi-purpose set of organizational qualities that support and facilitate the organization's technological innovation strategies (Burgelman et al., 2004).

Technological innovation capabilities are special resources that embody technology, products, processes, data, expertise and organization. Developing technological innovation is probably going to be beneficial for corporations that are trying to boost their capabilities and can propel them to improve their level of competitiveness. Successful new product inputs would possibly give corporations with the potential to get a foothold within the market and obtain long gains in comparison to a scarcity of a new input (Yam et al., 2004: 1124). ICs that are a part of organization's dynamic capabilities are characterised as the ability of corporations to mobilize structural resources and activities like firm's experience, technical systems, values and norms, for strategic functions (Wu and Chen, 2010). ICs have numerous definitions within the literature. For instance; Lall, (1992) focuses on the classification of IC, proposes the subsequent definition; IC is the information and skills to assimilate, grasp and modify the prevailing technology and to form new technology. Similar to the definitions of ICs, several studies within the literature evaluating ICs have ascertained that researchers utilize numerous elements. Our study notably utilizes; the dimensions from the research of Yam et al., (2004) who have examined ICs in seven completely different dimensions namely; learning capability, R&D capability, resource allocation capability, manufacturing capability, marketing capability, organization capability and strategic planning capability.

Particularly, ICs encourage organizations to invest and stay active in R&D operations that in turn contribute to creation of advanced technological product and processes that are faster and can with success transfer them from external sources (Huang, 2011). Parallel to the current argument, corporations enhancing their ICs, effectively integrate, transfer and homogeneously utilize resources for the organization level collaborative efforts of making new products and processes (Wang et al., 2008). At the same time, ICs strengthen internal and external communication permitting efficient knowledge flow and collaboration among the value chain. This, results in higher resource availability and allocation, and also as a chance to acknowledge competitor's innovative strategies and technological developments (Yam et al., 2004). Therefore ICs



enhance successful technological innovations that serve for the organizations to ceaselessly adapt to ever-changing environment, supporting technological innovation performance and having a major impact on achieving competitive advantage (Guan et al., 2006).

Successful technological innovation depends not solely on technological capability, as well as on alternative critical capabilities within the areas of manufacturing, marketing, organization, strategy planning, learning, and resources allocation. As per Adler and Shenbar (1990), four types of TICs are known, which are (1) the capability of satisfying market demand by developing new products; (2) the capacity of producing these products by utilising appropriate process technology; (3) the capability of satisfying future requirements by developing and introducing new products and new process technology, and; (4) the capacity to respond to an unexpected technology activity caused by competitors and unforeseen circumstances. These capabilities exist in a firm and at company levels. Chiesa et al. (1996) developed a technical innovation audit framework encompassing many main elements, like product innovation, product development, process innovation, technology acquisition, leadership, and resourcing. That framework targeted on core processes and enhancing processes to delineate technological innovation. However, as Chiesa et al.'s (1996) advised, supportive evidences are required to check the validity of the framework (e.g. overlapping between product innovation and development). Alternative areas like learning, organizing, and strategic planning that were necessary for a firms' innovation capability ought to stressed upon. The innovative capabilities audit framework planned by Burgelman et al. (1988) enclosed 5 audit dimensions resource availability and allocation; capability to identify competitor innovative strategies and business evolution; capability to know technological developments; structural and cultural context; strategic management capability.

This study follows an audit framework planned by Yam et al. (2004) to analyze the IC and their impacts on innovation performance. The framework was developed by reviewing existing literature in innovation capabilities (Burgelman et al., 2004; Chiesa et al., 1996; Cooper, 1996; Christensen, 1995; Rothwell, 1992), conducting a focus group discussion of senior executives from innovative corporations in Beijing region, and thereby statistically testing the framework through a large-scaled questionnaire survey in Beijing (Yam et al.,

2004). Revisions were introduced based on their comments. A summarised description of seven dimensions is given below, and a list of auditing elements are presented in Appendix A.

- (1) *Learning capability* is the capacity to identify, assimilate, and exploit new knowledge essential for a firm's competitive success.
- (2) *R&D capability* refers to a firm's ability to integrate R&D strategy, project implementation, product portfolio management, and R&D expenditure.
- (3) *Resource allocation capability* is the firm's ability to mobilize and expand its technological, human, and financial resources in the innovation process.
- (4) *Manufacturing capability* refers to the ability to transform R&D results into products, which meet market needs, in accordance with design request and can also be manufactured in batches.
- (5) *Marketing capability* indicates the capacity to publicize and sell the products on the basis of understanding consumer's current and future needs, customer's access approaches, and competitors' knowledge.
- (6) *Organizing capability* is the capacity to constitute a well-established organizational structure, cultivate organizational culture, coordinate the work of all activities towards shared objectives, and influence the speed of innovation processes through the infrastructure it creates for developmental projects.
- (7) *Strategic planning capability* is the capacity to identify internal strengths and weaknesses and external opportunities and threats, adopt different types of strategies that can adapt to environment changes for the excelling in the highly competitive environment.

## 2.4 Firm Competitiveness

In the globalized world, the concept of the competitiveness has gained and has been gaining an unprecedented importance in the recent years. After 1970s, there occurred an increase in foreign direct investments of the countries causing a change in the business segment of the firms. Before 1970s, the activities of the firms were concentrated on the manufacturing sector with the primary products; however, during and after 1970s, the activities of the firm gave its place to technology intensive manufacturing and services sector. Therefore, 1970s can be regarded as the turning point in the view of globalization. Furthermore, during 1980s, many developing countries started to be more liberal in their economic policies. Privatization, increasing market economy, financial liberalization and the attempts of the countries for the articulation to the world economy existed in

these countries started to be in great demand. Then, developing countries began to be more connected to each other which brought an increasing competition in the world. Owing to these changes observed in the world economy, firms in the developed and developing countries became more efficient and they became as a serious rival at the international markets. All these developments and changes gave rise to the increased volume of trade in the world and paved the way for accelerating competitiveness and prevailing globalization. In this regard, the concept of “international competition power” gained importance in the world. This implies that in general, international competition power is explained as the share of trade volume in the world trade that a country owns.

In the matter of “competition power” or “competitiveness” of a country, competitiveness is defined as "the ability of a country to produce goods and services that meet the test of the international markets and simultaneously to maintain and expand the real income and also rise the welfare level of its citizens" (Haque, 1995) [1]. However; the concept of competition power shouldn't be totally explained by only the ability of a country's productivity, it should also be explained by the firm level competition power.

Firm-level competitiveness is of great interest among practitioners. Nations can compete only if their firms can compete, argues Christensen of Harvard Business School. Porter says “it is the firms, not nations, which compete in international markets”, (Porter, 1998). Firm level competitiveness can be defined as the ability of firm to design, produce and or market products superior to those offered by competitors, considering the price and non-price qualities (D’Cruz, 1992). The environmental factors are more or less uniform for all competing firms. Research shows that 36 per cent of the variance in profitability could be attributed to the firms’ characteristics and actions (McGahan, 1999). Other pro-firm views (Bartlett and Ghoshal, 1989; Prahalad and Doz, and 1987; Prahalad and Hamel, 1990) focus on individual firm and their strategies for global operations, and resource positions to identify the real sources of their competitiveness.

The following table enlists the various competitiveness connotations cited by researchers over the years.

**Table 1: Competitiveness Connotations by various authors**

<b>Authors ( Year)</b>	<b>Competitiveness Connotations</b>
Leachman et al. (2005)	Superior manufacturing performance leads to competitiveness
Ajitabh and Momaya (2004)	Firm's competitiveness is dependent on its ability to provide goods and services more efficiently than others involved in the market place
Hitt et al. (2001)	Competitiveness comes through a process by which one entity strives to outperform another through the use of various resources and capabilities
Economic Times (2001)	Competitiveness is a concept comprising of the potential, the process and the performance
DISR et al. (2001)	Competitiveness is a combination of assets and processes, where assets are inherited or created and processes transform assets to achieve economic gains from sales to customers
Khalil (2000)	To be competitive, several factors must exist: the desire to win, commitment or perseverance and the availability of certain resources
Dou and Hardwick (1998)	Competitiveness is defined in terms of "helping business to win", "price", product range and quality and "distribution and marketing"
Cho and Moon (1998)	Competitiveness refers to the relative position of an organization against its competitors
Waheeduzzaman and Ryans (1996)	Competitiveness involves different attributes like comparative advantage and price competitiveness perspective, strategic and management perspective, as well as historical and socio-cultural perspectives
Pace and Stephan (1996)	Competitiveness is the ability of the organization to stay in business and to protect the organization's investments, to earn a return on those investments and to ensure jobs for the future
Ramasamy (1995)	Competitiveness is the ability to increase market share, profit and growth in value added and to stay competitive for a long duration
Chaharbaghi and Feurer (1994)	Competitiveness is the ability to persuade customers to choose their offering over alternatives and ability to improve cost process capabilities

Yinghong and Wang (2011) noted that collaboration is paramount in competitive price advantage which helps maintain better services through efficient distribution channels. Kristal et al. [2010] discovered the benefits to enterprise performance by use of a combination of an

ambidextrous supply chain strategy with competitive capabilities. Therefore, enterprises must always be searching for ways to improve their technical and technological skills and capabilities in R&D [Chumaidiyah E, 2012] and take advantage from the market's requirements. Multiple researchers agree that high performance organizations continually improve their selves by use of state-of-the-art technologies which helps companies create sustainable competitive advantages while increasing operational efficiency [Porter M.] Oh and Rhee [2010] are in agreement from their Korean automotive supplier research which concluded that flexibility, engineering and modularization capabilities have positive influences on collaboration in new car development which, in turn, positively affects competitive advantage of carmakers. Research in Taiwan concerning the semiconductor industry (TSI) by Wang and Chiu [2013] indicated that a competitive edge entailed speed, cost, flexibility, and quality. This was driven by policy formulation, bridging institutions, public infrastructure, vertical disintegration, entrepreneurship, and human capital. However, leadership depended on the development of additional core competencies to increase competitiveness. Verma and Jayasimha [2014] also suggested that technology, value creation, sustainability and brand strategy helped increase competitive advantage with product innovation and product quality being key elements. Antonio et al. [2009] researched competitive capabilities and concluded that product innovation, product quality, delivery, flexibility and customer services could be significantly improved with better internal integration.

Based on the literature research, firm competitiveness can be defined through seven dimensions, which are defined as below:

1. *Technology Structure and Innovativeness*: Defines the firm technological infrastructure and innovative adaptability in place, how unique is the product in comparison to its domestic and foreign competitors and its capability for technical upgradation
2. *Market Structure*: Defines the extent of expansion of the firm to domestic and global markets, the firm position in the market in terms of dealing with potential rivals and developing synergies with similar producers/ suppliers
3. *Flexibility*: Defines how quickly and efficiently the firm can bring changes in product design, swings in volume, product mix and product diversification, as per the market requirements

4. *Production Structure*: Defines the efficiency of scale of production of the firm, its ability to handle raw material bottlenecks, and the capability of the firm to match global standards for production
5. *Cost*: Defines how cost effective is the firm in its production and its ability to harness cost advantage in manufacturing.
6. *Quality*: Defines the level of quality of product offered by the firm in compliance with domestic and global standards. It is the degree of excellence of a particular product or service with the global auto maker embracing this idea with the corporate slogan “*Quality is Job 1*”. Quality is also concerned with product longevity and strength, as well consumer satisfaction in the after-sales service process and through advertisement through word-of-mouth.
7. *Customer Service*: Defines the quality of customer service provided before and after sale of the product, and the extent of customer base developed through wide distribution access in place.

A brief description of seven dimensions is given above, and a list of auditing elements are presented in Appendix B

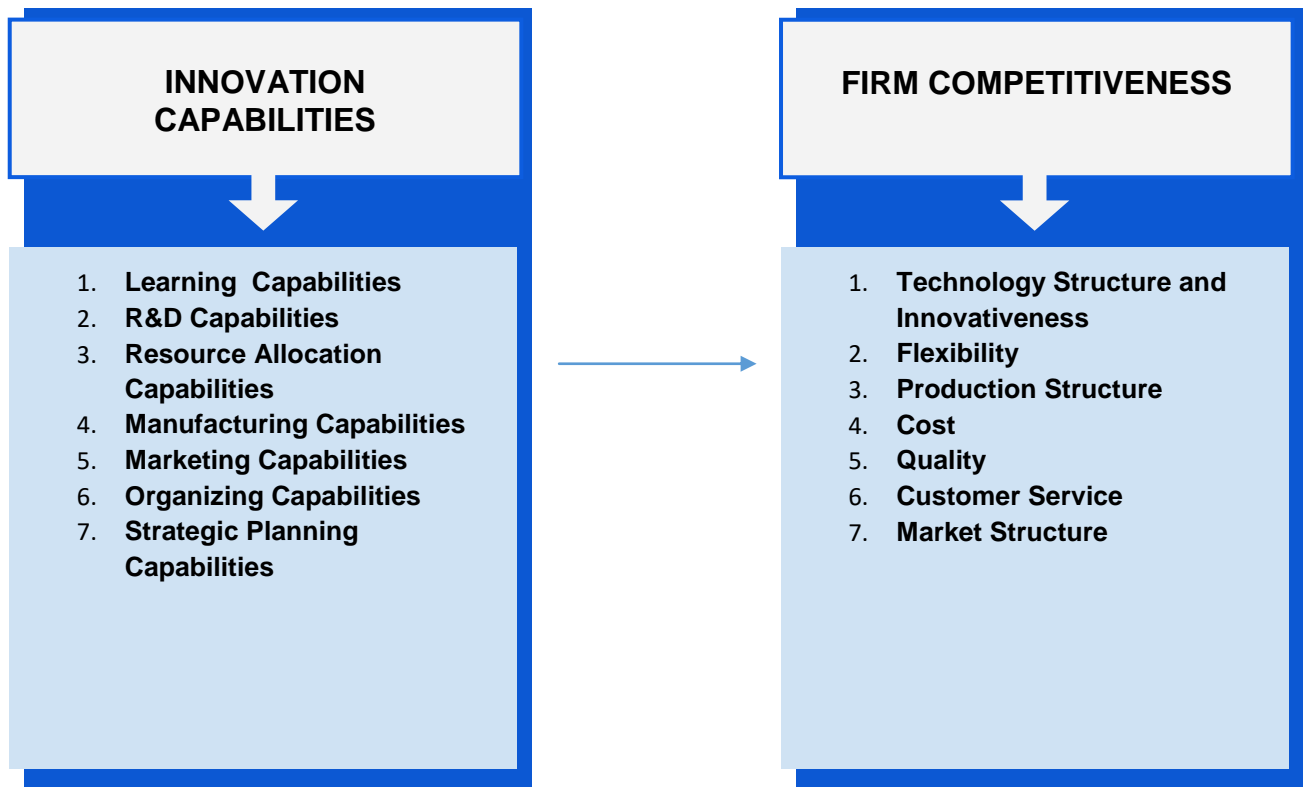
### **3. Findings and Results**

#### **Linkage between Innovation and Firm competitiveness**

Recent decades of innovation research has demonstrated that innovation plays a critical role in determining the long-term survival of organizations (Ancona and Caldwell, 1987), enhancing an organization’s success (Higgins, 1995), and sustaining its competitive advantages (Porter, 1990). Nevertheless, key issues of innovation management have so far only been linked in a descriptive manner to competitive and economic outcomes at national level (OECD, 2010; Schmoch et al., 2006; Lundvall, 1992) and to the performance of innovation systems at the regional level (Cooke et. al., 1997; Cooke, 2001). It is, however, at the level of the firm that one will be able to analytically examine the influence of innovation management on performance most directly. Still, firms exist in a complex environment including a wide array of sources of knowledge for innovation and crucial but intricate

processes of learning that delivers the final innovation (Vega-Jurado et al., 2009; Amara and Landry, 2005).

It is thus widely recognized that learning involves both the development of absorptive capabilities at the level of the organization and the use of knowledge from a variety of sources. The role of external sources of knowledge for innovation has been increasingly emphasized in the analysis of innovative behavior (e.g., von Hippel, 1988; Block and Keller, 2009) and in studies of evolutionary economics and systems of innovation (Lundvall, 1992; Edquist and Hommen, 1999; Edquist, 1997). The external sourcing or knowledge for innovation has also been prominently highlighted in theories of organizational learning in knowledge-based firms (Leonard-Barton, 1995; Cohen & Levinthal, 1990; Grant, 1996), and in the emerging theories of open innovation (Chesbrough, 2006, 2003). The theoretical implications of these approaches is that innovation depends on the leveraging of organizational capabilities and resources – both those that have been accumulated by internal functional units and those that can be acquired through contacts with other organizations such as suppliers, customers, universities, research institutions and the like (Grant, 1996; Verona, 1999). Evolutionary theory suggests that diverse sources of information allow firms to create new routines through combinations of technologies and knowledge, leading to more opportunities to dynamically innovate and select competitive technology (Nelson and Winter, 1982). Organizational learning theory likewise suggests that innovation is an interactive learning process involving the generation, adoption, implementation and incorporation of new ideas and practices internally and externally (Cohen and Levinthal, 1990; Dodgson, 1993; Hitt et. al., 2000). The outcomes of organization learning thus generates the knowledge and skill needed for firms to select, acquire, maintain, adapt, improve and develop competitive capabilities (Hamel and Prahalad, 1994). Such knowledge and capabilities further prepares the firms to better understand, evaluate and exploit external knowledge in the future (Cohen and Levinthal, 1990). More recent theories of open innovation further elaborates on the use of both internal and external ideas and paths to market, which increases the number of possible innovations and the ways that firms can capitalize on these innovations (Chesbrough, 2006, 2003). Finally, the systems of innovation theories maintain that innovation is rarely made merely on the basis of resources available within a firm, but are developed within a context of institutions, government policies, competitors, suppliers, customers, value system, and social and cultural practices that affect the innovation activities (Edquist, 2005).

**Figure 1: Linkage between Innovation Capabilities and Firm Competitiveness**

In a world of increasing competition and technological change, the generation and diffusion of innovations increasingly rely upon new technological knowledge which is generated not only by learning processes within internal R&D department, but also by interactions with sources of innovation in the systems of innovation (Tidd, 2006; Equis, 2005; Caloghirou al.et., 2004; Romijn and Albaladedjo, 2002). Thus, a critical component of successful innovation is the ability of a firm to exploit and utilize external knowledge from different sources of innovation (Lin et. al., 2002). However, the relationship between sources of innovation and a firm's capabilities, and the role of this relationship on performance, is seldom examined in the literature. Such relationships are most usefully analyzed with reference to theories concerning firms' resources or capabilities (Barney and Clark, 2007), organization learning theories (Cohen and Levinthal, 1990) and ultimately the theoretical propositions associated with the concept of systems of innovation (Edquist, 2005; von Hippel, 1988; OECD, 2008b; Fagerberg, 2005; Nelson and Pack, 1999).



A firm's competitiveness roots in its possession of special assets and resources that are valuable, heterogeneous, and difficult to be imitated and substituted. These would safeguard the firms' position in the areas of strategy and technology management. Bobe and Bobe (1998) adopted a checklist method for measuring TIC practices in three European Union countries, namely, Germany, the UK, and France. Similarly OSLO manual (OECD, 1997) proposed the following measurements, such as the national innovation systems context; innovation and firms strategy; organizational structures and the organizational moves linking production, marketing, and design; origin of technological resources; management of human resources; global innovation trends.

#### 4. Discussions and Conclusions:

Innovation is a complex technological, social, and economic process. Therefore, success is not measured through just one or two factors and no factor could be effective alone. As such, no management or technical tool or instrument can establish an efficient environment for innovation. In fact, what we obtain in research is a collection of different factors which should regularly establish and improve an innovation environment so as to guarantee the innovation success in an organization (Barnano, 2005). Innovation capacity completes as the result of several relationships and communication among organizational, resources, qualifications, and connections with other organizations (Hii & Neely, 2000). Therefore, the innovation capability of a firm is not the result of one of its abilities but it flows from a collection of abilities and other capabilities, which means an internal potential for generation of new ideas, identification of new market opportunities, new services and products through resources and capabilities of a firm. The purpose of the above study was to conduct an in-depth literature research to identify the key dimensions that would define innovation capabilities of a firm, and based on the literature acquired through case studies, anecdotes, and consultants' frameworks, it can be defined through seven dimensions. These 7 dimensions are defined as learning capability, research & development capability, resource allocation capability, manufacturing capability, marketing capability, organization capability and strategic planning capability.

The purpose of this systematic review is to synthesize peer reviewed articles published in the area to develop a conceptual framework and to aid future research. The study also focussed on main factors that define firm competitiveness and through an extensive literature the

following seven dimensions were identified: technology structure and innovativeness, flexibility, production structure, cost, quality, customer service and market structure.

Strategy researchers and practitioners have shown interests in the increasingly important role of ICs on a firms' competitiveness, but existing literature still relies heavily on with little solid empirical findings. Recent research shows that one of the most dynamic capabilities that lead to strongest competitive advantage in the organizations is innovation capability. The innovation capability is connected with to other organizational capabilities. The innovation capability is defined as a great ability to provide innovative services and products continuously through the organizational capabilities and capacities. The main aim of the systematic literature review is to understand how firms develop their innovation capability for achieving competitive advantage. The recent rapid changes in technology, consumers' taste, preferences, and general market condition means that post-industrial organisations' survival and success depend on capability to be innovative. Therefore, it has become imperative to study the extent of relationship between the firm's innovation capabilities and its level of firm competitiveness. Once the nature of this relationship is identified, it would make it easier for firms to capitalise on their innovation capabilities in the most effective way to enhance the firm competitiveness. The future scope of research lies in developing this relationship in various industrial sectors.

## Appendix A

### 1. Learning Capability

- Your company does not encourage work teams to identify opportunities for improvement
- Your company adopts accessed knowledge into your daily activities
- Your company understands its core capabilities and match them with market needs
- Your company cultivates learning readiness and invests on learning.
- You company systematically monitors technology development trends
- Your company has the capacity to assess technologies relevant to firm's business strategies

### 2. Research and Development Capability:

- Your company links the R&D plans to the corporate plan and technology competence
- Your company has cross sectional screening of R&D project plans
- Your company establishes project targets, phase standards and project managing regulations

### 3. Resource Allocation Capability:

- Your company trains for human resources in programmed phases
- Your company selects key personnel in each functional department into the innovation process
- Your company provides steady capital supplement for innovation activity.
- Your company has flexibility and diversity of capital origins

### 4. Manufacturing Capability:

- Your company's manufacturing department has ability in transforming R&D output into production
- Your company has capable equipment operating skilled manufacturing personnel.
- Your company has system in place for continuous improvement of existing manufacturing system
- Your company adjusts the production process according to the requirement of R&D process designing

### 5. Marketing Capability

- Your company has an effective marketing intelligence system
- Your company selects and tests innovation ideas, product concepts, product prototypes and customer preferences according to customer requirements and competitive goals
- Your company tracks customer satisfaction levels
- Your company provides after service and technological assistance

### 6. Organising Capability

- Your company has high-level integration and control of the major functions with the company.
- Your company has good coordination and cooperation of amongst all the departments such as R&D, marketing and manufacturing
- Your company cannot handle multiple innovation projects in parallel

### 7. Strategic Planning Capability:

- Your company is highly adapted and responsive to changes in external environment
- Your company has a clear plan —a road map of new product and process with measurable milestones.
- Your company has high capability in identifying external opportunities and threats.
- Your company has high capability in identifying internal strengths and weaknesses.
- Your company has accurate connection between technological strategy and business strategy

## Appendix B

### 1. Technology Structure and Innovativeness:

- Product design is developed as per market requirements
- Your company has sufficient preparedness to upgrade to new technologies
- There has been a high Research and Development expenditure
- Low technology competitiveness in comparison to domestic competitors
- Low technology competitiveness in comparison to Foreign competitors
- High degree of collaboration with Indian/ Foreign companies for technology up gradation

### 2. Flexibility:

- Your Company makes rapid design changes and introduces new products quickly
- The company changes the product mix quickly
- The company has a low scope for product diversification

### 3. Production Structure:

- Your company faces a shortfall of raw materials
- There are some infrastructure bottlenecks that hinder overall production performance
- The effective average product concept-to-launch time is good
- Your company has high degree of capability to develop domestic production base for global requirements

### 4. Cost

- Cost competitiveness of firm in comparison to domestic rivals is high
- Cost competitiveness of firm in comparison to foreign rivals is high
- Presence of major impediments to cost advantage

### 5. Quality:

- Compliance with national/ global standards
- Positive impact of brand image on quality of product
- Rejection of product by customer due to lack of quality
- Presence of incidental factors that lead to poor quality production
- Quality parameters of raw materials has an impact on the product

### 6. Customer Service:

- The company provides timely delivery of products to customer
- The company provides excellent and accurate information, technical assistance and after sale service
- The company provides wide distributions access to product
- The company provides products satisfactory to customers

### 7. Market Structure:

- The proximity of domestic competitors acts as a threat
- The proximity of foreign competitors acts as a threat
- There is a probability of rivals to grab regular dealers
- The company has an effective strategy to explore markets for new dealers/ suppliers/ retailers
- Synergies with other similar producers/suppliers has an impact on the product

## References

1. Dierickx, I., Cool, K., 1989. Asset stock accumulation and sustainability of competitive advantage. *Management Science* 35, 1504–1511
2. Guan, J., 2002. Comparison study on industrial innovation between China and some European countries. *Production and Inventory Management Journal* 43 (3–4), 30–46.
3. Guan, J., Ma, N., 2003. Innovative capability and export performance of Chinese firms. *Technovation* 23 (9), 737–747.
4. Naughton, B., 1990. China's experience with guidance planning. *Journal of Comparative Economics* 14, 743–767.
5. Brockhoff, K., Guan, J., 1996. Innovation via new ventures as a conversion strategy for the Chinese defense industry. *R&D Management* 26 (1), 49–56.
6. Lall, S. (1992). Technological Capabilities and Industrialisation. *World Development*. Vol 20 (2). 165-186.
7. Yam, R., Guan, J.C., Pun, K.F., & Tang, E. (2004). An audit of technological innovation capabilities in Chinese firms: some empirical findings in Beijing, China. *Research Policy* 33 , 1123-1140.
8. Liu, X., White, S., 2001a. An exploration into regional variation in innovation activity in China. *International Journal Technology Management* 21 (1–2), 114–129.
9. Liu, X., White, S., 2001b. Comparing innovation systems: a framework and application to China's transitional context. *Research Policy* 30, 1091–1114.
10. Lu, Q., Lazonick, W., 2001. The organisation of innovation in a transitional economy: business and government in Chinese electronic publishing. *Research Policy* 30, 55–77.
11. Guan, J., Ma, N., 2003. Innovative capability and export performance of Chinese firms. *Technovation* 23 (9), 737–747.
12. A. Burgelman, Robert & M. Christensen, Clayton & C Wheelwright, Steven. (1997). Strategic Management of Technology & Innovation. *Journal of Product Innovation Management - J PROD INNOVAT MANAGE*. 14.
13. Peteraf (1993). The Cornerstones of Competitive Advantage : A Resource Based View. *Strategic Management Journal*. Vol 14. No. 3, 179-191
14. Lu, Q., Lazonick, W., 2001. The organisation of innovation in a transitional economy: business and government in Chinese electronic publishing. *Research Policy* 30, 55–77.
15. Adler, P.S., Shenbar, A., 1990. Adapting your technological base: the organisational challenge. *Sloan Management Review* 25, 25–37.
16. Porter M.E., *Competitive Advantage*, New York, USA: Free Press, 1985.
17. McGahan, A. M. (1999). Competition, Strategy, and Business Performance. *California Management Review*, 41(3), 74–101. <https://doi.org/10.2307/41165998>
18. Yinghong W., Wang Q. *Making sense of a market information system for superior performance: The roles of organizational responsiveness and innovation strategy*, *Industrial Marketing Management*, 40, 2, 267–277, 2011, <http://dx.doi.org/10.1016/j.indmarman.2010.06.039>

19. Kristal M.M., Huang X., Roth A.V., *The effect of an ambidextrous supply chain strategy on combinative competitive capabilities and business performance*, *Journal of Operations Management*, 28, 5, 415–429, 2010, <http://dx.doi.org/10.1016/j.jom.2009.12.002>
20. Porter M.E., *The technological dimension of competitive strategy*, *Research on Technological Innovation, Management and Policy*, R.S. Rosenbloom [Ed.], Greenwich, CT, USA: Jai, pp. 1–33, 1983.
21. Oh J., Rhee S.-K., *Influences of supplier capabilities and collaboration in new car development on competitive advantage of carmakers*, *Management Decision*, 48, 5, 756–774, 2010, <http://dx.doi.org/10.1108/00251741011043911>.
22. Wang C.-T., Chiu C.-S., *Competitive strategies for Taiwan's semiconductor industry in a new world economy*, *Technology in Society*, 36, 60–73, 2014, <http://dx.doi.org/10.1016/j.techsoc.2013.12.002>.
23. Verma R., Jayasimha K.R., *Service delivery innovation architecture: An empirical study of antecedents and outcomes*, *IIMB Management Review*, 26, 2, 105–121, 2014, <http://dx.doi.org/10.1016/j.iimb.2014.03.002>.
24. Antonio K.W.L., Richard C.M.Y., Tang E., *The complementarity of internal integration and product modularity: An empirical study of their interaction effect on competitive capabilities*, *Journal of Engineering Technology Management*, 26, 4, 305–326, 2009, <http://dx.doi.org/10.1016/j.jengtecman.2009.10.005>.
25. Chumaidiyah E., *The Technology, Technical Skill, and R&D Capability in Increasing Profitability on Indonesia Telecommunication Services Companies*, *Procedia Economics and Finance*, 4, 110–119, 2012, [http://dx.doi.org/10.1016/S2212-5671\(12\)00326-7](http://dx.doi.org/10.1016/S2212-5671(12)00326-7).
26. Ajitabh, A. and Momaya, K. (2004), “Competitiveness of firms: review of theory, frameworks and models”, *Singapore Management Review*, Vol. 26 No. 1, pp. 45-61.
27. Dougherty, S. M., Herd, R. and Chalaux, T. (2009). “What is Holding Back Productivity Growth in India? Recent Micro evidence.” *OECD Journal: Economic Studies* .Volume 2009
28. Barnano A. M. (2005), Getting innovation Technology, *Revista Brasileira Journal*, v. 4, n. 1, 57–96.
29. Hii, J., Neely, A. (2000), Innovative capacity of firms: on why some firms are more innovative than others, *International Annual Europa Conference*, 7, Ghent, Proceedings, Brussels: Euroma,