

Institutions and Innovation

Kaushalesh Lal*

and

Shampa Paul

ABSTRACT

New ideas and value creation applications may translate into incremental changes such as the introduction of additional features in a consumer product leading to innovation. In this paper we investigate the relationship between innovation activities and firm performance and identify factors that influence innovation related to product quality. In order to investigate the role of institutional support in innovation activities of MSMEs of ICT clusters, primary data from firms located in the industrial clusters of National Capital Region has been used. In addition to traditional variables representing size and CEO characteristics, the study includes variables representing innovation strategies. The results show that firm specific characteristics influence innovation activities and supporting institutional policies stimulate innovation, a result that is in accordance with recent propositions in the literature.

Keywords: Innovation strategies; Institutions; Quality consciousness; MSME; Discriminant analysis; India

*Corresponding author, E: lal@merit.unu.edu. Authors are Professor and Associate Professor (shampa.paul147@gmail.com) at Society for Development Studies, Core 6A, 2nd Floor, India Habitat Center, Lodi Road, New Delhi – 110003.

1. Introduction

Micro, Small and Medium enterprises (MSMEs) play a pivotal role in the industrial economy of developing countries particularly India. MSMEs are considered as engines of growth and every country has adopted some policy instruments to assist them. MSMEs in India constitute more than 90% of the total industrial enterprises and support industrial development (Profile of MSME, 2013). They are credited with generating the highest rates of employment growth and also account for a major share of industrial production (45%) and exports (40%) [ibid]. With globalization, there is an urgent need of a dynamic and self-sustaining culture of innovation and cluster based approach for the development of MSMEs. The world economy being characterized as a 'Knowledge-Based Economy' with knowledge as the most important resource and learning being the most important process (Moreno, 1997; Lal, 2004; Peres and Stumpo, 2000; MSME and FICCI, 2012).

The MSMEs in India are defined² as per MSMED (Micro, Small and Medium Enterprises Development) Act 2006, based on their investment in plant and machinery (for manufacturing enterprise) and on equipment for enterprises providing or rendering services. For manufacturing enterprise, a micro firm is that in which the investment in plant and machinery does not exceed INR 2.5 million; a small firm is where the investment in plant and machinery does not exceed INR 50 million and a medium enterprise is where the investment in plant and machinery does not exceed INR 100 million. In case of services, a micro enterprise involves investment in plant and machinery that does not exceed INR 1.0 million; a small enterprise where the investment does not exceed INR 20 million and a medium enterprise where the investment in equipment does not exceed INR 50 million (Lal and Paul, 2013).

In this globalized world, knowledge and intellectual skills are critical to create and improve products and services, develop more efficient distribution and marketing methods and ensure customer satisfaction. Competitive advantage is more derived from the ability of organizations and societies to generate ideas and to translate them into

² The Gazette of India, Extraordinary, Para II, Section 3, Sub-section (ii), New Delhi, September 30, 2006, Government of India.

economic value while it is equally derived from access to physical resources. New ways of information management and application are used to improve competitiveness. A knowledge economy is not about accumulating information, but using knowledge to improve performance. And that performance can be enhanced with innovation. Innovation is thus regarded as one of the most important factors in the Knowledge-Based Economy. This has become the driving force behind expanding global commerce and the rise in living standards (Chaminade and Vang, 2008; MSME and FICCI, 2012).

Innovations refer to the creation and application of a new idea to create value in a certain context. Some of these ideas and value creation applications may translate into incremental changes such as the introduction of additional features in a consumer product; while others may lead to radical or even revolutionary changes - such as the launch of the PC or the iPod. As global competition intensifies and information-based innovation becomes more important, the business sector has been internationalizing knowledge-intensive business functions, including R&D. Various companies are increasingly opening their innovation processes, their collaboration with external partners including suppliers, customers and universities. Thus creating effective collaborative innovation ecosystems is vital for enhancing access to knowledge from around the globe and speeding up the conversion of that knowledge into value added products and services. Institutions and the environment matter a lot for innovation at the industrial level. Hwang and Powell (2005) view institutional change as the necessary and essential aspect in formulating laws that enable the efforts made to work in R & D activities necessary for innovation. Institution helps in altering the constraints in R & D and structures the incentives in industries to direct economically productive activities. New opportunities open up as emerging economies undertake the shift towards an open market (Nee, 1996), but we still lack an understanding of which shifts are more important for increasing technological innovation.

It is argued by Williamson (2002) that institutions play a critical role and their autonomy needs to be recognized in influencing innovation. Institutions are mainly concrete entities related to the production or diffusion of innovation as universities, research institutes, prevailing patent laws, public programs or technical societies (Nelson,

2008). Contributions from institutions can help firms to choose an innovation strategy, where new products can be introduced from existing knowledge base, or by exploring new areas outside of its current knowledge-base (or a combination of the two). Proper institutional support and changes in the external knowledge environment (induced through public R&D), is expected to impact firms that are already involved in innovation activities. However, shifts in the external knowledge environment may be expected to have greater impact on new firms still in the process of choosing whether an innovation strategy is more attractive than alternative strategic positions. Institutional support is another important element for MSMEs' innovation. Government through regulation can both encourage and discourage the adoption of innovation. As a result, institutional policies are important factors in innovation activities of an economy (Barbosa and Faria, 2011).

The innovative strategies of MSMEs are attributed to both internal and external factors. Internal variables refer to characteristics and strategies of MSMEs and external variables refer to environment impact on MSMEs' innovation activities. The internal factors are determined by MSMEs' specific resources and technology competencies, quality consciousness, innovation strategies and entrepreneurship. New innovation knowledge development should adopt a variety of strategies and make sure which strategic options can be optimally matched. Human resource and its capabilities play major role in establishing special competitiveness.

While several researchers (Lal, 2004; Barbosa and Faria, 2011) have studied the association between innovation and institutional support in general, this paper specially focuses on a particular sector. The main objectives of the study are:

1. To examine the role of institutional support in innovation activities of firm.
2. To identify factors that influence innovation related to product quality.
3. To investigate the relationship between firm performance and innovation activities.

The remainder of the paper is organized as follows: Section 2 contains literature review while Section 3 describes the theoretical framework of the study. The data and methodology is described in Section 4. The hypotheses have been formulated in Section 5

while empirical results and discussions are presented in Section 6. The conclusions have been drawn in Section 7.

2. Literature review

A literature review on the topic is presented in this section. There is substantial evidence to show that a large number of SMEs in a wide variety of sectors do engage in technological innovations, and that these innovations are likely to be an important determinant of their success in performance. A study by Hashi and Stojčić (2013) evaluates the impact of innovation on firm performance. Their findings reveal a positive relationship between innovation activities and productivity. Firms decide to engage in innovation and on how much to invest under pressure of competition. In making these decisions firms rely on the knowledge accumulated from previous innovations and cooperation with other firms and institutions and other members of their group. Koellinger (2008) analyzes the relationship between the usage of Internet-based technologies, different types of innovation, and performance at the firm level. He found that firms relying on Internet-enabled innovations are equally likely to grow as firms that rely on non-Internet-enabled innovations. It was also found that all innovation in Internet-based product or process is positively associated with turnover and employment growth and innovation activity is not necessarily associated with higher profitability. Nassimbeni (2001) study shows that the propensity of small units on export performance is strictly linked to their ability to innovate the product and develop valid inter-organisational relations, while it is less related to other technological factors namely, manufacturing, quality control, management, design, communication, handling, storage technologies of the firm. A paper by Chudnovsky, López, and Pupato (2006) contributes to the analysis of the determinants of innovation outputs and their impacts on manufacturing firms' productivity in developing countries. The results indicate that in house R&D and technology acquisition expenditures have positive payoffs in terms of enhanced probability of introducing new products and/or processes to the market. According to Yam, Lo, Tang and Lau (2011) the dual role of knowledge intensive business services acts as both sources of and bridges for innovation in the regional innovation system. The results also show that externally available information affects all innovation capabilities of the firm, while organizations

affect only the firm's R&D and resources allocation capabilities to achieve global competitiveness. Lee, Park, Yoon and Park (2010) focuses their article on the concept of open innovation in the context of SMEs and finds the role of input of an intermediary in facilitating innovation in Korean SMEs'. Their research results support the potential of open innovation for SMEs, and indicate networking as one effective way to facilitate open innovation among SMEs.

It is essential for the firms to be more quality-conscious to enhance their competitiveness. In order to enhance the quality of the output of firms on par with world class markets, there is a need to use continuous improvement strategies. Hence to achieve process improvement and introduce new products, quality consciousness is essential. In this regard, a study by Hanif and Manarvi (2009), based on 38 SMEs from Pakistan, Britain and Portugal, focuses on investigating quality initiatives implemented by SMEs and its innovation. They found that local SMEs considered profitability and quality as their key strategic parameters. Spanos and Voudouris (2009) examine the trajectories of advanced manufacturing technology (AMT) adoption in three categories of stand-alone, intermediate, and integrated technologies of manufacturing. The study is based on a sample of 87 Greek manufacturing SMEs and it was found that AMT adoption follows an incremental progression from the least complicated through intermediate to integrated technologies and an increase in the firms' quality and flexibility capabilities induces them to adopt AMT.

For creating competitive advantage in the market, it is necessary for small firms to be creative and innovative. Human capital is innovative organization's most vital component. According to Gupta and Singhal (2012), innovative firms carefully analyze personal needs and hire creative people to fulfill organizations' goal. They put into place adequate appraisal system and implement reward systems to recognize and boost employee creativity. A study by Marcati, Guido and Peluso (2008) conceptualizes innovativeness at two levels i.e. general innovativeness, the degree of openness to newness and specific innovativeness, the predisposition to be among the firsts to adopt innovations in a specific domain. They found that entrepreneurs' innovativeness and human personality play a key role in the adoption of innovations in Small- and Medium-sized Enterprises (SMEs). Another study by Macpherson and Holt (2007) found

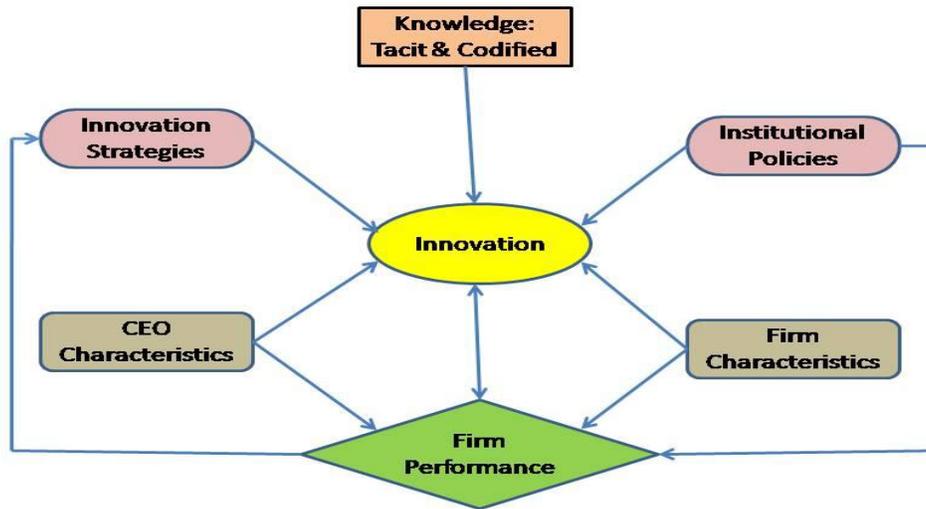
empirical evidence of knowledge and growth in small firms and indicate that knowledge networks, human and social capital facilitate growth.

The institutions are a key to economic growth and the distribution of resources and development of better markets. This issue is important particularly in the developing world, where market failures are pervasive and so the role of institution in innovation is all the more essential. A paper by Hadjimanolis and Dickson (2001) analyses the concept of national innovation policy (NIP) for small developing economies of Cyprus and highlights the importance and need of NIP for small firms. Bala Subrahmanya (2012) concludes that institutional policy to support SMEs is needed to offset the internal technical deficiencies of innovative SMEs by providing proper policies regarding production and infrastructure for firms at different stages of their life-cycle. A study by Mayer-Haug, Read, Brinckmann, Dew and Grichnik (2013) concludes that growth of firms, number of employees and sales outcomes are significantly related to planning human skills. Also it was found that entrepreneurial talent is more relevant in developing economies. Monreal (2010) argues that relatively autonomous decentralized local development is viable in a centralized economy where local institutions can lead to more effective development necessary for innovative activities. Paraskevopoulou (2012) explores the role of regulation for innovation and innovation policy by emphasizing the importance of non-technological regulatory effects for innovation and their potential as an input for innovation policy. She found that regulatory policy can contribute to the achievement of targets set by innovation policy while innovation policy measures can facilitate the negative regulatory implications for innovation. Chaminade and Vang (2008) highlights the need to adopt a flexible and accommodative institutional policy that takes into account the changes in the needs of the indigenous firms, the endowments of the regional innovation system and the international networks. According to Tödting and Trippel (2005) there is no 'ideal model' for innovation policy as innovation activities differ strongly between central, peripheral and industrial areas. The regional innovation policies adopt best practice models derived from high-tech areas and well performing regions. Other literatures (Barbara and Faria, 2011; Hwang and Powell, 2005; North, 1990) find evidence of the role of supporting institutions in innovation intensity in several industries across different countries.

3. Theoretical framework

In the present era of globalization, innovation policies are major factors that determine the success of a firm. This is particularly relevant for MSMEs. The association between innovation policies and performance of firms is stronger in sectors like ICT where product obsolescence rate is very high. Thus based on theoretical arguments and empirical findings of earlier studies, an analytical framework used in the study is depicted in Figure 1.

Figure 1: Analytical Framework



The figure shows that knowledge, both in tacit and codified form influences innovation which is shown by unidirectional arrow between knowledge and innovation. There is a bidirectional association between innovation and firm performance indicating that both the entities influence each other. Innovation is also dependent on innovation strategies of firms such as employing high skilled workers with good communication skill who can market the new products effectively. In case of MSMEs, sometimes supporting institutions and their policies play an important role in innovation activities of firms. This relationship is indicated by unidirectional arrow between institutional policies and innovation. Evidence of this is provided by many authors (Hadjimanolis and Dickson, 2001; Monreal, 2010; Bala Subrahmanya, 2012) that effective innovation policies are necessary for MSMEs in developing economies. On the other hand, firm performance and innovation are influenced by CEO characteristics such as CEO education and age. Firm characteristics namely, firm age also influences both these entities. Many times innovation strategies are also influenced by the firm performance. In fact the association between performance of firm and innovation strategies is mutually reinforcing suggesting that innovation strategies are influenced by better performance in turn innovation strategies leads to better performance through new products or modified products. The institutional policies affect the firm performance both directly and

indirectly. Direct influence of institutional policies on performance can be visualized in terms of marketing or financial support which is highly relevant for MSMEs. It is clear from Figure 1 that the association between innovation and performance of firms is very complex. Hence we have preferred statistical analytical technique rather than econometric one.

4. Data and methodology

This study is based on a primary data from firms located in the industrial cluster of Gurgaon and NOIDA. Both the clusters are located near the national capital New Delhi. Gurgaon and NOIDA are dominated by new technology firms and are major industrial clusters around Delhi. The sample firms of the study consists of 50 firms each from Gurgaon and NOIDA and all the firms belong to the category of MSMEs. All these are the member firms of National Association of Software and Services Companies (NASSCOM). The survey was conducted during September 2010 and January 2011 and a semi-structured questionnaire was used to collect data from the sample firms.

Data on various indicators such as firm performance, innovation, CEO characteristics like age, educational qualification and others were collected. The variables, namely; sales turn over and profit before tax are measured in INR millions. For analysis, communication skill is used as a proxy for innovation enablers. The respondents were asked to provide information about the role of communication skill on 10 point Likert-scale with 1 'non-competitor' and 10 'very strong competitor'. The factors contributing to the competitive edge of the firms which is measured as the quality consciousness have been taken as an indicator for evaluating innovation. Again the respondents were asked to provide information on a 10 point Likert-scale for other two variables namely, main competitor firm and quality consciousness of firms with 1 'un important' and '10 'very important'. Accordingly, all the firms are grouped into three categories, i.e. firms which consider quality as most important, very important and moderately important.

The supporting institutional policies and infrastructure development also play an important role in firm's innovation activities. The possibility of getting such support is through membership of Software Technology Parks of India (STPI). In order to promote

exports of software, the STPI was set up in 1991 under the Department of Electronics and Information Technology, Ministry of Communications and Information Technology, Government of India. It is an export oriented scheme for the development and export of computer software, including export of professional services. It has a special focus on SMEs software industry. The exports during 2010-11 by STPI registered units were INR 2,152,640 millions³. As of now, there are 51 STPI centres across the country to provide a major boost to the IT and IT enabled services (ITES) exports. The member firms are provided incentives like exemption from income tax of export profits, on customs duty, service tax etc. Members are also ensured access to latest technological infrastructure.

STPI centers also provide variety of services, which includes –

- High Speed Data Communication: The member firms get various data protection and business continuity facilities. Different remote backup services like tape, disk, server, NAS etc. are also provided.
- Incubation facility: In order to facilitate the entrepreneurs to kick-start their operations, seed money, office space, etc. are provided.
- Consultancy: The firms are provided project management and other consultancy services both at national and international level.
- Network Monitoring, Data Center, Data Hosting etc.: The members are provided dedicated telecommunication networks with maximum security and reliable transmission. They are also provided cost effective solutions on international communication.
- Training: It helps the member firms by providing export promotional activities such as technology assessments, market analysis, market segmentation and also to organize workshops, exhibitions, seminars, conferences etc.

Due to the mutual association of entities i.e. institutional policies and innovation strategies influencing innovation which in turn is affecting the firm performance while firm performance is influenced by CEO and firm characteristics as depicted in Figure 1.

³ http://en.wikipedia.org/wiki/Software_Technology_Parks_of_India

This association limits the analysis to application of discriminant technique and therefore any other econometric technique such as regression could not be used. Thus, the study uses the stepwise multivariate discriminant technique to identify characteristics of firms that discriminate quality conscious firms from the rest. The discriminant analysis is used in cases where a random sample of observations, belonging to different groups (here, most important, very important and moderately important product quality), is drawn and a procedure is set up (in terms of measured characteristics) to differentiate them and allocate each observation its respective group membership so as to minimize the probability of misclassification.

5. Hypotheses

Existing literature suggests that innovation at the firm level is a function of firms' characteristics such as age, quality consciousness, market preference etc. As depicted in the analytical framework, there is a strong relationship between the firms' characteristics and innovation behaviour. The role of supporting institutions in innovation activities of MSMEs is very critical. The hypotheses related to firms' characteristics, role of supporting institutions, innovation activities and quality consciousness of firms are formulated in this section.

H1: The institutions are expected to play a critical role in innovation activities of MSMEs.

Several studies have been carried out on innovation and institutional support. Most of these studies suggest that the innovation activities of firms are successful due to supporting institutions in key technologies over time (Freeman, 1987; Dosi et al., 1988; Lundvall, 1992; Nelson, 1988). Another study by Barbosa and Faria (2011) highlights the importance of institutions in explaining differences in the intensity of innovation in manufacturing industries of EU member countries. The findings also point out the relevance of industry specific effects and their interactions with institutions in order to influence innovation. The outstanding innovation performance of newly industrializing countries suggests that institutional policy plays a central role in the innovation process

of firms because it facilitates innovation activities through its impact on learning and innovation (Nelson and Pack, 1999; Kim and Nelson, 2000). Firms that are more quality conscious are expected to focus their innovation activities towards product quality. In order to attain the required targets, MSMEs are forced to improve their products and services. One way to achieve this could be through innovation and product quality. This could lead to better performance of firms. Hence we argue that more quality conscious firms can achieve their targets with active support of institutions.

H2: Firm specific characteristics are expected to differentiate firms based on their quality consciousness.

In general old firms follow different technological trajectory and are likely to be less innovative compared to new firms. In this context, a study by Balasubramaniam and Lee (2008) found that firm age is negatively related to technical quality, and that this effect is greater in technologically active areas. However, these findings cannot be generalized because technological innovations depend on maturity and obsolescence of the technology. The technology considered in this paper is relatively new and accumulated knowledge is expected to drive innovation activities. Hence older firms are expected to capitalize their experience and are likely to be more innovative and quality conscious. Firms' characteristic is represented by age of firm in this study. Hence we hypothesize that older firms are likely to be more innovative than the rest.

H3: Quality conscious firms are expected to perform better than the rest of firms.

The firms' that consciously and explicitly develop and invest in innovation capability are likely to be quality conscious and have a higher likelihood of achieving sustainable innovation outcomes as the engine of their business performance. According to Lawson and Samson (2001), for higher performance of firms, their approach needs to be more than "black-box" solution to innovation as they need to adopt a holistic approach. Bala Subrahmanya, Mathirajan, and Krishnaswamy (2010) focused their study on both product and process innovations in the auto and electronics sectors and process innovations in the machine tool sector. They conclude that SMEs innovations enhanced competitiveness in firms in the form of quality improvement and innovative SMEs

registered higher growth relative to non-innovative ones. We also expect that firms that are quality conscious shall perform better than the rest.

H4: Firms focusing on product quality are expected to follow different trajectory of human resource management.

Human resources are the most vital factor for firms' innovative activity. The innovation and creativity of firms are effectively managed by their best workforce. Swart and Kinnie (2003) suggest that the concept of knowledge intensive firms should be restricted to those companies that create market value through exploitation of tacit knowledge in novel circumstances via effective management of a highly qualified workforce. One of the human resource policies could be to employ workforce with better communication skill that gives an edge in marketing new innovations. In this study, the proxy used for human resource policies is to focus on persons with better communication skill. Thus it is hypothesized that quality conscious firms assign more importance to communication skill of their workforce.

6. Empirical results and discussion

The data analysis has been carried out at three levels. The firms' characteristics are presented at the first level of analysis. The second level analysis presents uni-variate results while at third level multivariate statistical technique called stepwise discriminant analysis has been used to test the hypotheses.

6.1 Firm Characteristics

As mentioned earlier the sample firms belong to MSME category. Their average employment size in 2009 was 39 persons. The average sales turnover and profit before tax in the same year were INR 18.72 millions and 4.34 millions respectively. In addition to the basic information about sample firms, it is considered important to present association between quality consciousness of firms and firm characteristics. The results are presented in the following tables.

The association between CEO education and factors contributing to the competitive edge of a firm i.e. quality consciousness is presented in Table 1.

Table 1: Education of CEO and Importance of quality

CEO Education	Importance of Quality						Total
	Moderately Important	Row (%)	Very Important	Row (%)	Most Important	Row (%)	
M.Sc					1	100.00	1
BE	2	7.69	12	46.15	12	46.15	26
MBA	3	20.00	5	33.33	7	46.67	15
M. Tech	5	8.62	26	44.83	27	46.55	58
Total	10	10.00	43	43.00	47	47.00	100

It can be seen from the table that highest percentage of CEO holding MBA degrees (46.67%) followed by M. Tech degrees (46.55%) and BE degrees (46.15%) consider the quality as most important factor that contributes to the competitive edge across the firms in NOIDA and Gurgaon. We can infer from these findings that irrespective of the educational qualification of CEOs, similar percentage of firms shared the same views on the importance of quality.

The role of supporting institutions has been measured by two variables namely, STPI membership and opinion on infrastructure development. Table 2 presents analysis of quality consciousness and opinion on infrastructure development.

Table 2: Infrastructure development and Importance of quality

Infrastructure Development	Importance of Quality						Total
	Moderate	Row (%)	Very Important	Row (%)	Most Important	Row (%)	
Moderate	5	19.23	8	30.77	13	50.00	26
Better	4	9.30	18	41.86	21	48.84	43
Best	1	3.23	17	54.84	13	41.94	31
Total	10	10.00	43	43.00	47	47.00	100

Table 2 indicates that 41.94% of MSMEs consider that high quality of infrastructure development is necessary for the competitive edge of the firms while only 3.23% of firms with moderate level of quality consciousness have same opinion about development of infrastructure. It can also be seen from the table that 26% of the firms assigned moderate

importance to infrastructure development while 74% firms opined that high quality of infrastructure is needed for competitive edge of firms. Thus it can be concluded that most of the sample firms are of the opinion that role of supporting institutions is necessary for better performance of firms which is achieved by quality consciousness of CEOs.

Another institutional variable i.e. membership of STPI is considered to be important factor for contributing to the quality consciousness of firms. The distribution of firms by STPI membership and quality consciousness is presented in Table 3.

Table 3: Membership of STPI and Importance of quality

STPI Membership	Importance of Quality						Total
	Moderate	Row (%)	Very Important	Row (%)	Most Important	Row (%)	
Members	4	5.41	32	43.24	38	51.35	74
Non-members	6	23.08	11	42.31	9	34.62	26
Total	10	10.00	43	43.00	47	47.00	100

Table 3 indicates that 51.35% STPI member firms regarded quality as most important factor for better performance while the percentage of non-STPI member firms with similar opinion was 34.62% suggesting that there is a strong association between quality consciousness of firms and STPI membership.

6.2 Univariate Analysis

The univariate analysis of the variables used in the study is presented in Table 4. It can be seen from the table that the mean values of sales turnover and profit earnings in 2009 increase with increase in importance of quality among the sample firms. Also the STPI membership, communication skill and infrastructure development of firms has an increasing effect on the importance of quality.

Table 4: Univariate analysis of variables

Variables	Importance of Quality			Label
	Moderately Important	Very Important	Most Important	
STO_2009	176.50	182.70	193.62	Sales turnover in 2009
PROFIT	40.70	42.49	44.89	Profit earned in 2009
CEO_AGE	48.70	45.53	47.55	Age of CEO

FIRM_AGE	9.50	12.35	10.55	Age of firm
M_COM_DO	3.00	2.72	2.49	Main competitor domestic firms
STPI_MEM	1.40	1.74	1.80	Membership of STPI
COMM_SKI	8.50	8.77	8.72	Communication skill
C_EDU	3.30	3.33	3.28	Education of CEO
COMM_CLN	9.30	8.19	8.72	Communication with clients
INFRA_DE	8.60	9.20	9.00	Infrastructure Development

Note: The numbers show mean value of variables in each category of importance

We collected opinion on “large domestic IT firms as main competitor”. The opinion was recorded on a five point scale ranging from 1 ‘non competitor’ to 5 ‘very strong competitor’. It can be seen from the table that more quality conscious firms assigned lower score (2.49) suggesting that they did not think large domestic IT firms are their main competitors. On the other hand less quality conscious firms gave higher importance (score 3.00) to large domestic IT firms as their main competitors. The opinions on role of communication skill and infrastructure development were collected on a ten point scale ranging 1 ‘unimportant’ to 10 ‘very important’. Surprisingly firms who were most quality conscious assigned average score (8.72) to communication skill while moderately quality conscious firms assigned higher score i.e. 9.3. On the other hand the average score on role of infrastructure increases with the quality consciousness of firms. We can infer from the table that firms who were most quality conscious assigned highest importance to infrastructure.

6.3 Discriminant Analysis

After univariate analysis, the data were subjected to multivariate framework. The results are presented in Table 5.

Table 5: Discriminant analysis

	Wilks' Lambd a	F	Sig.	Label
STO_2009	.995	0.232	0.793	Sales turnover in 2009
PROFIT	.995	0.231	0.794	Profit earned in 2009
CEO_AGE	.963	1.887	0.157	Age of CEO
FIRM_AGE	.932	3.531	0.033**	Age of firm
M_COM_DO	.932	3.524	0.033**	Main competitor domestic firms
STPI_MEM	.928	3.740	0.027**	Membership of STPI
COMM_SKI	.943	2.930	0.058*	Communication skill
C_EDU	.999	0.033	0.967	Education of CEO
COMM_CLN	.946	2.758	0.068*	Communication with clients
INFRA_DE	.943	2.931	0.058*	Infrastructure Development

Note: *→10%, **→ 5% level of significance

We included all the variables in the analysis. It can be seen from the table that six variables – age of firm (FIRM_AGE), main competitor (M_COM_DO), membership of STPI (STPI_MEM), communication skill (COMM_SKI), communication with clients (COMM_CLN) and infrastructure development emerged as significant discriminant among the three group of firms.

The age of firm, FIRM_AGE has emerged as significant discriminant that reaffirms our expectation that older firms utilize their experience favourably and assigned more importance to quality consciousness compared to other firms. The result is not surprising because owners of newer firms might have thought that the quality in software industry is meaningless concept as long as particular software performs its functions properly. However, as experienced by older firms, quality and reliability of software products is a major concern, which drives the industry.

A unique finding of this study is the emergence of significant variables such as STPI_MEM and INFRA_DE that play an important role as institutional factors. Firms get lot of advantage being member of STPI. To name a few marketing information, latest trend in the industry, technological support etc. These supporting factors are expected to contribute favourably in product quality and performance. That could be the reason for firms being members of STPI. The institutional support was found a critical factor in

performance of firms by other studies also (Rawat, 2005). The study highlights the need of congruent environment and supportive public policies as essential requirement for innovation activities of MSMEs. The findings of the study are in accordance to our hypothesis that institutions play a significant role in innovation activities of firms.

The results also show that M_COM_DO emerged significant discriminant of three types of firms. As shown in table 4 less quality conscious firms felt that large IT domestic firms were their main competitors while high quality conscious firms did not think so. Therefore, the variable emerged as significant discriminant.

The variable i.e. communication with clients measured as an innovation enabler has emerged as a significant discriminant of the three types of firms and is in accordance to earlier study by Lal and Paul (2013). CEOs might have preferred workers with better communication skill so that they can communicate with clients more effectively which in turn is expected to be helpful in marketing new or modified products. These findings are according to our expectations.

Based on a score of discriminant function, the firms were reclassified. The actual and predicted membership of the firms is shown in Table 6.

Table 6: Classification results

Importance of Quality	Actual membership	Predicted Group Membership		
		Moderately Important	Very Important	Most Important
Moderately Important	10	8 (80.0%)	1 (10.0%)	1(10.0%)
Very Important	43	7 (16.3%)	23 (53.5%)	13 (30.2%)
Most Important	47	7(14.9%)	10 (21.3%)	30 (63.8%)

Note: Classification power of the discriminant function 61.0%

It can be seen from the table that 63.8% of firms with highest level of quality consciousness were classified correctly by the discriminant function and 80% firms that considered quality as moderate factor were classified correctly. The total classification power of the discriminant function is 61%.

7. Conclusions

The paper aims at identifying and analyzing internal and external factors leading to innovation and product quality. The findings of the study are based on 100 ICT MSMEs located in NOIDA and Gurgaon. These are major industrial clusters around National Capital Region. The survey was conducted during September 2010 and January 2011. External factors represent institutional support provided by Software Technology Parks of India (STPI) and also the role of physical infrastructure providing institutions. Internal factors include innovation strategies of firms, CEO and firm characteristics. The sample firms were grouped into three categories based on the importance assigned to product quality. The first category of firms is those that considered quality as moderate factor while second category of firms is those that assigned higher importance, i.e., “Very Important” to product quality. Third group of firms is those that regarded quality as most important factor to remain competitive in the market.

Given the nature of bi-directional and mutually reinforcing relationships among various factors included in the analysis, analytical technique that does not pre-assume causality among variables is preferred. Therefore discriminant analysis is used to identify factors that discriminated three groups of firms.

The study finds the evidence that institutional support is very critical for small firms to survive and remain viable in the era of globally competitive environment. The study concludes that more quality conscious firms are members of STPI. On the other hand the majority of less quality conscious firms were not members of STPI. Findings related to the role of physical infrastructure are similar to that of membership of STPI. Both these variables are related to external factors. Based on the findings of the study we can conclude that small firms needed institutional support, a notion, contrary to general belief that growth of Indian ICT sector has been possible without any support of the government. The findings are in concurrence with earlier studies (Barbara and Faria, 2011; Hwang and Powell, 2005; North, 1990).

The results related to firm-specific innovation strategies are similar to earlier findings (Gupta and Singhal, 2012; Marcati, Guido, Peluso, 2008). Innovation strategies include hiring of workforce with better communication skills. By hiring such persons, marketability of new or modified products increases. Although the findings of the study are similar to earlier studies as far as innovation strategies are concerned, the variables that have been used as proxy of innovation strategies are unique. Such variables have been used perhaps for the first time in any empirical study.

As far as main competitors are concerned, findings of the study suggests that most quality conscious firms did not think large domestic IT firms as their main competitor and it is the other way round for first category of firms. The major reason for this behavior of firms could be that quality conscious firms are confident of facing large firms on lower product prices as the overheads of large firms are very high which is reflected in higher product costs. In case of small firms, overhead expenditures are much lower compared to large firms. Moreover, small firms usually do not deal in technology-intensive products where large firms have competence.

Age of firms was also included in the analysis. Findings of the study suggest that older firms were more quality conscious. This is against general belief that CEOs of newer firms are equipped with latest product development platform and are expected to be more conversant about software product quality and reliability. Findings of the study suggest that older firms could reap benefit of their experience and assigned more importance to quality.

We can conclude that institutional support is essential for MSMEs to remain competitive in the market. In addition to external support, firm specific strategies play an important role in survival and growth of small firms.

Acknowledgement

We would like to thank Graduate School of Engineering, Nagoya University for allowing us to use the data collected for their project. The CEOs of sample firms deserve appreciation for sparing their time and sharing data related to their firms.

References

- Balasubramanian, Natarajan, Lee, Jeongsik, 2008. Firm age and innovation. *Industrial and Corporate Change*, 7(5), 1019–1047
- Bala Subrahmanya, M. H., Mathirajan, M., Krishnaswamy, K. N., 2010. Importance of Technological Innovation for SME Growth Evidence from India UNU-WIDER Working Paper No. 2010/03, 1-21
- Bala Subrahmanya, M. H., 2012 Technological Innovation in Indian SMEs: Need, Status and Policy Imperatives available at <http://www.cuocient.com/index.php/cl/article/view/co5>
- Barbosa, Natália, Faria, Ana Paula, 2011. Innovation across Europe: How important are institutional differences? *Research Policy*, 40, 1157-1169.
- Baumol, W.J., 1990. Entrepreneurship: Productive, unproductive, and destructive. *The Journal of Political Economy*, 98(5), 893-921.
- Chaminadea, Cristina, Vang, Jan, 2008. Globalisation of knowledge production and regional innovation policy: Supporting specialized hubs in the Bangalore software industry, *Research Policy*, 37, 1684–1696
- Chudnovsky, Daniel, López, Andrés and Pupato, Germán, 2006. Innovation and productivity in developing countries: A study of Argentine manufacturing firms' behavior (1992–2001). *Research Policy*, 35(2), 266-288.
- Dosi, G., Freeman, C., Nelson, R., Silverberg, G., Soete, L. (Eds.), 1988. *Technical Change and Economic Theory*. Francis Pinter/Columbia University Press, London/New York.
- Freeman, C., 1987. *Technology Policy and Economic Performance: Lessons from Japan*. Pinter, London.
- Gupta, Ashok K., Singhal, Arvind, 2012. *Managing Human Resources for Innovation and Creativity* available in <http://utminers.utep.edu/asinghal/reports/>.
- Hadjimanolis, Athanasios, Dickson, Keith, 2001. Development of national innovation policy in small developing countries: the case of Cyprus. *Research Policy*, 30(5), 805-817
- Hanif, Aamer, Manarvi, Irfan Anjum, 2009. Influence of Quality, Innovation and New Product/Services Design on Small and Medium Enterprises. *Proceedings of the World Congress on Engineering 2009 Vol I*. available at http://www.iaeng.org/publication/WCE2009/WCE2009_pp748-751.pdf

- Hashi, Iraj, Stojčić, Nebojša, 2013. The impact of innovation activities on firm performance using multi-stage model: Evidence from the Community Innovation Survey 4. *Research Policy*, 42(2), 353-366
- Hwang, H., Powell, W., 2005. Institutions and entrepreneurship. In: Alvarez, S.A., Agarwal, R., Sorenson, Olav (Eds.), *Handbook of Entrepreneurship Research: Interdisciplinary Perspectives*. Springer, New York, pp. 201–232.
- Kim, L, Nelson, R R, 2000. *Technology, Learning, & Innovation: Experiences of Newly Industrializing Economies*. Cambridge University Press, Cambridge.
- Koellinger, Philipp, 2008. The relationship between technology, innovation, and firm performance—Empirical evidence from e-business in Europe. *Research Policy*, 37(8), 1317-1328
- Lal, K, 2004. E-Business and export Behaviour: Evidences form Indian Firms, *World Development*, 32(3), 289-309.
- Lal, Kaushalesh, Paul, Shampa, 2013. Export orientation and corporate policy during slowdown. In: Hirakawa, Hitoshi, Lal, Kaushalesh, Shinkai, Naoko, Tokumaru, Norio (Eds.), *Servitization, IT-ization, and Innovaiton Models: Two stage industrial cluster theory*. London, Routlege, pp. 150-164.
- Lawson, Benn, Samson, Danny, 2001. Developing Innovation Capability In Organisations: A Dynamic Capabilities Approach. *International Journal of Innovation Management*, 5(3), 377–400.
- Lee, Sungjoo, Park, Gwangman, Yoon, Byungun, Park, Jinwoo, 2010. Open innovation in SMEs—An intermediated network model. *Research Policy*, 39(2), 290-300.
- Lundvall, B.A. (Ed.), 1992. *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. Pinter, London.
- Macpherson, Allan, Holt, Robin, 2007. Knowledge, learning and small firm growth: A systematic review of the evidence. *Research Policy*, 36(2), 172-192
- Marcati, Alberto, Guido, Gianluigi, Peluso, Alessandro M, 2008. The Role of SME entrepreneurs' Innovativeness and Personality in the Adoption of Innovations. *Research Policy*, 37(9), 1579-1590.
- Mayer-Haug, Katrin, Read, Stuart, Brinckmann, Jan, Dew, Nicholas, Grichnik, Dietmar, 2013. Entrepreneurial talent and venture performance: A meta-analytic investigation of SMEs. *Research Policy*, 42(6–7), 1251-1273.

- Ministry of Micro Small and Medium Enterprises, FICCI, 2012. Innovation readiness of Indian SMEs - Issues and challenges. available at <http://www.ficci.com/spdocument/20144/FICCI-MSME-Summit-2012-knowledge-paper-new.pdf>
- Monreal, Pedro, 2010. The Office of the Historian of Havana: Notes on a Case of Institutional Upgrading. In: Doner, Richard F. (Ed.), Explaining Institutional Innovation: Case Studies from Latin America and East Asia, Brooklyn, Social Science Research Council, pp.19-36.
- Moreno, L, 1997. The determinants of Spanish industrial exports in European Union. *Applied Economics*, 29, 723-32.
- Nassimbeni, Guido, 2001. Technology, innovation capacity, and the export attitude of small manufacturing firms: a logit/tobit model. *Research Policy*, 30(2), 245-262
- Nee, V., 1996. The emergence of a market society: Changing mechanisms of stratification in China. *The American Journal of Sociology*, 101(4), 908-949.
- Nelson, R., 1988. Institutions supporting technical change in the United States. In: Dosi, G., Freeman, C., Nelson, R., Silverberg, G., Soete, L. (Eds.), *Technical Change and Economic Theory*. Pinter Publishers, London.
- Nelson, R R, Pack, H, 1999. The Asian Miracle and Modern Growth Theory. *The Economic Journal*, 457 (July), pp. 416-436.
- Nelson, R., 2008. What enables rapid economic progress: what are the needed institutions? *Research Policy*, 37, 1–11.
- North, D.C, 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge University Press, Cambridge.
- Paraskevopoulou, Evita. 2012, Non-technological regulatory effects: Implications for innovation and innovation policy, *Research Policy*, 41(6), 1058-1071
- Peres, W, Stumpo, G, 2000. Small and Medium sized Manufacturing Enterprises in Latin America and the Caribbean Under the New Economic Model. *World Development*, 28(9), 1643-55.
- Profile of MSME. http://www.dcmsme.gov.in/ssiindia/MSME_OVERVIEW.pdf available at on July 23, 2013.
- Rawat, Anil, 2009. Regional innovation system: STPI in the making of Bangalore as the global technology hub. available at <http://ibmtdedu.org/AnilRawat/Publications/>.

- Spanos, Yiannis E., Voudouris, Irini, 2009. Antecedents and trajectories of AMT adoption: The case of Greek manufacturing SMEs. *Research Policy*, 38 (1), 144-155.
- Swart, J., Kinnie, N., 2003. Knowledge-intensive firms: The influence of the client on HR systems. *Human Resource Management Journal*, 13(3), 37-55.
- Franz Tödting, Michaela Trippel, 2005. One size fits all?: Towards a differentiated regional innovation policy approach. *Research Policy*, Volume 34, Issue 8, October 2005, Pages 1203-1219
- Williamson, E. Oliver, 2002. The Theory Of The Firm As Governance Structure: From Choice To Contract, *Journal of Economic Perspectives*, 16 (3), 171–195.
- Yam, Richard C.M., Lo, William, Esther P.Y., Tang, Lau, Antonio K.W., 2011. Analysis of sources of innovation, technological innovation capabilities, and performance: An empirical study of Hong Kong manufacturing industries. *Research Policy*, 40(3), 391-402.