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The Role of Various Firm-specific Factors on the Innovation of Small and Medium Scale Enterprise in India

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Abstract: *The objective of the study is to identify the role of various firm specific variables on the innovation of SMEs operating in India. Indian Small and Medium-scale Enterprises (SMEs) are considered as the backbone our nation due to their multifaceted contribution towards the industrial growth, GDP, economic growth and employment generation. Though SMEs have vital role, such firms are facing severe completion from the larger firms both nationally and internationally. Innovation has become one of the best ways to solve the major challenges facing SMEs. This paper aims to find the various factors determining the types of innovation of the manufacturing SMEs operating in India. The result found that firm characteristics variables coincide with different types of innovational outputs in Indian manufacturing SMEs. The knowledge and skills acquired by entrepreneurs and workers through education and training programs help them to introduce various innovative outputs. The study also found that Medium-sized firms tend more towards innovation than Small-sized firms and the incubator SMEs are more involved in innovation-oriented activities than the established SMEs.*

Keywords: *firm specific variables, Small and Medium scale Enterprises, product innovation, Process innovation, Marketing innovation and Organizational innovation.*

INTRODUCTION

The world economy has undergone a characteristic change with knowledge, occupying an indispensable role in the production and hence termed as a knowledge-based economy. Knowledge in all its forms plays a central role in economic processes. Countries which create and manage their knowledge assets successfully perform better, organizations with high knowledge systematically performance better than the firm with less, and individuals with more knowledge get higher paid jobs. Innovation seems to have key role in this knowledge-based economy. At the macro level, innovation is considered as the major determinants of economic growth and development while at the micro-level it is the tool to enhance the competitive capacity of

the firm. Thus innovation is considered as the fuel for the growth and success of the business organization (Gaynor, 2002). Earlier studies argued that the performance and competitiveness of the organization is depends upon the ability of such firms to utilize their innovative capabilities (Voss, 1994; Bettis and Hitt, 1995; Helfat and Peteraf, 2003).

Traditionally the scope of innovation was restricted to new product development or technology management, and innovation studies are mostly carried out in larger firms only (Vossen, 1998). But the scope of innovation has widened and the studies discussion concerning to innovation has emerged as a major area of academic research. The significance of innovation in Small and Medium-scale Enterprises (SMEs) has been noted in many studies (Wolff and Pett, 1969; Brich, 1989; Gunday *et al.*, 2011; Bala Subrahmanya, 2012). The success of a small firm often depends upon the degree to which they incorporate innovation into their business strategies. According Harrison & Watson (1998) innovation is the one of the core competencies required for the growth and survival of the SMEs. Similarly, Peter F Drucker (1995) argued that innovation is the competitive weapon for SMEs. Thus, the unique features of SMEs such as flexibility, simplified organizational structure, quicker decision making power, better internal communication etc make SMEs more innovative than larger firms (Harrison and Watson, 1998; Mahemba and De Bruijn, 2003; Krishnaswamy *et al.*, 2012).

SMEs are considered as the backbone of every nation. It exerts a significant role in the economic growth and development of nations, because of their multifaceted contribution towards the employment generation, industrial production, export and the GDP of the country. As per MSME Annual report (2017). India is having more than 48 million manufacturing SMEs producing 6000 varieties of products ranging from traditional to high tech. It contributes 40 percent to total export and 17 percent to countries GDP and 45 percent to total manufacturing output. Besides that, SMEs is the second-largest sector, providing employment opportunities after agriculture. Apart from these, SMEs are considered as the seedbed for growth of many larger business firms (Johansson, 2002).

All the firms should not be innovating in the same manner. The types and levels of innovation may vary from organization to organization (Jose Silva *et al.*, 2011). The various determinants of innovation among SMEs has been widely investigated and reported in many previous studies. The internal and external drivers of innovation such as; education and prior experience of owners, age, size of the firm, R&D expenditure (Acs & Audretsch, 1998; Roper, 1997; Hadjimanolis, 2000; Romijn & Albaladejo, 2002; Bala Subramanya, 2007) employment, profit margin, training intensity,

foreign ownership (Rogers, 2004) qualified engineers and scientists, macroeconomic conditions, degree of marketing involvement (Hoffman *et al.*, 1998). Thus this paper is made an attempt to identify the effect of firm specific variables on the types of innovation of manufacturing SMEs operating in India. The paper has structured as follows;

REVIEW OF LITERATURE

The firm-level innovation is determined by various factors which may be organizational level, industry level and economy-level (Jose Silva, 2011). Earlier studies have identified various internal and external determinants of innovation. Internal factors consist of age of the firm, size of the firm, R&D investments, educational qualification of the entrepreneurs etc (Acs & Audretsch, 1988; Archibugi, Evangelista, & Simonetti, 1995; Hadjimanolis, 2000; Romijn & Albaladejo, 2002; Bougrain & Haudeville, 2002; Kim, Lee, & Marschke, 2009; Van de Vrande, De Jong, Vanhaverbcke, & De Rochemont, 2009; Carvalho, Costa, & Caiado, 2010; Jose Silva *et al.*, 2011; Mahmud & Ahmed, 2011; Milesi, Petelski, & Verre, 2011) and the external factors includes the cooperation with other firms (Romijn & Albaladejo, 2002; Santos & Teixeira, 2013), the environment or market in which the firm operates (Kim, Song, & Lee, 1993; Smolny, 2003; Abramovsky, Harrison, & Simpson, 2004; Jose Silva *et al.*, 2011). Similarly Oluwajoba *et al.* (2007) found various internal and external factors affecting the innovation of manufacturing SMEs. The internal factors include the higher academic degree, technical educational background and network relationship with other firms and the external factors includes the investments in R&D outputs from various universities and research institutions. The existence of the design office, technical qualifications of the entrepreneurs, external support are the major determinants of the technological innovation of Indian manufacturing SMEs Bala Subramnya (2011). Whereas the study of Tomi Heimonen (2012) shows that the factors such as success index, public R&D funding and turnover/employee ratio have a significant positive effect on SMEs innovation. The study also found that the age of the firm, the size of the firm and location of the operation does not have any significant role in determining innovation of SMEs. The study has argued that SMEs can increase their number of IPRs by enhancing investments in R&D. The skill of the entrepreneurs and technology acquisitions are the major important contextual factor determining innovation among SMEs in Korea. Similarly, Choi & Lim, 2017 has identified the educational qualification of the CEO's, their goal-oriented determination, competition pressure from the home market and abroad and government incentives are the major determinants of innovation of Uzbekistan and Chine's SMEs. The internal source of

knowledge has the most important influence on a firm's innovation (Sveitina & Prodan, 2008). Whereas the study of Burmaoglu & Sesen (2017) identified that both the internal and external sources of information lead to the introduction of product, service and process innovation among the SMEs in Turkey. The study of Roman & Romero (2013) listed out various firm level and individual characteristics variables affecting the product innovation of small scale firms. The individual characteristics variable includes the educational background of entrepreneurs, motivation, and degree of interpersonal trust. The firm-level variable includes the age of the firm, cooperation, proactively, risk-taking & specific innovation and growth policies. The earlier reviews have found different factors affecting innovation of SMEs in different countries. Only few studies have carried out to find the various determinants of innovation of the SMEs in India. Hence, the study aimed to find the effect of various firm specific variables on the different innovations of the manufacturing SMEs in India.

HYPOTHESIS DEVELOPMENT

Innovation studies have sought to explain why certain firms innovate more than others by identifying a number of critical success factors or determinants such as firm's size, strategy, and social capital and Technical education and previous work experience of the owners (Fritsch & Meschede, 2001; Balachandra & friar, 1997; Romijn & Albaladejo, 2002).

Age of the Firm

The associations between the firm's age, innovation and firm performance have long been debated in innovation and growth studies. The life cycle theory established the association between a firm's age and its innovation and growth characteristics. The basic assumption of the life cycle theory is that the development of new and young firm is based on innovation (Scott & Bruce, 1987; Davidson & Delmon, 1997; Churchill, 2000). The statement is more supported by findings of Bala Subrahmanya (2011) that new ventures are benefits heavily from innovation than the aged and established firms. Similarly, Rosenbusch *et al.* (2011) found that flexibility of the new firms might be a reason for them to access innovation more easily than established once. The study also found that the flexibility of the firms enables them to adopt environmental changes or induce rapid industrial changes themselves. It has been argued that new venture starts with less specialized resources but which are flexibility deployable, while matured organizations have specialized resources that enables them to operate in the existing market more efficiently (Amit & Schoemaker, 1993; Thornhile & Amit, 2003). Thus, based on the above reviews the study developed a hypothesis that;

H:1 Age of the firms has a significant effect on types of innovation of manufacturing SMEs

H:1a: Age of the firms has a significant effect on product innovation

H:1b: Age of the firms has a significant effect on process innovation

H:1c: Age of the firms has a significant effect on marketing innovation

H:1d: Age of the firms has a significant effect on organizational innovation

Size of the Firm

A contradictory result exists regarding the correlation between firms' size and innovation. Some studies argued that small firms are more innovative (Hansen, 1992; Stock, 2002; Gabsi, 2008), whereas others claimed that bigger size is considered as the major condition for making innovation (Huergo *et al.*, 2006; Laforet & Tann, 2006) Additionally, Santarelli (1990) identified that smaller firms are more tend to focus on incremental innovation, while large firms are in radical innovation. The Schumpeterian hypothesis is tested in many empirical studies that large firms tend to have resource advantage over smaller ones when it comes to exploiting new technologies (Acs & Audrestch, 1988; Cohen 1995; Santarelli & Piergiovanni 1996; Freeman & Socte, 1997; Tether, 1998; Bhattacharya & Bloch, 2004). Whereas, the study of Pla Barber, (2007) couldn't find any association between size of the firm and innovation. This inconsistent result leads to the development of the following hypothesis;

H2: Size of the firms has a significant effect on types of innovation of manufacturing SMEs

H:2a: Size of the firms has a significant effect on product innovation

H:2b: Size of the firms has a significant effect on process innovation

H:2c: Size of the firms has a significant effect on marketing innovation

H:2d: Size of the firms has a significant effect on organizational innovation

Technical Qualification of the Entrepreneurs

Earlier literature found the background knowledge of the entrepreneurs has an important role in organizational innovation. The magnitude of innovation is directly associated with the education level of the entrepreneurs Ciemleja & Lace (2008). Prior work experience and technical educational background of the entrepreneurs will probe to create innovation capabilities of small firms Bala Subramanya (2007). A similar result is found in the study of Kang & Lee (2008) that, the academic experience of the CEOs is an important determinant of innovation performance of SMEs. According

to Jun & Jin (2006), science or engineering background of the entrepreneurs is an important determinant of innovation of SMEs in China. The study of Hoffman *et al.* (1998) and Wignaraja (1998) suggested that firms should keep an adequate level of stock of technically qualified manpower to absorb new technologies, modified them, create and transfer new technological information, particularly scientist and engineers. Thus the following hypothesis is formulated;

H3:Technical qualification of the entrepreneurs has a significant effect on types of innovation of manufacturing SMEs

H:3a: Technical qualification of the entrepreneurs has a significant effect on product innovation

H:3b: Technical qualification of the entrepreneurs has a significant effect on process innovation

H:3c: Technical qualification of the entrepreneurs has a significant effect on marketing innovation

H:3d: Technical qualification of the entrepreneurs has a significant effect on organizational innovation

Qualification of the Workforce

The highly qualified employees are considered as the source of idea for innovation (Radas, 2009). Similarly, the studies of Hoffman (1998) and Romijin (2002) found that the higher proportion of qualified scientists and engineers are the major drivers of the innovation. Similarly, the skill and knowledge of the workforces positively affect firm's innovation capabilities (Radas & Bozic, 2009; Marco, 1995). The study of Frederic (2002) argued that qualified personnel are essential for SMEs for the acquisition of external knowledge. Therefore the universities are considered as the seedbed of innovation because they are supplying high skilled graduates, which are the major determinants of implementing innovative products and processes Pwc, (2010). Hence, the study assumed that;

H:4Qualification of the workforces has a significant effect on the types of innovation of manufacturing SMEs

H:4a: Qualification of the workforces has a significant effect on product innovation

H:4b: Qualification of the workforces has a significant effect on process innovation

H:4c: Qualification of the workforces has a significant effect on marketing innovation

H:4d: Qualification of the workforces has a significant effect on organizational innovation

Ownership Structure

Similarly, the ownership structure of the firm is identified as the determinant of innovation in a few studies. The study of Dary & Haruna (2013) identified that the ownership structure of the firm has a significant relationship with the innovation activities of microfinance banks in Ghana. Whereas, Hong *et al.* (2012) found that, the ownership structure does not have any impact on the technological innovation of Korean firms. In addition, the study of Caralt *et al.* (2005) identified that the high degree of ownership concentration does not favor R&D outputs. Hence the hypotheses are developed to find the impact of ownership structure on SMEs innovation.

H5: Ownership structure has a significant effect on types of innovation of manufacturing SMEs

H:5a: Ownership structure has a significant effect on product innovation

H:5b: Ownership structure has a significant effect on process innovation

H:5c: Ownership structure has a significant effect on marketing innovation

H:5d: Ownership structure has a significant effect on organizational innovation

Participation in Industrial Cluster

Industrial clusters are the group of geographically proximate firms in the same industry (Krugman, 1991). Firms in the cluster have better access to information than do other firms (Porter, 1990; Bianchi & Bellini, 1991; Harrison *et al.*, 1996). Similarly, the studies of Pascal & Mccall (1980), Burt (1987) and Rogers (1995) found that participation in clusters allows firms to make direct observation of competitors and it may lead to generate innovative outputs. Additionally, the studies of Porter (1990), Anderson (1994), Oslon (1998) and Kotler (2000) have identified that industrial clusters leads to increase enhance the depth and breadth of competition and cooperation, enables to improve the network relationship, which leads to enhance the operational performance of the organizations. Thus, this study made an attempted to test the effect of cluster participation on types of innovation. The hypotheses are developed as follows;

H6: Participation in industrial clusters has a significant effect on types of innovation of manufacturing SMEs

H:6a: Participation in industrial clusters has a significant effect on product innovation

H:6b: Participation in industrial clusters has a significant effect process innovation

H:6c: Participation in industrial clusters has a significant effect on marketing innovation

H:6d: Participation in industrial clusters has a significant effect on organizational innovation

Internal R&D investments

Other than firm-level variables, investments in R&D got the most attention as the determinants of innovation from various studies (Becheikh *et al.*, 2006) and particularly in the case of SMEs (Jong & Vermeulen, 2007). An investment in R&D is one of the most important mechanisms, other than the development of knowledge and competencies in determining the overall level of innovation (Baldwin & Hanel, 2003). The capacity of the firm to obtain external knowledge is a by-product of firms own internal R&D activities (Cohen & Levinthal, 1990; Rosenberg, 1990; Arora & Gambardella, 1994; Cassiman & Vugelers, 2002). Similarly, Escribano *et al.* (2009) identified that investment in internal R&D activities allows firms to access external knowledge more efficiently and it stimulates innovation output. The relationship between R&D investment and new product development is found in the study of Karlsson & Olsson (1998). Whereas a contradictory finding is reported by Todtling *et al.* (2009) in his study that formal research and development activities do not necessarily lead to a higher level of product or process innovation. An investment in R&D is an indicator to enhance the capacity or propensity to innovate by SMEs (Quian & Li 2003; Wolff & Pett 2006). Even though many studies have identified the relationship between R&D activities and innovation, in SMEs still requires clarification and further understandings (Raymond & St-Pierre, 2009). Thus the study developed the following hypotheses that;

H7:Internal R&D investment has a significant effect on types of innovation of manufacturing SMEs

H:7a: Internal R&D investment has a significant effect on product innovation

H:7b: Internal R&D investment has a significant effect on process innovation

H:7c: Internal R&D investment has a significant effect on marketing innovation

H:7d: Internal R&D investment has a significant effect on organizational innovation

RESEARCH METHODOLOGY

To empirically test the effect of firm characteristic variables on the types of innovation, a structured questionnaire is developed and the data were collected from the managers of the manufacturing SMEs. The questionnaire is classified into three sections, first section is deals with demographic details of the firms, and second section collects information regarding the firm specific characteristics variables. Age of the firm, size of the firm, technical qualifications of the entrepreneurs, qualification of the workforces, ownership structure, participation in industrial clusters and internal R&D investments are the firm specific variables used in the study. Final section is used to measure the types of innovation. The study classified types of innovation into four categories namely; product innovation, process innovation, marketing innovation, and organizational innovation as per OECD Oslo Manual (2005). Multinomial logistic regression technique is applied to find the effect of firm specific variables on the types of innovation by using IBM SPSS statistics 20. Four types of innovations are taken as the dependent variable and presented in categorical forma and nominal codes 1,2,3 and 4 are given for the product, process, marketing and organizational innovations respectively.

DATA ANALYSIS AND INTERPRETATIONS

Table 1
Sample profile of the data

Variables	*SD*	*Mean*	*Freq*	*%*
Investment in P&M	.490	2.40		
Small			234	60
Medium			156	40
Types of Industries	.614	2.17		
Low tech			114	29
Medium tech			231	60
High tech			45	11
Ownership structure	.789	2.256		
Sole proprietorship			84	22
Partnership			122	31
Limited Company			184	47
Educational level	.490	.602		
Technically Qualified			235	60
Non- Technical			155	40
Workers qualification	.500	.52		
Qualified			201	51
Not-qualified			198	49

contd. table 1

Variables	*SD*	*Mean*	*Freq*	*%*
Age of the firm	.420	.77		
Incubator			89	23
Established			301	77
Size of the firm	.728	1.76		
Less than 50			160	41
51-100			162	42
More than 100			68	17
Nature of firms				
Pharmaceutical			30	7.7
Food and Beverages			31	7.9
Textiles			34	8.7
Iron and Steel			42	10.8
Electrical and Electronics			25	12.1
Paper and Pulps			43	11
Footwear			32	6.4
Transport Equipment			36	9.2
Chemicals excluding Pharma			37	9.5
Fabricated and Metal products			33	8.5
Rubber and Plastics			47	8.2

No. of Observation: 390

An overview of the sampling profile (Table 1) shows that the majority (60 percentages) of the sampled firms is small scale enterprises and similarly most of the firms are coming under low tech industrial classification. Nearly Fifty percentages of the firms' are limited companies followed by the partnership and sole trader firms. More interestingly most of the entrepreneurs are technically qualified and fifty percentages of the worker forces having at least one bachelor's degree. The table also shows that the

Table 2
Correlation analysis

	TI	*OS*	*TE*	*R&D*	*Age*	*Size*	*WQ*	*IC*
TI	1	-.279**	.309**	-.312**	.006	-.147**	-.020	-.336**
OS		1	-.241**	.359**	.254**	.414**	.133**	.404**
TE			1	-.409**	.045	-.112*	.156**	-.424**
R&D				1	.084	.206**	-.147**	.754**
Age					1	.143**	-.063	.055
Size						1	.193**	.254**
WQ							1	-.043
IC								1

TI: Types of Innovation, OS: Ownership structure, TE: Technical qualification, R&D: Internal Rand D, WQ: Workers qualifications, IC: Industrial clusters participations.

majority (77 percentages) of the SMEs are established firms and nearly Ninety percentages of the SMEs having employees less than 100. It is also clear from the table that, the industries like Iron & Steel, Electrical & Electronic and Rubber & Plastic are the most common type of manufacturing SMEs in Indian.

CORRELATION ANALYSIS

The correlation result (Table 2) shows that the variables such as technical qualification of the entrepreneurs, ownership structure, internal R&D, size of the firm and workers qualification have a significant positive relationship with types of innovation. Since the correlations between independent variables are not high, the problem of multicollinearity does not exist. The results of multinomial logistic regression analysis are given in the following tables (Table 2, 3, 4, 5 and 6). The insignificance value of Pearson shows that the model is fit for further analysis and the Chi-square value also shows the overall fit of the model. The Nagelkerke value shows that 46 percent of the variation in types of innovation is explained by firm characteristics and linkage variables.

Table 3 reveals the result of the determinants of types of innovation with respect to Product innovation. The table explains that firm characteristic variables such as the qualification of the workforces, size of the firm, participation in industrial clusters have the probability to increase the likelihood of process innovation with respect to product innovation. Whereas the qualification of the workforces, industrial cluster participation, R&D investments, and ownership structure are the firm level variables affecting marketing and organizational innovations with respect to product innovation. Internal R&D investment has the highest probability to increase all types of innovation.

Table 4 explains the drivers of the types of innovation with respect to process innovation. The table reveals that the technical qualification of the entrepreneurs has the probability to introduce product innovation among SMEs. While participation in industrial clusters shows a significant positive impact on marketing innovation.

Table 5 shows the determinants of types of innovation with respect to marketing innovation. The table depicts that, ownership structure has a significant effect of the introduction of process and organizational innovations with respect to the marketing innovation.

Table 6 shows the determinants of types of innovation with respect to organizational innovation. The table explains that firms' size and technical

Table 3
Determinants of types of innovation with respect to Product innovation

	Process Innovation			*Marketing Innovation*			*Organizational Innovation*		
Predictive variables	*B*	*Wald*	*Exp (B)*	*B*	*Wald*	*Exp (B)*	*B*	*Wald*	*Exp (B)*
Size	0.94	4.38	2.57(.036)*	-0.21	0.14	0.81(.706)	-0.87	2.88	0.42(.089)
Age (Incubators)	0.08	0.03	1.08(.869)	0.62	1.62	1.86(.203)	-0.62	1.51	0.54(.219)
Tech_Qualification	-1.03	5.27	0.36(0.22)	-0.26	0.30	0.77(.582)	-1.58	11.32	0.21(.001)
Workers Qualification	1.10	6.50	3.01(.011)*	0.82	3.28	2.26(.070)**	1.32	8.60	3.73(.003)*
Industrial Cluster	1.67	9.02	5.33(.003)	2.88	16.96	17.88(.000)*	1.47	6.95	4.36(.08)**
Ownership structure									
Sole trader	0.83	1.39	2.30(.238)	1.01	2.05	2.75(.152)	1.45	4.10	4.25(.043)*
Partnership	0.68	2.01	1.98(.157)	-0.38	0.46	0.69(.449)	1.19	5.97	3.28(.015)*
Internal R&D	1.96	9.36	7.12(.002)*	1.85	7.94	6.35(0.005)	2.46	12.21	11.70(.000)*

Cox and Snell *0.432,* *Pearson* *0.200*
Nagelkerke *0.462,* *Chi-square* *220.354 (.000)**

Table 4
Determinants of types of innovation with respect to Process innovation

	Process Innovation			*Marketing Innovation*			*Organizational Innovation*		
Predictive variables	*B*	*Wald*	*Exp (B)*	*B*	*Wald*	*Exp (B)*	*B*	*Wald*	*Exp (B)*
Size	-0.08	0.03	0.92(.876)	-0.28	0.32	0.75(.415)	-0.94	4.38	0.39(.036)
Age (Incubators)	-0.08	0.03	0.92(.869)	0.54	2.22	1.72(.136)	-0.70	3.55	0.50(.059)
Tech_Qualification	1.03	5.27	2.81(.022)*	0.77	4.56	0.75(.415)	-0.55	2.25	0.58(.133)
Workers Qualification	-1.10	6.50	0.33(.011)	-0.29	0.66	0.75(.415)	0.22	0.46	1.24(.500)
Industrial Cluster	-1.67	9.02	0.19(.003)	1.21	3.67	3.35(.055)**	-0.20	0.21	0.82(.650)
Ownership structure									
Sole trader	-0.83	1.39	0.44(.238)	0.18	0.15	1.20(.703)	0.62	1.80	1.85(.179)
Partnership	-0.68	2.01	0.51(.157)	-1.06	5.62	0.35(.018)	0.50	2.07	1.66(.179)
Internal R&D	-1.96	9.36	0.14 (.002)	-0.11	0.03	0.89(.855)	0.50	0.57	1.64(.451)

Cox and Snell	*0.43,*	*Pearson*	*0.200*
Nagelkerke	*0.462,*	*Chi-square*	*220.354 (.000)**

Table 5
Determinants of types of innovation with respect to Marketing innovation

	Product Innovation			*Process Innovation*			*Organizational Innovation*		
Predictive variables	*B*	*Wald*	*Exp (B)*	*B*	*Wald*	*Exp (B)*	*B*	*Wald*	*Exp (B)*
Size	0.21	0.14	1.23(.706)	0.28	0.32	1.33(.575)	-0.66	1.59	0.52(.207)
Age (Incubators)	-0.62	1.62	0.54(.203)	-0.54	2.22	0.58(.136)	-1.24	9.61	0.29(.002)
Tech_Qualification	0.26	0.30	1.30(.582)	-0.77	4.56	0.46(.415)	-1.32	11.84	0.27(.001)
Workers Qualification	-0.81	3.28	0.44(.070)	0.29	0.66	1.33(.415)	0.50	1.84	1.65(.176)
Industrial Cluster	-2.88	16.96	0.06(.000)	-1.21	3.67	0.30(.055)	1.41	4.88	0.24(.027)
Ownership structure									
Sole trader	-1.01	2.05	0.36(.152)	-0.18	0.15	0.84(.703)	0.43	0.77	1.54(.379)
Partnership	-0.38	0.46	1.46(.499)	1.06	5.62	2.88(.018)*	1.57	11.56	4.79(.001)*
Internal R&D	-1.85	7.94	0.16(.005)	0.11	0.03	1.12(.855)	0.61	1.84	1.84(.382)

Cox and Snell	*0.432,*	*Pearson*	*0.200*
Nagelkerke	*0.462,*	*Chi-square*	*220.354 (.000)**

Table 6
Determinants of types of innovation with respect to Organizational innovation

	Product Innovation			*Process Innovation*			*Marketing Innovation*		
Predictive variables	*B*	*Wald*	*Exp (B)*	*B*	*Wald Exp*	*(B)*	*B*	*Wald*	*Exp (B)*
Size	0.87	2.88	2.37(.089)**	0.94	4.38	2.57(.036)*	0.66	1.59	1.93(.207)
Age (Incubators)	0.62	1.51	1.86(.219)	0.70	3.55	2.10(.059)**	1.24	9.61	3.47(.002)*
Tech_Qualification	1.58	11.31	4.86(.001)*	0.55	2.25	1.73(.133)	1.32	11.17	3.75(.001)*
Workers Qualification	-1.32	8.60	0.28(.003)	-2.15	0.46	0.81(.500)	-0.50	1.84	0.61(.176)
Industrial Cluster	-1.47	6.95	0.23(.008)	0.20	0.21	1.22(.650)	1.41	4.88	4.10(.027)*
Ownership structure									
Sole trader	-1.45	4.1	0.23(043)	-0.62	1.80	0.54(.179)	-0.43	0.77	0.65(.379)
Partnership	-1.19	5.97	0.30(.015)	-0.51	2.07	0.60(.150)	-1.57	11.56	0.21(.001)
Internal R&D	-2.64	12.21	0.088(.00)	-0.50	0.57	0.61(.451)	-0.61	0.76	0.54(.382)

Cox and Snell	*0.432,*	*Pearson*	*0.200*
Nagelkerke	*0.462,*	*Chi-square*	*220.354 (.000)**

Table 7
Consolidated Results of Multinomial Logistic Regression

	Product Innovation			*Process Innovation*			*Marketing Innovation*			*Organizational Innovation*		
Predictive variables	*B*	*Wald*	*Exp (B)*	*B*	*Wald*	*Exp (B)*	*B*	*Wald*	*Exp (B)*	*B*	*Wald*	*Exp (B)*
Size of the firm	0.87	2.88	2.37(.08)*	0.94	4.38	2.57(.03)*	—	—	—	—	—	—
Age of the firm	—	—	—	0.70	3.55	2.10(.06)**	1.24	9.61	3.47(.02)*	—	—	—
Tech_Qualification	1.58	11.31	4.86(.01)*	—	—	—	1.32	11.17	3.75(.00)*	—	—	—
Workers Qualification	—	—	—	1.10	6.50	3.01(.01)*	0.82	3.28	2.26(.07)*	1.32	8.60	3.73(.03)*
Industrial Cluster	—	—	—	—	—	—	2.88	16.96	17.88(.00)*	1.47	6.95	4.36(.08)**
Ownership structure	—	—	—	1.06	5.62	2.88(.02)	—	—	—	1.45	4.10	4.25(.04)*
Internal R&D	—	—	—	1.96	9.36	7.12(.00)	1.85	7.94	6.35(.05)*	2.46	12.21	11.70(.00)*

Cox and Snell *0.432,* *Pearson* *0.200*
Nagelkerke *0.462,* *Chi-square* *220.354 (.000)**

qualification of the entrepreneurs are the major organizational level determinants of product innovation with respect to organizational innovation. Whereas the size and age of the firm lead to increase the probability of increasing process innovation and age of the firm, technical qualification of the workers and participation in industrial clusters are the firm level determinants of marketing innovation.

Table 7 explains the consolidated result of multinomial logistic regression analysis. Size of the firm, technical qualification of the entrepreneurs is the firm level variables affecting product innovation of SMEs. Similarly, the variables such as firms' size, firms' age, workers qualification, participation in industrial clusters and investments in R&D are the firm level factors of process innovation. Interconnections with competitors, research institutions, and technical institutions are the linkage variables determined process innovation among SMEs in India. The table also shows that marketing innovation is determined by the organizational level variables such as firms' age, technical qualification of the entrepreneurs, qualifications of the workforces, participation in industrial clusters and investments in R&D activities and linkage variables such as interconnection with competitors, research institutions and technical institutions. Similarly, qualification of the workforces, participation in industrial clusters, ownership structure and investment in R&D are the firm level drivers of organizational innovation.

DISCUSSION OF THE RESULTS

The study is attempted to find the various determinants of types of innovation among manufacturing SMEs in India. The result reveals that firm characteristics variables and interconnections with various external partners coincide with different types of innovational outputs of manufacturing SMEs in India.

Determinants of product innovation

Table 7 explains that the technical qualification of the entrepreneurs and the sizes of the firm have the probability of introducing product innovation. It means that the technical background knowledge of the entrepreneurs leads to the development of new and improved products. Hence the hypothesis H:1a is accepted. The result is consistent with the result of (Hoffman et al, 1998; Mckenzie & Woodraff, 2009; Bala Subrahmnay, 2011; Faloye Olaleye Dotan 2015) that educational background and prior work experience of the entrepreneurs facilitate innovation in small scale enterprises. The result is more supported by Romijn & Albaladejo (2001)

that, educational profile of the entrepreneurs can contribute to the innovation capabilities of the firm. Additionally, the academic qualification of the CEO's is positively and significantly affects the firm's innovation outputs (Kang & Lee, 2008). The size of the firm is another firms characteristic variable affecting the likelihood of introducing product innovation in SMEs. The result is in line with the Schumpeterian theory of course within precincts of SMEs wherein it has been found that Medium-sized firms tend more towards than Small sized firm. Thus the study accepts the hypothesis H:2a that, size of the firm has significant effects on product innovation. The result is inconsistent with the result of Avermaete *et al.* (2004) that the size of the firm is independent of product innovation.

Determinants of process innovation

Firm size, qualification of the workforces, ownership structure and internal R&D are the firm characteristic variables affecting process innovation of manufacturing SMEs. The significant effect of the size indicates that larger firms may have a better way of producing goods and services because of their scaling advantages. Hence, the study supported the hypothesis H:2b that, size of the firms has a significant effect on process innovation. The result is agreed with the earlier study of Sylvie Laforet (2009) that, size of the firm has a positive impact on the process innovation and the study argues that large firms invest, substitute and update machinery and equipment more than small-sized firms. Whereas, a conflicting result is found in the study of Tessa Avermaete (2003) that, process innovation is independent of company's size. Similarly, the qualification of the workforces has the probability of increasing process innovation. It means that a higher proportion of qualified workforce leads to improve the way of producing the product of manufacturing SMEs. Thus, the hypothesis H:4b is accepted. The result is in line with earlier studies. Radas (2009) has found that highly qualified employees are the knowledge base, source of idea and inspiration for innovation. Similarly, the higher proportionate of technically qualified employees are more innovative (Frederic, 2002). More interestingly, the study found that the partnership firms have the likelihood of participating in process innovation in manufacturing SMEs than the limited companies and sole trader firms. The investments in internal R&D would be expected to increase the process of innovation of manufacturing SMEs. It means that higher R&D expenditure reduces the cost of producing the products. Hence the hypothesis H:7b is accepted. The result is consistent with previous studies. Adeyeye *et al.* (2015) have found that an investment in R&D has the probability of introducing process innovation. Similarly, internal R&D

is considered as the important source of knowledge for innovation among small scale firms (Amara *et al.*, 2008; Holzl, 2009; Kumi-Ampoto & Brooks, 2009).

Determinants of marketing innovation

The study results show that the age of the firm, qualification of the workforces and participation in industrial clusters are the major determinants of the marketing innovation of manufacturing SMEs in India. The significant effect of industrial clusters reveals that collaboration with similar firms allows manufacturing SMEs to acquire new marketing techniques more easily. Hence the hypothesis H:6c is accepted that industrial cluster participation has a significant effect in the introduction of new marketing techniques. The significant effect of participation in clusters on firm's innovation is found in many previous studies such as (Weijland, 1999; Waits, 2000; Najib & Kiminami, 2001; Flota *et al.*, 2006). More interestingly the incubator firms are mostly participating in marketing innovation activities than established firms. It might be due the high support and favorable environment for startups in India. The result is consistent with the lifecycle theory that the development of new and young firms is based on innovations. Hence the hypothesis H:1c is accepted that the age of the firm has a significant effect on SMEs innovation. The result is supported by the findings of Hansen (1992) and Huergo (2004) that, younger firms tend to have a higher probability of innovation compared to established firms. The similar result is found in the Chinese SMEs by Umidjon *et al.* (2014) that younger SMEs are more innovative than established firms. Additionally, the startups are highly innovative regardless of their size (Sherer, 2005) and new ventures have more benefit from innovation than matured SMEs (Rosenbusch *et al.*, 2011). Whereas, a conflicting result is found that matured firms have specialized resources which allows them to operate in the market more easily (Amit & Schoemaker, 1993; Thornhill & Amit, 2003). Besides that the study of Freeman et al, (1983) and Bruderl & Schussler, (1990) identified that, matured SMEs having established routines, which younger firms lack. Similarly, the qualification of workforces has the probability of increasing marketing innovation. It means the knowledge and techniques acquired by the employees are the best tools to improve the marketing techniques of manufacturing SMEs. Thus, the hypothesis H:4c is accepted that the qualification of the workforce has a significant effect on marketing innovation. The previous studies also identified the significant role of qualified workforces on the firm's innovational activities (Frederic, 2002; Oluwajoba *et al.*, 2007; Radas, 2009; Haruna, 2013).

Determinants of organizational innovation

The result shows that the academic experience of the workers and the knowledge and skills gained from R&D activities leads to introduce major changes in the organizational structure of the SMEs. It can be interpreted that, a higher proportion of qualified personnel is considered as a large base of resources with a better understanding of how things work in SMEs. Thus the hypothesis H:4d is supported. The result is more consistent with the findings of Oluwajoba *et al.* (2007) that, the innovative ability of a firm is significantly related to the working experience and academic qualification of the employees. Similarly, the educational profile of the staff and the owners are the indicators of innovation (Stanley & Haruna, 2013). A similar result is found in the studies of (Romijn & Albaladejo, 2001) that, the educational profile of the workforces can contribute to its innovative capabilities. Besides that, the study found that ownership structure has a significant impact on organizational innovation. The result indicates that the sole trader and partnership firms have the probability of introducing organizational improvements than the limited companies in Indian SMEs. Thus it can be assumed that the simple organizational structure is the important factor for the managerial and administrative restructuring of manufacturing SMEs. Thus the study supported the hypothesis H:5d. The result is consistent with the study of Woodruff *et al.* (2009) that, ownership ability of the firm has a strong positive impact on organizational innovation. The investment in internal R&D has an important role in the implementation of new or improved administrative techniques in manufacturing SMEs. Hence the hypothesis H:7d is accepted. The result is in support of previous research findings. Egbetokuri *et al.* (2008) identified that investment in R&D activities usually improves the innovation activities of Nigerian SMEs. Similarly, it is argued that the availability of in-house R&D resources is the key strength of innovative SMEs (Ebersberger *et al.*, 2012).

CONCLUSION

This objective is tried to identify the firm characteristics variables affecting the types of innovation of manufacturing SMEs in India. The study results show that firm characteristics variables coincide with different types of innovational outputs in Indian manufacturing SMEs. The knowledge and skills acquired by entrepreneurs and workers through education and training programs help them to introduce various innovative outputs. The study result gives support to the Schumpeterian theory within the precincts of SMEs that, Medium-sized firms tend more towards innovation than Small-sized firms. The study also found that interconnection with similar firms allows SMEs to acquire new marketing and organizational strategies

more easily. The study found an interesting result that, the incubator SMEs are more involved in innovation-oriented activities than the established SMEs. It might be due to the favorable environment for startups in India. The study found that acquisition of scientific knowledge (linkage with Technical institutions and Research institutions) it seemed to be an important source of innovation among SMEs. Thus, it can be concluded that the technical background of the entrepreneurs and qualification of the workforces enhance R&D investments and external collaboration among SMEs, which lead to the introduction of various innovative outputs.

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