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Impact of Technology Adoption on the Performance of Small and Medium Enterprises in India

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Abstract

Technological innovation is believed to improve organization's performance stimulates growth and the survival of the organization. Many factors influence the SME performance on technology adoption, such as formal strategy, Organization size, customer and supply relationship, technical capabilities, innovative cost and innovative support. The current study examines the performance of SMEs on technology adoption. It also examines the business performance along with the manufacturing performance of SMEs on adoption of newer technologies. The study uses logistic regression and linear regression to estimate manufacturing and business performance of SMEs. The results convey that the adoption of technologies by SMEs influence their manufacturing performance. Further, it can be concluded that, drivers of technology adoption partly influence the business performance of SMEs.

Keywords: SMEs; Technology adoption; Performance; India.

1. Introduction

Technology adoptions are helpful in the increase of economic performance of Small and Medium Enterprises (SMEs). The fast changing business environment has made the SMEs to incorporate new technologies into them. These innovations have become a necessity for a technology oriented business which promotes economic competitiveness and entrepreneur welfare in the society (Ciemleja and Lāce, 2008). The SMEs of different sizes are enthusiastic in the adoption of technology thereby becoming innovation potential (The World Bank, 2010). The successful adoption of innovation by the SMEs can be attributed towards several factors, such as technological factors, organizational factors, environmental factors, etc. The active status of SME group in the innovation process have made the patents and new products to increase considerably. Further, the adoption of technology has helped the SMEs to increase in employment and contribute to economic growth particularly thereby gaining competitive advantage and increasing their economic performance.

The significance of innovation as explained by Roberts and Amit (2003) is a means that leads to higher profits and competitive advantage. The innovative ideas adopted by the SMEs help them in reconsidering their competitive position at the firm level under intense competition at the global level. The firm performance is always effected by the product innovation and the process innovation since they influence the performance (Rosli and Sidek, 2013). Technological innovation is believed to improve organization's performance stimulates growth and the survival of the organization. There are five ways of measuring performance of SMEs, such as quality, time, finance, customer satisfaction, and human resource. The adoption of open innovation program by the SMEs has given them an opportunity to face the hardships of competition with the large firms (Zhang and Chen, 2014). Further, the commercialization of technology by the SMEs makes them to perform better in the market compared to the other firms. Moreover, the subcontracting of SMEs has made them to increase their economic performance, since the activity of assistance has helped in the adoption newer technologies (Kumar and Subrahmanya, 2010). Similarly, the SMEs are achieving the competitive advantage in response to the changes in the market with the help of technology adoption. The newer technologies make the firm perfect according to the changing demand. The technological capabilities of a firm play a pivotal role in the growth of business. The research studies of Hamid and Tasmin (2013) and other researchers have shown the evidence of increase in firm performance due to innovative capabilities of a firm. It is the responsibility of the managers to make the small businesses to become capable of innovation adoption. The activities of innovation are considered as the driving force behind the success and overall growth of the organisation. SMEs primarily owe their business success and growth to the development of innovations, which gradually effect their transformation into large enterprises. There are several factors of innovation that influence the performance of SMEs at large. They include market share increase, product quality improvement, reduction of material costs per unit, as well as the improvement of ecological, safety and health aspects and compliance with legal regulations and standards. The SMEs with strong market orientation have much better effects of innovation activities. The proportion of highly educated employees help in quality improvement and reduction in costs, in turn aid in performance of SME. In contrast, the strategic and management changes fail to strongly impact the effects of innovation in SMEs (Bozic and Radas, 2005). Technological innovation has the potential to aid growth of individual enterprises at the micro level and aggregate industries and economies at the macro level. There are certain driving factors of innovation that attributed to the growth of SMEs. The innovation factors include at the firm level known as the internal factors, and at the market level known as the external factors. The main objective of SME innovation

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was increase of competitiveness in the form of quality improvement, cost reduction, extension of product range, and replacement of phased out products, apart from penetrating the international market. A substantial majority of innovative SMEs are able to convert their innovative effort into sales as they realized varying proportions of innovated products in their total sales. Innovative SMEs registered higher growth relative to non-innovative SMEs in terms of not only sales turnover but also employment and investment (Subrahmanya *et al.*, 2010). Technology developers, and especially the new technology based SMEs have benefitted from public R&D support schemes. The leading technology users has benefited the most from the recent SME friendly programs introduced by many OECD countries. These firms perform some development and design work, often have an absorptive capacity that recognises and adopts new developments, but they lack the size to be very active in R&D. Considering that different SMEs will require different policy instruments, one of the major improvements would be policies that target technology-follower SMEs. One option with the policy makers is the association of technical centres with economic advisory agencies that specialise in SMEs. It is assumed that R&D granting institutions might play a role as central coordinating agencies and knowledge platforms for increasing the growth in SMEs (OECD report, 2011). Innovation has been termed as the most important of the elements in today's globalized and competitive environment, and enterprises focussing on it achieve not only competitiveness but are also able to sustain for a longer period of time. The Malaysian SMEs management is aware of the role that innovation plays in the growth of the firms. Due to inadequate resources, these SMEs are not in a position to enter into R&D activities or acquire new and advanced technologies, although these firms are engaged in developing skills and capacities of their employees through various training programs. It was found that the manufacturing SMEs are more involved in R&D activities than their counterparts in service industry. The technological innovations in SMEs help them to gain market share and also help them sustain in the longer run especially with the introduction of ASEAN economic community single market (Ismail *et al.*, 2014).

Small and Medium Enterprises (SMEs) differ from large organizations in many aspects. The competitive features of large scale organizations are really a hardened effort for SMEs, since these firms are limited with their structure, innovative ideas, resources, financial capabilities, etc. This is the reason that, the SMEs feel difficult to face competition in the market. A study by Wheelen and Hunger (1999) observed a failure rate of 24 percent among small firms in two years, while it was 63 percent in six year period. They attributed this failure to the in Organization size of smaller firms. Similarly, certain other research studies also found this type of results in several other countries. Further, the research studies of (Bessant and Tidd (2007); Terziovski, 2010) observed SMEs engaged in formulating new strategies to face competition from India and China. They suggested that, the SMEs should change their Organization size to face the competition in the open market. The other factor that influences the firm performance is the innovative capability. The SMEs should be capable to adopt newer technologies to increase their business performance. The research work of Hamid and Tasmin (2013) observed that the performance of firm depends upon the technical capabilities of a firm. The framework of technical and business innovation capabilities is helpful to the managers in making decisions which ultimately lead to the increase in firm performance.

Similarly, the performance of SMEs depends upon the support provided by the management and the government. The support provided by the management stimulates the SME in technology adoption, which in turn increases the firm performance. The fact is that the top management of every firm is the decision making body in adopting newer technologies. Further, the support provided by the respective governments also influences the firm performance. The governments help the small business houses by providing financial support and also allowing subsidies. Moreover, the innovative cost influences the firm performance. The main factor that is becoming hindrance in the adoption of newer technologies by the SMEs is cost. The reason behind non-adoption of newer technologies by the SMEs is the huge innovation cost. The SMEs mainly lack with the availability of funds. Furthermore, the other component that influences the firm performance is the relationship with the customer and suppliers. The positive association with these stakeholders make them trustworthy, hence helpful in providing finance and supply of raw materials.

There are many previous studies that examined the manufacturing and business performance of SMEs after technology adoption. The research work of Terziovski (2010) examined the performance of manufacturing SMEs relating to the drivers of innovation leading to increase in SME performance, and how these innovation practices differ from large scale companies.

2. Literature Review

The impact of information technology (IT) on organizational performance has been examined by the IT business value research and it was found that, high degree of complexity leads to a context-contingent set of synergistic combination of innovative practices. It was also found that the characteristics of industry to which the firm belong may hinder IT business value (Melville *et al.*, 2004). Small enterprises have contributed a lion's share in accelerating the growth of Chinese economy. The reasons behind the success of China's small enterprises are, general economic reforms, market for consumer goods, responding to market signals, and role rural communities and local governments (Wang and Yao, 2002). There are certain factors that made them inferior to other organisations, such as informal strategic planning process, lack of systems to track SME performance, cheaper manufactured products, etc. Therefore, the current study suggest that, there are certain key drivers of innovation in manufacturing SMEs such as innovation strategy and formal structure that can improve the firm performance. The SMEs with strong market orientation have much better effects of innovation activities. The proportion of highly educated employees help in quality improvement and reduction in costs, in turn aid in performance of SME. In contrast, the strategic and management changes fail to strongly impact the effects of innovation in SMEs (Bozic and Radas,

2005). The low level technology sector revealed positive effect of innovation on firm performance, similar to the high technology sector (Auken *et al.*, 2008). The process of innovation followed by the R&D investment are the two elements that explain the firms' improved performance and consequently lead to the creation of competitive advantage (Marques and Ferreira, 2009). Further, the old knowledge among academicians and policy makers suggest that technology is the key driver of growth among SMEs. In the context of SMEs, innovation helps in expansion of new markets, where a firm can become a partner of the supply chain network. This is possible with the proper of adoption of information technology among the SMEs (Thurasamy *et al.*, 2009). The role of innovation in enhancing the firm performance of SMEs and establishing a connection between the internal environments of the firm and its external environment is vital to the firm's performance (Abouzeedan, 2011; Mazzarol and Reboud, 2008; Wolff and Pett, 2006).

Innovative SMEs registered higher growth relative to non-innovative SMEs in terms of not only sales turnover but also employment and investment (Subrahmanya *et al.*, 2010). The KM capabilities allow practice to be more effective and assure a positive impact on innovation performance by adapting them to change (Alegre *et al.*, 2011). Technological innovations are a pre-necessary condition for a knowledge-oriented business unit that promote not only the economic competitiveness of the whole country, but also the welfare of each entrepreneur and the society (Ciemleja and Lāce, 2008). Innovative firms with growth of factor inputs would be able to achieve better economic performance in the form of higher sales growth (Subrahmanya, 2011). The significant association between the turnover growth of SMEs and their interest in incremental innovation has important implication to the policy makers, where they can prepare the policies which are helpful for the growth of SMEs. One option with the policy makers is the association of technical centres with economic advisory agencies that specialise in SMEs. It is assumed that R&D granting institutions might play a role as central coordinating agencies and knowledge platforms for increasing the growth in SMEs (OECD, 2011). The connective capacity of a firm impacts its access to knowledge in local and foreign markets, while the absorptive capacity touches on a firm's ability to utilise its resources to acquire and interpret knowledge and capture its benefits for commercial purpose, the ambidextrous capacity represents the strategic mode of the organisation. These capabilities mediate the association between the technological innovation and SME firm performance (Albesher and De Coster, 2012). The technological innovations in SMEs help them to gain market share and also help them sustain in the longer run especially with the introduction of ASEAN economic community single market (Ismail *et al.*, 2014). Moreover, it was found that, borrowing from others in case of financing choice has a negative impact on firm performance (Bilgin *et al.*, 2012). It was suggested that, the organisations which could exploit these elements effectively in their innovation processes are expected to have successful results of innovation activities, which will have an effect on the organisations' overall performance in the long run (Saunila and Ukko, 2012).

The SMEs which are empowered with resources to increase their innovation capabilities are more likely to increase their market and production performance (Hassan *et al.*, 2013). SMEs should network, through networking, and they should recruit skilled personnel. SMEs should be knowledgeable or seek information about the supporting institutions such as SEDCO (Mbizi *et al.*, 2013).

Actual usage of innovation is instrumental for SMEs to not only improve their business performance, but also significantly contribute to the national economic growth (Mubaraki and Aruna, 2013). Moreover, mobilising distinct ideas and information from different sources allow a firm to create an environment that possess the advantage of stimulating new ideas and creating new knowledge (Park and Rhee, 2013). SMEs have to really spend their time and money on gathering enough information about the market demand and trend for their products, competitors and sources of innovation before any decision can be made (Rosli and Sidek, 2013).

The SMEs should adopt the open innovation theory for their successfulness. The innovation process should take full advantage of innovative resources both from internal and external, and focus on promoting the role of external ideas and external market channels (Zhang and Chen, 2014).

According to the modern business conditions, the activities of innovation are considered as the driving force behind the success and overall growth of the organisation. The innovation has a positive impact on the performance of SMEs in low and high technology industries. The role of innovation in enhancing the firm performance of SMEs and establishing a connection between the internal environments of the firm and its external environment is vital to the firm's performance

3. Theoretical Model and Hypotheses

There are many factors that influence the SME performance on technology adoption. The literature review of SME performance suggest distinct methods in association with the SME manufacturing and business performance. The current study follows the methodology of Terziovski (2010) in examining the performance of SMEs on technology adoption. The study also examines the business performance Rosli and Sidek (2013) along with the manufacturing performance of SMEs on adoption of newer technologies.

The factors of technology adoption that influences the SME manufacturing and business performance are formal strategy, Organization size, customer and supply relationship, technical capabilities, innovative cost and innovative support.

3.1. Formal Strategy

A strategy is a plan of action prepared for a future course of action. The firms prepare formal and informal strategies, and (Hudson et al. 2001) says that SMEs typically adopt informal strategies which are followed by the top

level management, since these units doesn't have strategic planning units. The newer technologies adopted by these SMEs will impact on their performance.

Hypothesis 1: *There is a positive and significant relationship between formal strategy and firm performance.*

3.2. Organization size

The component of structure is related to firm size. There is much literature that studied the relationship between innovation and firm size. The results suggests an inconsistent relationship between the two. The manufacturing SMEs specifically takes firm size into consideration due to manufacturing economies of scale (Camison-Zornoza *et al.*, 2004; Terziovski, 2010).

Hypothesis 2: *There is a positive and significant relationship between Organization size and firm performance.*

3.3. Customer and Supplier Relationship

The relationships developed by the SMEs with customers and suppliers helps them in maximizing their resources (Appiah-Adu and Singh, 1998), but it is difficult to maintain such relationships due to limitation of time and expertise (Terziovski, 2010). The relationships may give the SMEs an opportunity to develop new skills, or improve the existing skills.

Hypothesis 3: *There is a positive and significant relationship between customer and supplier relationship and firm performance.*

3.4. Technical Capabilities

The SMEs should be capable to adopt newer technologies to increase their business performance. The research work of Hamid and Tasmin (2013) observed that the performance of firm depends upon the technical capabilities of a firm. The benefit of advanced technology and improvement in quality, and being innovative belongs to large firms, while small firms lack in all these activities (Terziovski and Samson, 1999).

Hypothesis 4: *There is a positive and significant relationship between technical capabilities and SME performance.*

3.5. Innovation Cost

The technology adoption by the SMEs prepares them to reduce costs and increase the level of productivity which leads to a better firm performance. The lower the cost of adoption of technologies, the better will the SME performance (Premkumar and Crum, 1997).

Hypothesis 5: *There is a positive and significant association between innovation cost and SME performance.*

3.6. Innovative Support

The support provided by top management and the government in technology adoption increases the SME performance. The top management support creates a supportive climate in technology adoption (Premkumar and Roberts, 1999), hence enhances firm performance. Further, the promotion and support to small businesses by the government enhances the performance of SMEs.

Hypothesis 6: *There is a positive and significant association between innovative support and SME performance.*

4. Research Methodology

The following section explains about the research methodology used to test the formulated hypothesis which includes research design, sampling design and measurement.

4.1. Research Design

Exploratory research has been applied for the current study, since this type of research is useful to examine ICT adoption and its influence on SME performance. Hence, to conduct this research both primary and secondary data has been used. The primary data was collected through scheduling an interview with the decision makers in SMEs. In conducting the interviews, letters were sent to the SMEs in our sample. The interview was conducted with those firms from where the invitation calls were received. The respondents were informed that their participation in the interview is voluntary and their information shall be kept confidential. The secondary data was collected from different journals, books, magazines, and published government sources related to SMEs.

4.2. Sample Design

The current study has used stratified random sampling method, since the nature of population is finite. This method allows to classify the heterogeneous population into homogeneous sub-set. Basing on this, the SMEs that are registered with DIC are considered for this study. In estimating the sample, a precision rate of (+/-) 5% has been desired, i.e. the acceptable rate of error for the current study is equal to 5%. Therefore, based on the standard deviation of population, a random sample of 300 was chosen in the state of Maharashtra.

The sample size consists of those major districts where the SMEs are situated. Therefore, a sample size of 50 was considered for each district. The following Table 1 details about the sample size of six major districts.

Table-1. Details of Sample Size of Six Districts of Maharashtra

S.No.	Major Districts	Sample Size
1.	Mumbai	50
2.	Nashik	50
3.	Dhule	50
4.	Jalgaon	50
5.	Pune	50
6.	Aurangabad	50
	Total	300

The industries' selection for the current study is very small, i.e. among 53,070 industries in Maharashtra, only 300 SMEs were considered as sample.

4.3. Measurement

Table 2 presents the measures of dependent and independent variables. Most of the measures are taken from previous research works, and their validity and reliability has been shown.

Table-2. Measures of the Empirical Model

Concept	Operational Measure	Sources
Dependent Variable		
TQM and MRP		
(SME Manufacturing Performance)	Dummy Variable 1 = has TQM or MRP 0= doesn't have TQM or MRP	
Business Performance	Sum of Sales, Sales Return, Net Profit Growth.	
Independent Variables		
Formal strategy Terziovski (2010)	Multi-items	Hudson *et al.* (2001)
Organization size	Multi-items	Camison-Zornoza *et al.* (2004), Terziovski (2010)
Customer and Supplier Relationship	Multi-items	Appiah-Adu and Singh (1998) Terziovski (2010)
Technical Capabilities	Multi-items	Terziovski (2010)
Innovative Cost	Multi-items	Lymer *et al.* (1997)
Innovative Support	Multi-items	Premkumar and Roberts (1999)

4.4. Validity and Reliability

The test of validity and reliability is carried out to ensure that the measurements were accurate.

Validity refers to how accurately the factors measure what they intend to measure, and reliability refers to the consistency in the results obtained. The operational measures otherwise known as factors were taken from the previous research works. The reliability of these factors was tested using Cronbach's α. The construct results are given in Table 3.

Table-3. Reliability Results of the factors measuring SME performance

Factor	Number of Items	Cronbach's α
Formal strategy	6	0.70
Organization size	10	0.70
Customer and Supplier Relationship	7	0.75
Technical Capabilities	2	0.68
Innovative Cost	2	0.70
Innovative Support	8	0.85

The results given in Table indicate that all the variables except technical capabilities are having cronbach's alpha of 0.7 as suggested by Nunnally (1978), while the remaining 1 variable is below 0.7. The variables Formal strategy, Organization size, Customer & Supplier Relationship, Innovative Cost and Innovative Support have a cronbach's alpha of 0.7 and above. The research work of Ramdani *et al.* (2009) and Terziovski (2010) has reported similar values. The remaining one variable has a cronbach alpha of 0.68. Spiliotopoulou (2009), reported that low size of the coefficient alpha might not always indicate problems within the construction of the tool; whereas large sizes of the alpha do not always indicate reliability. The paper quoted the work of Katz *et al.* (2007), where the alpha values ranged between 0.61 and 0.77. Similarly, the work of Klein *et al.* (2002) identified reliability issues

where the alpha values ranged between 0.23 and 0.89, and they associated this issue to small sample size. Further, Lane and Ziviani (2003) have also reported low alpha values of 0.40 and related the result to small sample size.

The current study uses logistic regression and linear regression to estimate manufacturing and business performance of SMEs. As reported by many researchers that among the assumptions of linear models, the assumption that the residuals are normally distributed is a most important one. The dependent variable is an outlier to this assumption, but it should be continuous, unbounded and should be measured on a ratio or interval scale. Moreover, the categorical variables are victims of this assumption, since it is impossible to get normal residuals from a model consisting of categorical variables. Therefore, there are number of models to estimate the categorical variables, and logistic regression model is one of those models.

Logistic regression model is much similar to the normal linear regression model, while a logit link function makes a big difference. A logit link function is a function of the mean of the response variable Y that we use as the response instead of Y itself. Therefore, when Y variable is categorical, we use the logit of Y as the response in our regression equation. The logit function is the log normal of the odds, i.e. Y equals one of the categories which are coded as 0 and 1. The logit of Y is written as $Ln\left[\dfrac{P}{1-P}\right]$, where P is defined as the probability that Y is equal to 1. According to Premkumar (2003), with the usage of logistic regression model, we maximise the likelihood of a firm adopting ICT innovations.

The logistic regression model for a particular data point i is estimated as follows:

$$Ln\left[\frac{P_i}{1-P_i}\right] = \alpha_0 + \beta_1 INNOVSTRAT_i + \beta_2 OFFSTRUC_i + \beta_3 CUSSUPREL_i + \beta_4 TECHCAP_i + \beta_5 INNOVCOST_i + \beta_6 INNOVSUPP_i + \varepsilon_i$$

The current study found certain variables of technology adoption to examine SME performance, such as Total Quality Management (TQM), Computer Aided Manufacturing (CAM), Computer Aided Design (CAD) and Materials Requirement Planning (MRP) to include as a Dependent Variable (DV) in the logistic regression. Among these variables, the Total Quality Management (TQM) which is Logit of Y as given in the above equation is the DV. The study has also tested the model with the help of other variables. The results of these model tests has shown most of the Independent Variables (IV) as insignificant, and moreover the R^2 (Cox & Snell and Nagelkerke) were small, i.e. ranging from 0.16 to 0.30, while the opposite was true with the TQM. Therefore, the Total Quality Management (TQM) was selected as a DV to estimate the model.

Similarly, the current study also estimated the business performance of SMEs with the help of a linear regression. The model is estimated as follows:

$$BUSPERF_i = \alpha_0 + \beta_1 INNOVSTRAT_i + \beta_2 OFFSTRUC_i + \beta_3 CUSSUPREL_i + \beta_4 TECHCAP_i + \beta_5 INNOVCOST_i + \beta_6 INNOVSUPP_i + \varepsilon_i$$

The current study found certain variables of technology adoption to examine business performance of SMEs, such as Sales, Sales Returns, and Net Profit to include as a Dependent Variable (DV) in the multiple regression. All the three variables are summed up as one variable as BUSPERF (Business Performance) and taken as Dependent Variable (DV).

5. Data Analysis

The current study examines the technology adoption by SMEs on their manufacturing and business performance. The factors that influence the technology adoption by SMEs has affected their performance. This was evidenced by previous research works of (Hamid and Tasmin, 2013; Linzhou and Yunfei, 2015; Olughor, 2015; Subrahmanya, 2011). There are several drivers of technology that influence the performance of SMEs. The influence will be on their manufacturing and business as whole, hence the study has ventured in examining the both the performances, such as manufacturing and business performance. The results are explained in two parts, i.e. for manufacturing and business performance.

Table-4. Correlation Matrix

	Constant	Innovstrat	Offstruc	Cussuprel	Techcapb	Innovcost	Innovsupp
Constant	1.000	-.531	-.477	-.250	.214	-.376	.106
INNOVSTRAT	-.531	1.000	-.167	-.121	-.146	.120	-.008
OFFSTRUC	-.477	-.167	1.000	-.244	-.372	.108	-.089
CUSSUPREL	-.250	-.121	-.244	1.000	-.019	-.118	-.325
TECHCAPB	.214	-.146	-.372	-.019	1.000	.088	-.344
INNOVCOST	-.376	.120	.108	-.118	.088	1.000	.147
INNOVSUPP	.106	-.008	-.089	-.325	-.344	.147	1.000

The correlation results are presented in Table 4. Therefore, with Total Quality Management (TQM) as a dependent variable, even though the independent variables are negatively related with each other, they are not correlated.

Table-5. Results showing Manufacturing Performance of SMEs

Independent Variables	β	Wald	Sig.	Exp(β)
INNOVSTRAT	0.26	17.07	0.000	1.29
OFFSTRUC	0.18	15.17	0.000	1.19
CUSSUPREL	0.15	10.48	0.001	1.17
TECHCAPB	-0.34	15.57	0.000	0.71
INNOVCOST	0.05	0.62	0.43	1.05
INNOVSUPP	-0.12	0.22	0.64	0.98
χ^2 (df) final model	122.07***			
Cox & Snell R^2	0.34			
Nagalkerke R^2	0.45			
Classification Table				
Predicted				
TQM				
Observed		0	1	%correct
TQM	0	100	36	73.5
	1	34	129	79.1
Overall Percentage				76.6

***Significant at the 0.01 level, *Significant at the 0.10 level

The results of the first model where 'Total Quality Management (TQM)' is the dependent variable are given in Table 5. The independent variables, such as Formal strategy, Organization size, Customer & Supplier Relationship, and Innovative capability are significant at less than 1% level, while the innovative cost (INNOVCOST) and the innovative support (INNOVSUPP) are insignificant. The chi-square is significant at <0.01 level, and Nagarkerke R^2 is 0.45. Further, the overall classification percentage is 76.6 percent.

Table-6. Correlation Matrix

DV - MRP	Constant	Innovstrat	Offstruc	Cussuprel	Techcapb	Innovcost	Innovsupp
Constant	1.000	-.454	-.418	-.187	.123	-.402	.040
INNOVSTRAT	-.454	1.000	-.271	-.196	-.058	.105	.010
OFFSTRUC	-.418	-.271	1.000	-.302	-.348	.098	-.069
CUSSUPREL	-.187	-.196	-.302	1.000	.017	-.116	-.246
TECHCAPB	.123	-.058	-.348	.017	1.000	.121	-.389
INNOVCOST	-.402	.105	.098	-.116	.121	1.000	.111
INNOVSUPP	.040	.010	-.069	-.246	-.389	.111	1.000

The correlation results are presented in Table 6. Therefore, with Materials Requirement Planning (MRP) as a dependent variable, even though the independent variables are negatively related with each other, they are not correlated.

Table-7. Results showing SME manufacturing performance

Independent Variables	β	Wald	Sig.	Exp(β)
INNOVSTRAT	0.19	2.94	0.09	1.09
OFFSTRUC	0.13	9.85	0.002	1.14
CUSSUPREL	0.12	8.61	0.003	1.13
TECHCAPB	-0.24	10.23	0.001	0.79
INNOVCOST	0.01	0.03	0.87	1.01
INNOVSUPP	0.03	1.38	0.24	1.02
χ^2 (df) final model	75.70***			
Cox & Snell R^2	0.22			
Nagalkerke R^2	0.30			
Classification Table				
Predicted		Predicated		
MRP				
Observed		0	1	%correct
MRP	0	91	42	68.4
	1	44	122	73.5
Overall Percentage				71.2

***Significant at the 0.01 level, *Significant at the 0.10 level

The results of the second model where 'Materials Requirement Planning (MRP)' is the dependent variable are given in Table 7. The independent variables, such as Formal strategy, Organization size, Customer & Supplier Relationship, and Innovative capability are significant, while the innovative cost (INNOVCOST) and the innovative support (INNOVSUPP) are insignificant. The chi-square is significant at <0.01 level, and Nagarkerke R^2 is 0.30. Further, the overall classification percentage is 71.2 percent.

The independent variables, such as Formal strategy, Organization size, Customer & Supplier Relationship, and Innovative capability in the above mentioned two models. There is a difference in the explanation of variance. The first model mentions the variance between the dependent variable and independent variables in a better way. Further, the classification of first model is better that the second one. Hence, Total Quality Management (TQM) is chosen as the best variable that explains the manufacturing performance of SMEs.

Table-8. Results showing Business Performance of SMEs

Independent Variables	β	t-stat	Sig.	S.E
INNOVSTRAT	0.04	0.57	0.57	0.08
OFFSTRUC	0.12	1.53	0.13	0.05
CUSSUPREL	0.38	5.49	0.00	0.06
TECHCAPB	-0.15	2.28	0.02	0.10
INNOVCOST	0.33	6.18	0.00	0.09
INNOVSUPP	-0.05	0.78	0.43	0.03
CONSTANT	6.15	2.46	0.01	2.49
F-statistic	17.81***			
R^2	0.27			

***Significant at the 0.01 level, *Significant at the 0.10 level

The results given in Table 8 show that the independent variables, such as Customer & Supplier Relationships, Innovative capability, and Innovative Cost are significant, while the innovative support (INNOVSUPP) is insignificant.

The F-statistic is significant at <1 percent level. The R^2 for the given model is 0.27. The given model is unable to explain the business performance in a better way, as nearly 50 percent of the explanatory variables are insignificant.

6. Discussion of the Results

The current study examined the technology adoption on manufacturing and business performance of SMEs. The factors such as, Formal strategy, Organization size, Customer & Supplier Relationships, Innovative capability, Innovative Cost, and Innovative Support are taken as the variables that influence the manufacturing and business performance of SMEs. The discussion of the results is divided into two parts, i.e. the first part explains the manufacturing performance, while the second part explains the business performance of SMEs.

The results show that the explanatory variables, such as Formal strategy, Organization size, Customer & Supplier Relationship, and Technical Capabilities are significant and can be regarded as the high predictors of manufacturing performance of SMEs. The other variables, such as Innovative Cost and Innovative Support are insignificant. The two-phase innovation theory given by Schumpeter and cited by Narayanan (2001) and Terziovski (2010) explains distinct drivers that influence the performance of SME, and formal strategy and Organization size are the important ones among them. According to the modern business conditions, the activities of innovation are considered as the driving force behind the success and overall growth of the organisation. SMEs primarily owe their business success and growth to the development of innovations, which gradually effect their transformation into large enterprises. There are several factors of innovation that influence the performance of SMEs at large. In contrast, the strategic and management changes fail to strongly impact the effects of innovation in SMEs (Bozic and Radas, 2005).

The formal strategy has a pivotal role to play in SMEs, since they need technologies for the new product development and this depends upon the organizations' motivation towards innovation (Bessant and Tidd, 2007). Further, the implementation of innovation based strategy depends upon the cost that an SME can afford. The research studies of Terziovski (2010) suggests a cost-based strategy to implement innovation in SMEs, so that they can enhance their performance. The results of current study show positive and significant relationship between formal strategy and performance, and are in accordance with the results of the above mentioned research works. It was found that the manufacturing SMEs are more involved in R&D activities than their counterparts in service industry. The technological innovations in SMEs help them to gain market share and also help them sustain in the longer run. The elements of training, technology adoption, finance channels and exporting behaviour affect the performance of SMEs by examining the determinants of profit per worker. It was observed that, training proxied by the percentage of workers who received formal training from the firm has no big effect on a firms' profitability (Bilgin et al., 2012).

Similarly, the Organization size, which is also termed as Organization size, also acts as a key driver of innovation, which ultimately leads to SME performance. The research works of (Prakash and Gupta, 2008; Terziovski, 2010) found a positive and significant association between Organization size and implementation of

innovation in SME that leads to better performance. There are studies that explained the resistance to the implementation of innovation in SMEs (Khan and Manopichetwattana, 1989), and some other studies that contradict with the opinion that the formalization is not a driver of innovation in SMEs. The results of the current study are in line with the results of (Prakash and Gupta, 2008; Terziovski, 2010), where there is a positive and significant association between Organization size and innovation.

There is a positive and significant association between customer & supplier relationships and innovation. The relationships with the stakeholders explain the manner in which the organization is developing itself technically according to the needs of the society. The stakeholders are interested in the technical development of the SMEs. The results of the current study contradict with the research of work of Terziovski (2010) where the association between innovation and customer & supplier relationship was insignificant.

Similarly, there is a negative and significant relationship between innovative capability and SME performance. The results of the current study contradict with the other research works. Terziovski (2010), says that innovative capability is viewed as an enabler by the SMEs rather the driver of performance. Innovation capability has been suggested as one of the key drivers of performance of SMEs. There is a need to measure the innovation capability and performance relationship. Performance measurement and management of innovation capability is challenging, because SMEs usually have some drawbacks compared to large firms (Saunila and Ukko, 2012). Among the organisational innovation capabilities, the technological innovation capability (TIC) and business innovation capability (BIC) significantly impact the firm performance. There are five ways of measuring SME firm performance; quality, time, finance, customer satisfaction, and human resource (Hamid and Tasmin, 2013).

The study has shown innovation cost as insignificant. The technology adoption by the SMEs prepares them to reduce costs and increase the level of productivity which leads to a better firm performance (Lymer et al. 1997). The lower the cost of adoption of technologies, the better will the SME performance (Premkumar and Crum, 1997). The results of current study are really amazing and not in accordance with the previous research works. Similarly, there is an insignificant relationship between innovative support and SME performance. The support provided by top management and the government in technology adoption increases the SME performance. The top management support creates a supportive climate in technology adoption (Premkumar and Roberts, 1999), hence enhances firm performance. There are other research studies, such as (Alam, 2011) where the importance of government support has been explained in technology adoption by SMEs which ultimately leads to better performance. There are certain factors associated with the technology commercialization, which in turn affects the performance of SMEs. It was found that, new technology-based SMEs, a strong tie up with business partners should help to raise the ability of commercialising technologies. Therefore, the SMEs need to place more effort in building intensified business relationships, which allow them to have access to useful external resources and assistance. It was evidenced that successful commercialisation of technology plays a significant role for SMEs in achieving superior performance. (Park and Rhee, 2013).

Therefore, the results of the current study convey that the adoption of technologies by SMEs influence their manufacturing performance. The hypotheses related to Formal strategy, Organization size, Customer & Supplier Relationships, and Technical Capabilities got supported, while the hypotheses associated with Innovative Costs and Innovative Support does not get supported. The study concludes that, the adoption of technologies in SMEs increases their manufacturing performance, since this performance is associated with the drivers which are shown significant.

The other part of the study explains the business performance of SMEs on the successful adoption of technology. The results show that the main explanatory variables, such as formal strategy and Organization size are insignificant. The business performance of an enterprise is associated with implementation of a good strategy relating to sales, profit earning, and the growth. Similarly, the size of the organization which is a part of the Organization size also plays an important role in explaining the business performance. These two variables are shown as insignificant by the study. The studies such as, (Bessant and Tidd, 2007; Prakash and Gupta, 2008; Terziovski, 2010) has shown positive and significant association between formal strategy, Organization size and SME performance.

Similarly, the innovative support is also insignificant. The previous works of (Premkumar and Roberts, 1999) says that the top management support creates a supportive climate in technology adoption, hence enhances firm performance. Further, the drivers, such as customer & supplier relationships, technical capabilities and innovative are significantly associated with the SME performance. This is a good sign that, it is necessary for the business to be associated with the customers and suppliers for the growth of the business. Similarly, it is also good that the business is moving towards cost-saving and increasing its innovative capability. But, the problem is that without a concrete strategy and an Organization size, it is not possible for an organization to achieve the other objectives. Therefore, it can be concluded that, drivers of technology adoption partly influence the business performance of SMEs.

According to the modern business conditions, the activities of innovation are considered as the driving force behind the success and overall growth of the organisation. The innovation has a positive impact on the performance of SMEs in low and high technology industries. The role of innovation in enhancing the firm performance of SMEs and establishing a connection between the internal environments of the firm and its external environment is vital to the firm's performance (Abouzeedan, 2011; Albesher and De Coster, 2012; Auken *et al.*, 2008; Bozic and Radas, 2005; Hassan *et al.*, 2013; Marques and Ferreira, 2009; Mazzarol and Reboud, 2008; Mubaraki and Aruna, 2013; Subrahmanya *et al.*, 2010; Wolff and Pett, 2006). Therefore, technology adoption by the SMEs make them to enhance their manufacturing and business performance.

7. Conclusion

The adoption of technology has helped the SMEs to increase in employment and contribute to economic growth particularly thereby gaining competitive advantage and increasing their economic performance. Technological innovation is believed to improve organization's performance stimulates growth and the survival of the organization.

Many factors influence the SME performance on technology adoption, such as formal strategy, Organization size, customer and supply relationship, technical capabilities, innovative cost and innovative support. The literature review of SME performance suggest distinct methods in association with the SME manufacturing and business performance. The current study follows the methodology of Terziovski (2010) in examining the performance of SMEs on technology adoption. The study also examines the business performance (Rosli and Sidek, 2013) along with the manufacturing performance of SMEs on adoption of newer technologies. The current study uses logistic regression and linear regression to estimate manufacturing and business performance of SMEs.

The results of the current study convey that the adoption of technologies by SMEs influence their manufacturing performance. The hypotheses related to Formal strategy, Organization size, Customer & Supplier Relationships, and Technical Capabilities were supported, while the hypotheses associated with Innovative Costs and Innovative Support is not supported. The study concludes that, the adoption of technologies in SMEs increases their manufacturing performance, since this performance is associated with the drivers, which are shown significant. . Further, it can be concluded that, drivers of technology adoption partly influence the business performance of SMEs.

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