

# Impact of Technology Management Strategies on Product / Process Innovations in SMEs

Naveen S <sup>1</sup>

Doctoral Scholar, Jain (Deemed to be University),  
Bengaluru, India

C.G. Krishnadas Nair <sup>2</sup>

Former Chancellor, Jain (Deemed to be University) and  
Former Chairman,  
Hindustan Aeronautics Limited, Bengaluru, India

**Abstract:-** The paper deals with recent research study conducted to understand the impact of technology management for growth of SMEs. The research study revealed that the technology management strategies are well integrated into corporate / business unit strategy for product / process innovations through R&D. Technology Applications adopted for Systematic use of IT tools for product / process development and Technology Acquisition by entering strategic alliances to develop or acquire potential technologies. SMEs have confirmed the trend of effective usage of technology management for growth of organisations through product / process innovations.

**Keywords:** Performance of SMEs, Technology Management Strategies, Usage of Application of IT Tools and Technology, Technology Acquisition, Engineering Sectors, Strategies for R&D, Product / Process Innovations.

## I. INTRODUCTION

In general, Technology Management is a set of management disciplines that allows organizations to manage their technological fundamentals to create competitive advantage. Technology management is the integration of planning, design, optimization, operation and control of technological products, processes and services. Technology is not static concept but is of dynamic in nature and there is a need of continuous upgradation of technology. Technology comprises hardware as well as technical know-how, skills and knowledge related to techniques and operations of using hardware / software for production, the competencies related to commercial-scale production and the knowledge generated through incremental innovations towards efficiency and the improvement of technology. It incorporates R&D, design, process and production engineering, maintenance, management, and the demands of marketing. Management of these technologies to create new product / process is done through innovation management by carrying out new combinations.

The research study was on the application of technologies and management of R&D for innovations in Small & Medium Enterprises (SMEs) from engineering sector. One of the objectives of the research study is to understand the management strategies for R&D, innovation for technology development and utilisation.

The study is conducted to know whether the technology management and applications are pertained in SMEs for prioritizing R&D, innovations and technology investments to enable the access of required technology. To know the importance given by the senior management commitment to technology creation, generation & exploitation by perceiving supportive corporate culture by linking internal staffs, research bodies, agencies etc. Systematic use of IT tools for product / service / process development.

### ➤ Primary Objective of the Study:

Primary objective of the study is to understand the management strategies for R&D, innovation for technology development and utilisation. Based on the objectives, literature on SMEs was reviewed and perused on their experience in on technological learning through R&D and technology dissemination programmes and extramural R&D support in India in SMEs published in various journals, books, official websites, conferences, webinars and policy documents from government and non-governmental agencies. For the firm's performance, technology factors have an impact in the development of the organization, human resources, profit and better service to the society. Technological competence has been an especially important determinant of small scale industries ability to keep their identity. The research gaps identified as assignment of Technology Management Strategies for product / process innovations. The study conducted on technology management strategies that are integrated into corporate / business unit strategy for product / process innovations. In addition, Technology Applications in terms of Systematic use of IT tools for product / service / process development and entering strategic alliances to develop or acquire potential technologies, i.e Technology Acquisition.

### ➤ Sampling Process and Data Collection:

A detailed questionnaire was prepared for the research study indicating the level of importance given by the SMEs from engineering areas to the technology management strategies by integrating them into corporate / business strategy for innovations, namely, i) strategies for R&D, ii) Systematic use of IT tools for product / service / process development and Technologies are employed with IT in Design & Manufacturing, iii) Entering strategic alliances to develop or acquire potential technologies for technology acquisition. SMEs were sampled out from areas of Electronic / Electrical equipments, Mechanical equipments,

Electronic / Electrical components, Machined Components, Sheet metal component, Rubber / plastic components, Foundry & Forging, which are actively involved in automobile / aerospace / defence sectors / consumer electronics, to learn their awareness and utilisation of support schemes, across the country. The structured questionnaire was developed and made to reach to a large number of SMEs to collect data in fillable format under engineering sectors which are manufacturing and trading companies.

SMEs based on the level of importance given for technology management. Performance analysis of SMEs was done which is based on the performance indicators which are the outputs of the firms depending on the influencing parameters which are the inputs of the firm.

The following are the parameters identified for the study. The responses for these parameters from the organisations were graded on the 10-point scale based on rating parameters given below:

**II. DATA ANALYSIS**

A total of about 300 SMEs responded all over the country, participated in the study and replied with valuable responses which were provided by the CEOs and MDs of the SMEs. These were analysed and fifty SMEs were selected for the intensive analysis that represent different industry belonging to small and medium enterprises. The primary data is considered for grading the performance of

➤ *Rating the Input Parameters :*

• *Parameter 1 – Technology Management Strategies:*

The level of importance given by the SMEs to the technology management strategies by integrating them into corporate / business strategy for innovations, namely, strategies for R&D, application of IT tools and technology acquisition.

Table 1 Rating of Parameter 1 – Technology Management Strategies

<b>Having Technology Strategy to align with corporate &amp; business strategy</b>	Higher importance given	Moderate importance given	Lesser importance given	Very less importance given
Rating scale 1 to 10	8 - 10	5 - 7	3 - 4	1 - 2

• *Parameter 2 – Application of IT Tools and Technology:*

Technology Application are graded based on senior management commitment to technology creation, generation, linking internal staff, research bodies, agencies etc., systematic use of IT tools for product / service / product development.

Table 2 Rating of Parameter 2 – Application of IT Tools and Technology

<b>Technology Applications in terms of Systematic use of IT tools for product / process development</b>	Higher importance given	Moderate importance given	Lesser importance given	Very less importance given
Rating scale 1 to 10	8 - 10	5 - 7	3 - 4	1 - 2

• *Parameter 3 – Technology Acquisition:*

Technology Acquisition are graded for transfer of new technology especially for further development & commercialisation.

Table 3 Rating of Parameter 3 –Technology Acquisition

<b>Technology Acquisition : Entering strategic alliances to develop or acquire potential technologies</b>	Higher importance given	Moderate importance given	Lesser importance given	Very less importance given
Rating scale 1 to 10	8 – 10	5 - 7	3 – 4	1 - 2

• *Parameter 4 – Percentage of R&D expenses to Sales year on year:*

The percent of R&D expenses to sales amount given in lakhs year on year for five-year data are rated based on the average of the percentage change.

Table 4 Rating of Parameter 4 – Rating Percentage of R&D Expenses to Sales Year on Year

<b>% R&amp;D expenses to Sales year on year</b>	High rate of R&D to Sales	Moderate rate R&D to Sales	Lesser rate of R&D to Sales	Very poor rate of R&D to Sales
	More than 30.1%	10.1% to 30.0%	5.1% to 10.0%	0.1% to 5.0%
Rating scale 1 to 10	8 - 10	5 - 7	3 - 4	1 - 2

➤ *Rating the Output Parameters :*

• *Parameter 5 – Product Innovations:*

Product Innovations will be graded based on implementation of new products.

Table 5 Rating of Parameter 5 – Product Innovations

Product Innovations	Higher number of product innovations			Moderate number of product innovations		Lesser number of product innovations	Very poor number of product innovations
	More than 10	9 to 10	7 to 8	5 to 6	3 to 4	1 or 2	Zero
Rating scale 1 to 10	9	8	7	5 - 6	3 - 4	1 - 2	0

• *Parameter 6 – Process Innovations:*

Process Innovations will be graded based on implementation of new processes and / or significantly technological improvements in production processes.

Table 6 Rating of Parameter 6 – Process Innovations

Process Innovations	Higher number of process innovations			Moderate number of process innovations		Lesser number of process innovations	Very poor number of process innovations
	More than 10	9 to 10	7 to 8	5 to 6	3 to 4	1 or 2	Zero
Rating scale 1 to 10	9	8	7	5 - 6	3 - 4	1 - 2	0

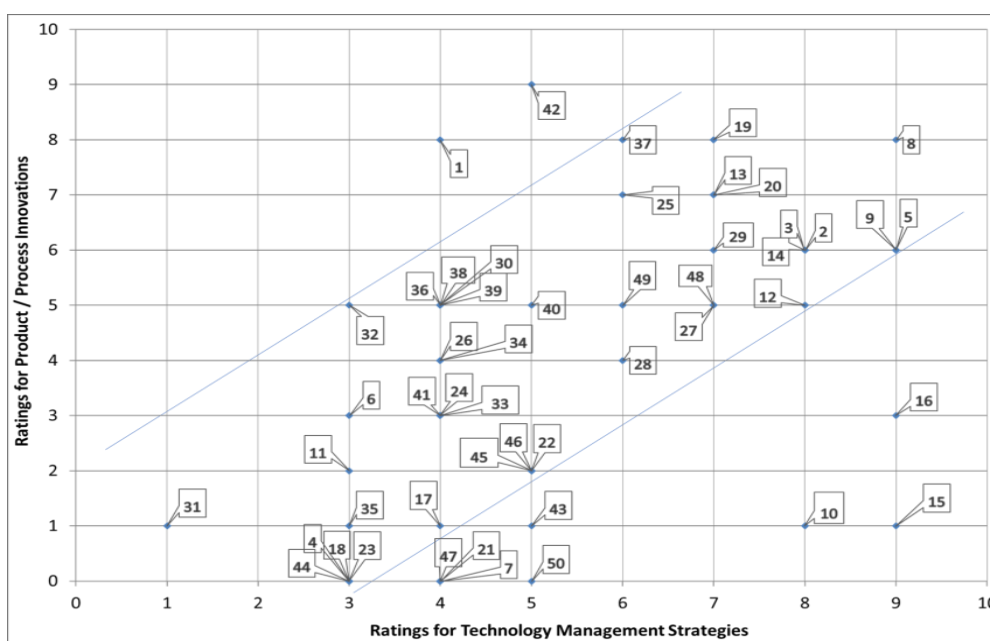
➤ *Impact of Technology Management on Product / Process Innovations:*

The impact of technology management on product / process innovations is studied in this section. The study is on good assignment of Technology Management Strategies adopted with respect technology development, technology purchase / utilisation of R&D and how it is integrated in corporate / business strategies. Application of IT tools and technologies can impact on sales by implementing on production, management, administration. Consolidated product / process innovations are considered by taking the highest rating among the ratings obtained for both product and process innovations from each of the organisations. Ratings for innovations vs Ratings for Technology

Management Strategies, Application of IT tools & technology and Technology Acquisition are dealt separately.

• *Graph 1 Ratings for Product / Process Innovations vs Ratings for Technology Management Strategies:*

The following scatter plot graph shows ratings for product / process innovations on Y axis and ratings for Technology Management Strategies on X axis for each of the organisations which is indicated by their respective serial numbers:



Graph 1 Ratings for Product / Process Innovations vs Ratings for Technology Management Strategies

✓ *Analysis:*

Ratings based on importance given to Technology Management Strategies is plotted across product / process innovations. The graph 1 shows a very clear linear relationship indicated between two parallel lines showing a trend of growth in product / process innovations with respect to index.

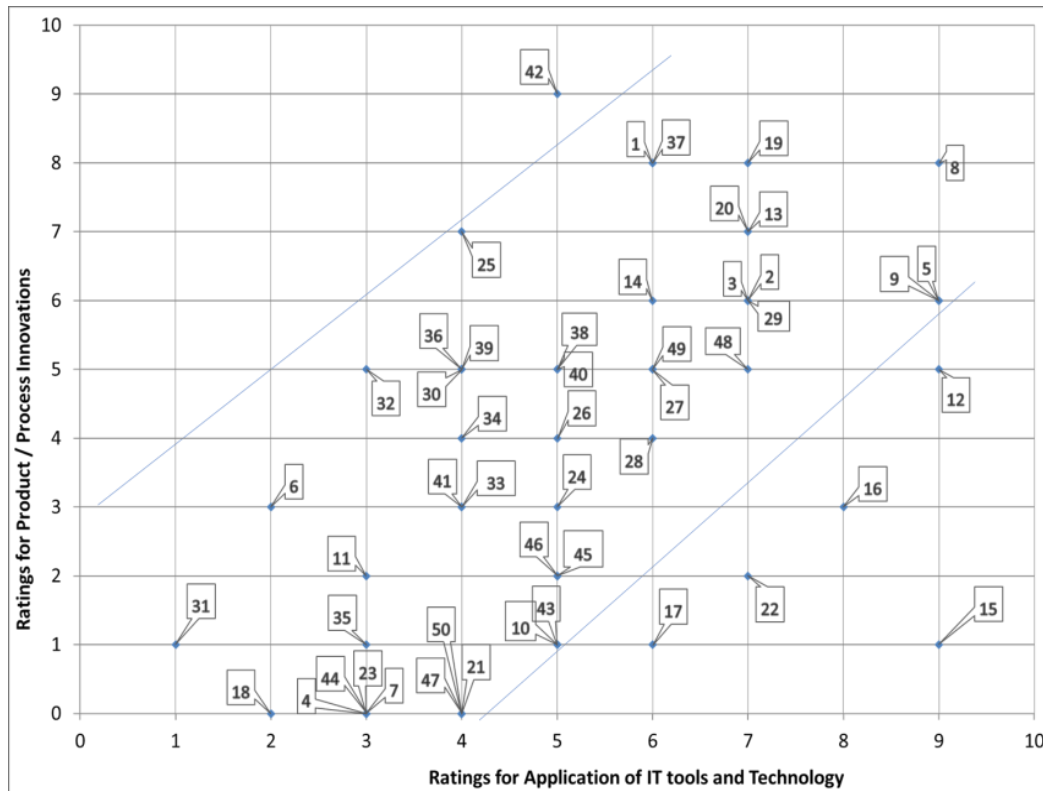
✓ *Interpretation:*

Better Technology Management Strategies well integrated into corporate business plan will lead to purchase / acquisition of technology, R&D development,

collaboration with R&D labs lead to better performance, i.e. more product / process innovations.

• *Graph 2 Ratings of Product / Process Innovations vs Ratings of Technology Applications in IT Tools:*

The following scatter plot graph shows ratings for product / process innovations on Y axis and ratings for applications of IT tools and technology on X axis for each of the organisations which is indicated by their respective serial numbers:



Graph 2 Ratings of Product / Process Innovations vs Ratings of Technology Applications in IT Tools

✓ *Analysis:*

The Graph 2 shows a very clear linear scale relationship indicated between two parallel lines showing a trend of product / process innovations in respective of application of IT tools and technology. Effective usage of application of IT tools and technology provides more efficiency in all operations for the organisations and also do better R&D activities which in turn lead performance of the organisations with more product / process innovations.

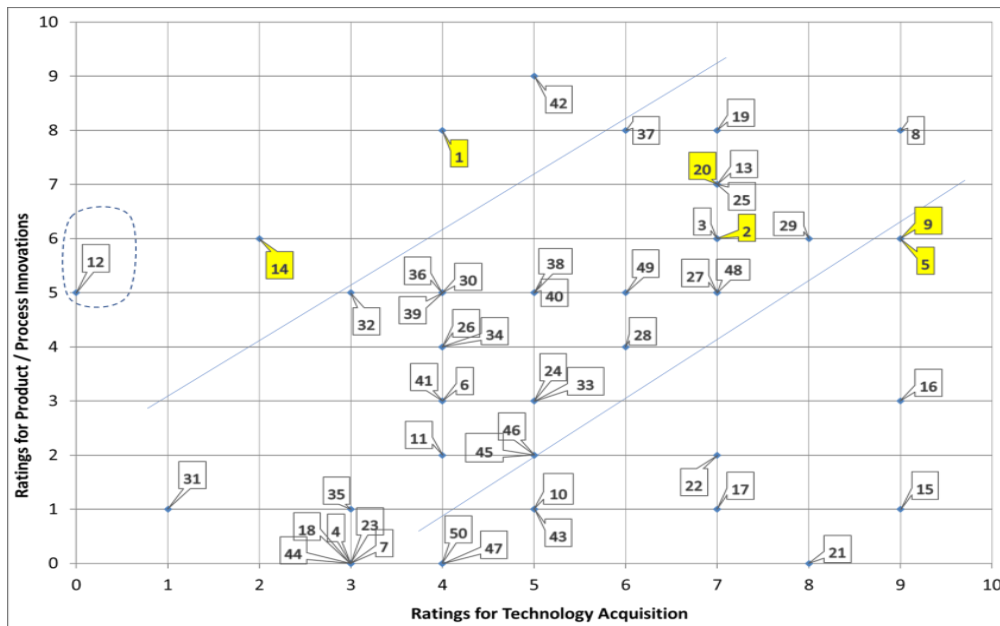
✓ *Interpretation:*

Increasing the usage of application of IT tools and technology will directly lead to greater realization and

operations efficiency which increases in production, manufacturing, HR and improves overall efficiency which therefore increases a greater number of product / process innovations.

• *Graph 3 Ratings for Product / Process Innovations vs Ratings for Technology Acquisition:*

The following scatter plot graph shows ratings for product / process innovations on Y axis and ratings for Technology Acquisition on X axis for each of the organisations which is indicated by their respective serial numbers:



Graph 3 Ratings for Product / Process Innovations vs Ratings for Technology Acquisition

✓ *Analysis:*

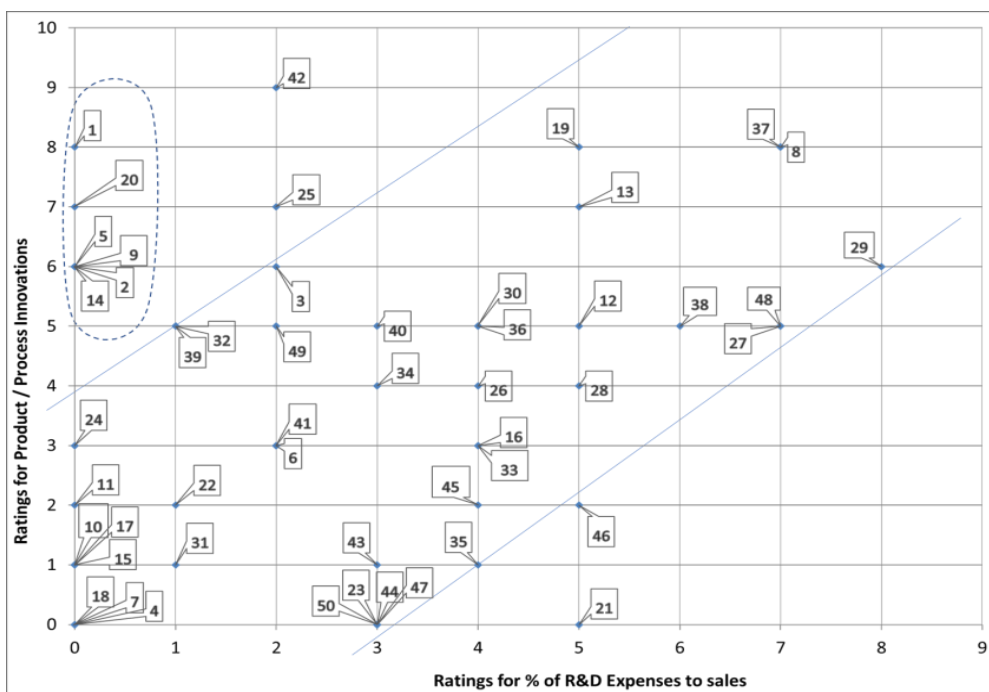
The graph 3 shows a very clear linear scale relationship indicated between two parallel lines showing a trend of product / process innovations in respective of Technology Acquisition. Only 2% have deviation and 98% of organisations having confirmed the trend shown in dotted circle. It is found that the organisations referred by serial numbers 1, 2, 5, 9, 14 and 20 (highlighted) having less R&D expenses have moderate or good product / process innovations because they have doing better with technology acquisitions referred in the Graph 4.

✓ *Interpretation:*

Increasing the importance given to Technology Acquisition by entering strategic alliance to develop or acquire potential technologies will lead to more number of product innovations.

• *Graph 4 Ratings for Product / Process Innovations vs Ratings for % of R&D Expenses to Sales:*

The following scatter plot graph shows ratings for product / process innovations on Y axis and ratings for percentage of R&D expenses to sales on X axis for each of the organisations which is indicated by their respective serial numbers:



Graph 4 Ratings for Product / Process Innovations Vs Ratings for % of R&D Expenses to Sales

✓ *Analysis:*

The graph 4 shows a very clear linear scale relationship indicated between two parallel lines showing a trend of product / process innovations in respect of percentage of R&D expenses to sales. While 88% confirmed the trend 12% has deviation. Some organisations having rated for lesser input on percentage of R&D expenses to sales have moderate or good product / process innovations. On further analysis, it is found that some of these organisations have high score in acquisition of technology which is already developed and transferred by the customers or they might have scored high in product / process innovation.

✓ *Interpretation:*

Higher the percent of R&D expenses to sales will lead to more product / process innovations. In exceptional cases the organizations with less percent of R&D expenses to sales could do more product / process innovations due to Technology Acquisitions.

### III. CONCLUSION

Technology Management Strategies well integrated into corporate business plan will lead to purchase / acquisition of technology, R&D development, collaboration with R&D labs lead to better performance, i.e. more product / process innovations. SMEs have confirmed on to good assignment of Technology Management Strategies adopted with respect technology development, technology purchase / utilisation of R&D and its integration into corporate / business strategies for growth of organisations through product / process innovations.

Increasing the usage of application of IT tools and technology will directly lead to greater realization and operations efficiency which increases in production, manufacturing, HR and improves overall efficiency which therefore increases a greater number of product / process innovations. SMEs have confirmed on to effective usage of application of IT tools and technology for more efficiency in all operations for the organisations and also do better R&D activities for growth of organisations through product / process innovations.

SMEs are to be provided with a lot of support on incentive schemes and technological incentives for better managing R&D to make them more innovative.

Increasing the importance given to Technology Acquisition by entering strategic alliance to develop or acquire potential technologies will lead to a greater number of product innovations. SMEs have confirmed on to the trend is effective usage of technology acquisition for growth of organisations through product / process innovations.

### REFERENCES

- [1]. Naveen S, & C G Krishnadas Nair. (2022). *An analysis of R&D Expenditure and Innovations (Product & Process) by SMEs and its impact on performance*. International Journal of Engineering Research and Advanced Technology (ijerat) (E-ISSN 2454-6135) DOI: 10.31695/IJERAT, 8(11), 9–16.
- [2]. Upadhyay, Vinod Kumar, Pawan Sikka and D.K. Abrol. 2010. 'Technology dissemination programmes and extramural R&D support in India', Journal of Technology Transfer. Vol 35:680–690.
- [3]. Baral SK, *An empirical study on changing face of MSME towards emerging economies in India*, A Journal of Radix International Educational and Research Consortium, Volume 2, Issue 1 (January 2013) ISSN: 2250 – 3994
- [4]. Chidambaram, R. 2011. 'Research and Innovation: An Indian Perspective', *Industrial Research Institute, Inc.* Invited Paper.
- [5]. Gupta, Priya Dhamija, Samapti Guha and Shiva Subramanian Krishnaswami. 2013. 'Firm growth and its determinants', *Journal of Innovation and Entrepreneurship*. 2:15.
- [6]. Kulkarni P.R. 2008. 'A New Deal for Small and Medium Enterprises in India'. *The ICFAI Journal of Entrepreneurship Development*. Vol. V, No. 1.
- [7]. Nair, C.G. Krishnadas. 2014. 'SMEs as R&D and Innovation partners in Aerospace', *Key note address at the seminar on 'Innovation and R&D by Private Industries in Aerospace & Defence'*.
- [8]. Ray, Amit S. & Saradindu Bhaduri. 2001. 'R&D and Technological Learning in Indian Industry: Econometric Estimation of the Research Production Function', *Oxford Development Studies*. Vol. 29, No. 2.
- [9]. Srivastava, Mukesh. 2011. 'A Case Study and Survey-Based Assessment of the Management of Innovation and Technology', *Journal of Technology Management & Innovation*. Vol 6:1.