

# An analysis of R&D Expenditure and Innovations (Product & Process) by SMEs and its impact on performance

Naveen S<sup>1</sup> and C.G. Krishnadas Nair<sup>2</sup>

<sup>1</sup> Doctoral Scholar, Jain (Deemed to be University), Bengaluru

<sup>2</sup> Former Chancellor, Jain (Deemed to be University) & Former Chairman, Hindustan Aeronautics  
Limited, Bengaluru, India

---

## ABSTRACT

*The paper deals with recent research study on impact relation of R&D expenses and product / process innovations by SMEs on performance. SMEs contribute 42% of industrial production. Many SMEs are resorting to any subcontract work like build to print. However, OEMs and R&D organisations involving SMEs have been encouraging SMEs to be partner in R&D and innovations for product innovation to develop process. While it is understood that R&D is engine for growth in this study. R&D expenses, product and process impact on performance of growth in sales and growth in profitability.*

**Keywords:** Performance of SMEs, R&D expenditure, Product innovation, Process innovations, Profitability, Engineering Sectors.

---

## 1. INTRODUCTION

A study has been conducted to understand the intent of R&D for innovations by SMEs. SMEs were preferred because of its attributes that drive them in terms of economical investments [1], indigenous entrepreneurship, employee skill developments, and quick adaptability to the production / processes with technological innovations as per consumer needs. SMEs from engineering background was chosen as it is signified to know the technology needs to be applied with technical know-how, skill development, R&D intensity to create new product / process / services done through innovation management. Management of Technologies to create innovative product / process is done through application of scientific knowledge which is referred as R&D, R&D in engine for growth [2]. The surplus generated by the industry should be reinvested for research activities to become self-sufficient. Analysis is done on the percent of R&D expenses to sales for innovations and its impact on performance.

In general, innovation comprises, a process of idea creation, elements of creativity and R&D, but ultimately it is implementing new products / process / service with significant technological improvements [3]. Product innovation is the market introduction of new goods or significantly improved goods and which are new to the company [4]. Process / service innovation is the implementation of new or significantly improved production processes, distribution method, or support activity which are new to the company.

The innovative products / processes are controlled by the technology management [5]. 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. This effort is achieved through application of scientific knowledge which is referred as Research & Development (R&D).

Hence, the percentage of R&D expenses to sales by individual organisation is studied upon growth of sales and profit and number of products / processes.

## 2. PRIMARY OBJECTIVE OF THE STUDY

Primary objective of the study is to know the status of technology applications, innovation and R&D in SMEs under Engineering Sector, to understand the encouragement in R&D by management and motivation to employees. To arrive at best practices for the growth and contribution of SMEs.

Based on the objectives, review of literature on SMEs experience in R&D and innovation and technologies published in various journals, books & policy documents from government were pursued. Thereafter, certain gaps were identified to strengthen the research work and to give a different perspective in understanding the thrust areas in techno-innovations, R&D Management in SMEs, role of management to encourage engineers / managers in continuous technology improvement.

## 3. SAMPLING PROCESS AND DATA COLLECTION

A detailed questionnaire was prepared for the research study. The SMEs from Engineering areas were sampled out from areas of Electronic / Electrical equipment's, Mechanical equipment's, 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 technological interests in R&D for innovations, across the country [6].

The structured questionnaire was developed for collecting the details of number of products / process innovations, technology acquisition details, annual sales, yearly R&D expenses and annual profit. The questionnaire was made to reach a large number of SMEs to collect data in fillable format under engineering sectors which are manufacturing and trading companies.

## 4. DATA ANALYSIS

A total of about 300 SMEs responded all over the country, participated in the study and replied with valuable responses. After intense interaction, 50 SMEs were selected for the detailed analysis purpose whose responses could be considered for grading the performance of SMEs based on the R&D activities and technology-innovations.

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 as follows.

- i. Product and process Innovations as output parameter and % of R&D Expenses to sales as input parameter
- ii. Growth Rate of Sales as output parameter and Product and process Innovations as input parameter
- iii. Profitability as output parameter and Product and process Innovations as input parameter

The responses from the organisations were graded on the 10-point scale based on rating parameters given below.

### Parameter 1 – Average Annual Growth Rate of Sales

Ratings for Average Annual Growth Rate of Sales are done by taking difference in sales amount given in lakhs year on year for five-year data and are rated on a 10 point scale based on the average of the percentage change, as shown in Table1.

**Table 1. Average Annual Growth Rate of Sales**

Average Annual Growth Rate of Sales	High rate of growth of sales		Moderate growth of sales		Lesser rate of growth of sales	Very poor / negative growth of sales
	More than 15%	10% to 15%	7% to 10%	4% to 6%	1% to 3%	Zero & Negative growth
Rating on 10 point scale	9	8	7	4 - 6	1 - 3	0

**Parameter 2 – Average Annual Percentage of Profit to Sales (Profitability)**

Ratings for Average Annual Percentage of Profit to Sales are done on the ratio of profit to sales amount given in lakhs year on year for five-year data and are rated on a 10-point scale based on the average of the percentage change, as shown in Table2.

**Table 2 Average Annual Percentage of Profit to Sales**

Average Annual Percentage of Profit to Sales	High ratio		Moderate ratio		Lesser ratio	Very poor / negative ratio
	More than 15%	10% to 15%	7% to 10%	4% to 6%	1% to 3%	Zero & Negative growth
Rating on 10 point scale	9	8	7	4 - 6	1 - 3	0

**Parameter 3 – Product Innovations**

Ratings for Product Innovations are done based on implementation of number of new products and are rated on a 10-point scale, as shown in Table3.

**Table 3. 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 4 – Process Innovations**

Ratings for Process Innovations are done based on implementation of number of new processes and / or significantly technological improvements in production processes and are rated on a 10 point scale, as shown in table 4

**Table 4. 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

**Parameter 5 – Technology Acquisition**

Technology Acquisition will be graded for transfer of new technology especially for further development & commercialisation:

**Table 5. Technology Acquisition**

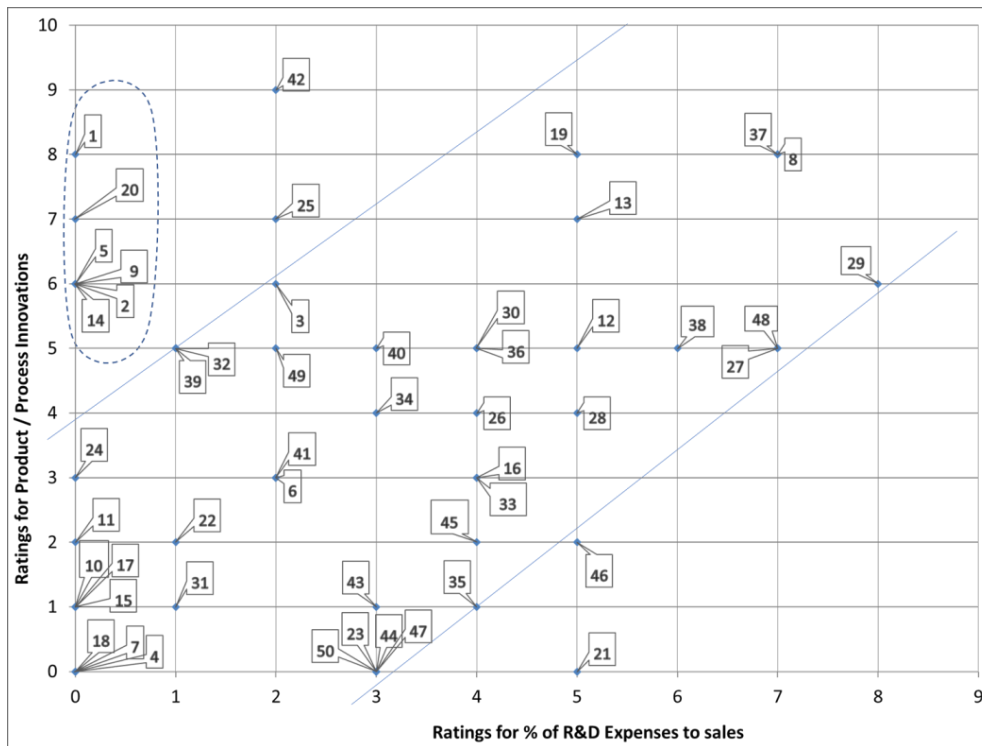
Technology Acquisition - Entering strategic alliances to develop or acquire potential technologies	Higher importance given	Moderate importance given	Lesser importance given	Very less importance given
Rating scale 1 to 10	8 – 10	5 - 7	3 – 4	1 - 2

### 5. INFLUENCE OF R&D EXPENSES ON PRODUCT / PROCESS INNOVATIONS

The influence of percentage of R&D expenses to sales on product / process innovations is studied in this section. Ratings for product / process innovations vs Ratings for percentage of R&D expenses to sales are dealt. 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.

#### 5.1 Ratings for Product / Process Innovations V/S Ratings for % of R&D Expenses to Sales

The following scatter plot graph 5.1 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 1. Ratings for Product / Process Innovations vs Ratings for % of R&D Expenses to Sales

#### 5.1.1 Analysis.

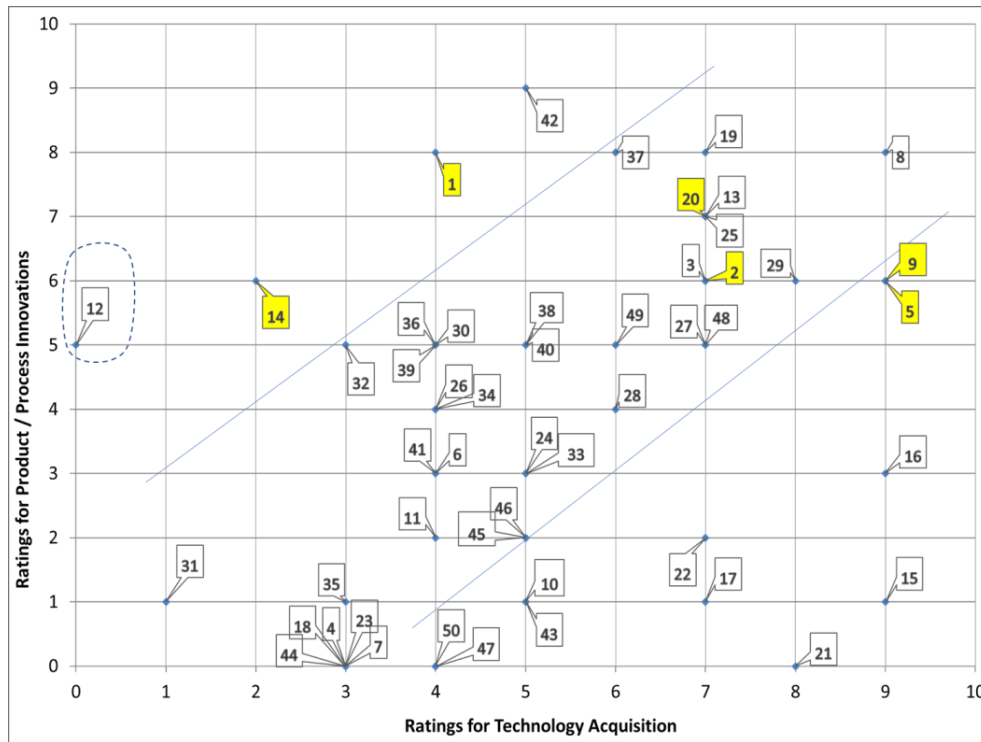
The Graph 1 shows a very clear linear scale relationship indicated between two parallel lines showing a trend of product / process innovations in respect of percentage of R&D expenses to sales. While 88% confirmed the trend 12% has deviation. Some organisations having rated for lesser input on percentage 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.

#### 5.1.2 Conclusion

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

#### 5.2 Ratings for Product / Process Innovations vs Ratings for Technology Acquisition

The following scatter plot graph 2 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 2. Ratings for Product / Process Innovations vs Ratings for Technology Acquisition**

**5.2.1 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 Technology Acquisition. Only 2% have deviation and 98% of organisations having confirmed the trend shown in dotted circle. As percolation earlier in analysis section of the Graph 1, it is proved 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.

**5.2.2 Conclusion**

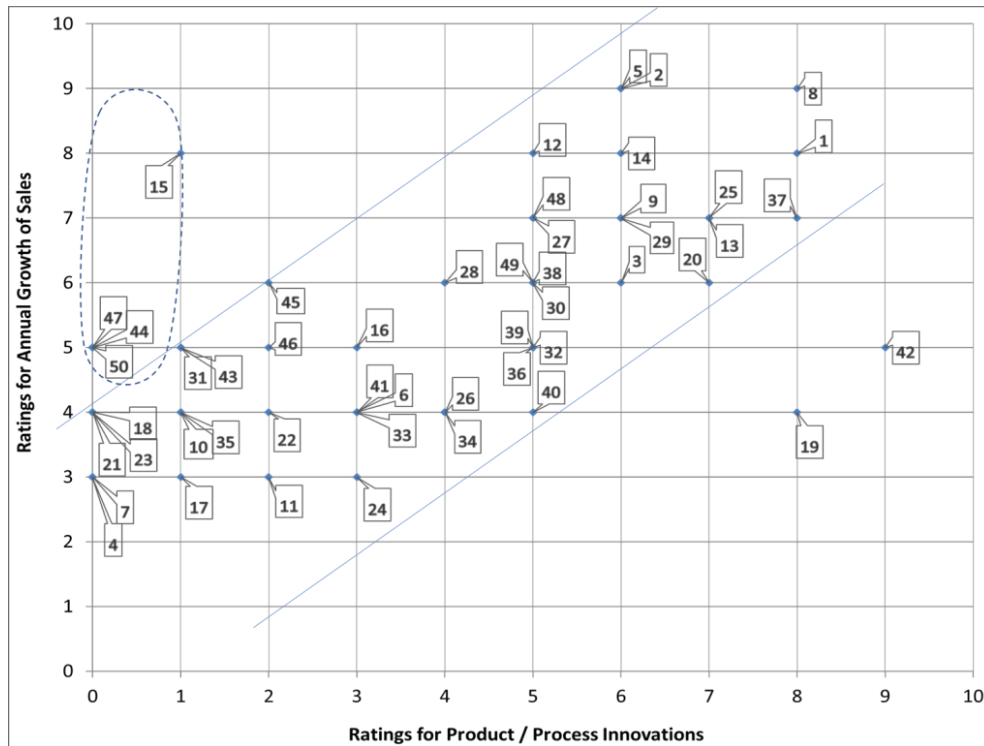
Increasing the importance given to Technology Acquisition by entering strategic alliance to develop or acquire potential technologies will lead to more number of product innovations.

**6. IMPACT OF PRODUCT / PROCESS INNOVATIONS ON GROWTH OF SALES.**

The impact of product / process innovations on growth of sales is studied in this section. Ratings of average annual growth rate of sales vs product innovations / process innovations by considering highest rating among product / process innovations from each of the organisations.

**6.1 Ratings for Annual Growth of Sales vs Ratings for Product / Process Innovations**

The following scatter plot graph 3 shows ratings for annual growth of sales on Y axis and highest ratings among ratings for product / process innovations on X axis for each of the organisations which is indicated by their respective serial numbers:



**Graph 3. Ratings for Annual Growth of Sales vs Ratings for Product / Process Innovations**

**6.1.1 Analysis**

The Graph 3 shows a very clear linear scale relationship indicated between two parallel lines showing a trend of growth in sales in respective of product / process innovations. Exceptions are few, combined effect of product and process innovations is confirmed.

**6.1.2 Conclusion**

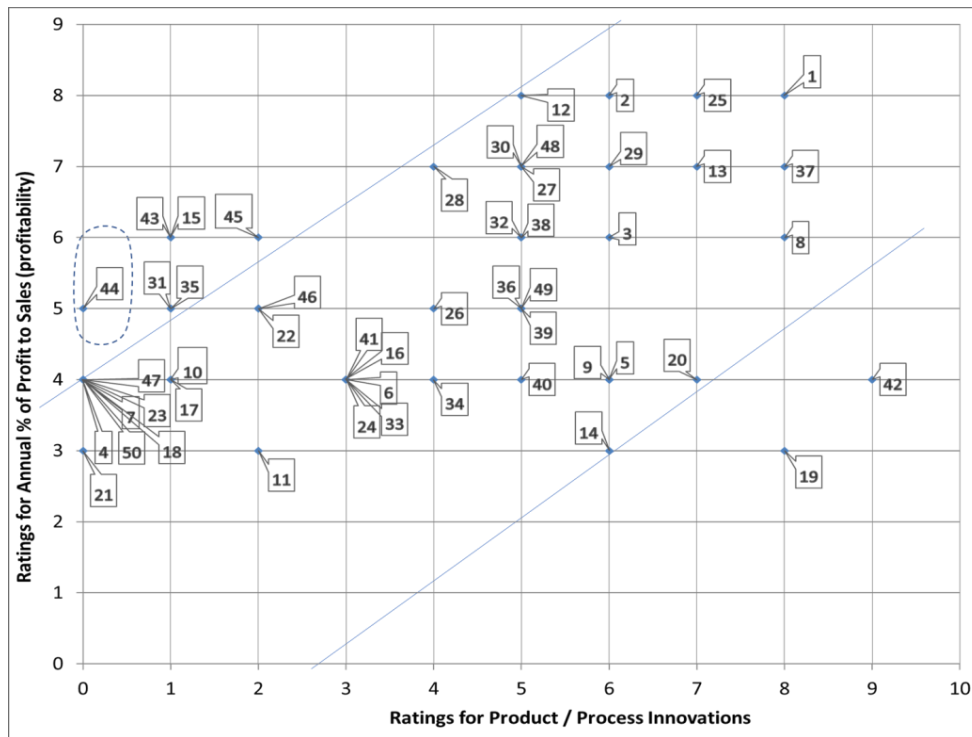
Product Innovations and Process Innovations have a definite impact on growth of sales. As this lead to new products and improved processes improving quality, increasing productivity etc. these in turn lead to more orders.

**7. IMPACT OF PRODUCT / PROCESS INNOVATIONS ON RATE OF PROFIT TO SALES.**

The impact of product / process innovations on rate of profit to sales is studied in this section. Ratings for annual percent of profit to sales (profitability) vs Ratings for product / process innovations by considering highest rating among product innovations and process innovations from each of the organisations.

7.1. Graph 4. Ratings for Annual % of Profit to Sales vs Ratings for Product / Process Innovations

The following scatter plot graph shows ratings for average annual percent of profit to sales on Y axis and ratings for product / process innovations on X axis for each of the organisations which is indicated by their respective serial numbers:



Graph 4. Ratings for Annual % of Profit to Sales vs Ratings for Product / Process Innovations

7.1.1 Analysis :

The Graph 3 shows a very clear linear scale relationship indicated between two parallel lines showing a trend of growth of profit to sales in respective of product / process innovations. Exceptions are few, combined effect of product and process innovations is confirmed.

7.1.2 Conclusion

Product Innovations and Process Innovations have a definite impact on growth of profit. As this lead to new products and improved processes improving quality, increasing productivity etc. these in turn lead to more orders.

8. OVERALL CONCLUSION AND RECOMMENDATIONS

Higher the rate of R&D expenses to sales will lead to more product / process innovations. In exceptional cases the organizations with less rate of R&D expenses to sales could do more product / process innovations due to Technology Acquisitions. 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. Product Innovations and Process Innovations have a definite impact on growth of sales. Product Innovations and Process Innovations have also a definite impact on growth of profit. As this lead to new products and improved processes improving quality, increasing productivity etc. these in turn lead to more orders. The companies who depend on subcontract may lead to problem in future if they are not doing R&D in process and product innovations.

REFERENCES

1. 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 – 399
2. 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*.

3. Chidambaram, R. 2011. 'Research and Innovation: An Indian Perspective', *Industrial Research Institute, Inc.* Invited Paper.
4. Kulkarni P.R. 2008. 'A New Deal for Small and Medium Enterprises in India'. *The ICFAI Journal of Entrepreneurship Development*. Vol. V, No. 1.
5. 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.
6. Gupta, Priya Dhamija, Samapti Guha and Shiva Subramanian Krishnaswami. 2013. 'Firm growth and its determinants', *Journal of Innovation and Entrepreneurship*. 2:15
7. 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.