EFFECTS OF R & D METRICS ON FIRM'S PROFITABILITY OF INDIAN TEXTILE-CUM-CHEMICAL-BASED COMPANIES : A REVIEW

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ABSTRACT

This paper examines the impact of Research and Development (R & D) and on the profitability of Chemical-based Companies. The study experiments critical variables, which are influencing R & D management and performance and their effect on the profitability of Chemical-based firms. The variables taken in this study are as Patent Quality, Patent/R & D Rate, Citation/R & D Rate, R & D Intensity and Technology Portfolio. Correlation and regression analysis have been applied to find the relationships of the above variables on profitability. Correlation analysis shows that there is negative relation between profitability and R & D efficiency. Two models have been applied in Regression analysis, the fixed effects model and ordinary least squares model. The regression analysis shows that the R & D Intensity and technology portfolio are found to be insignificant.

Key words: Research and Development, Chemical-based companies, Profitability, Correlation and regression analysis.

INTRODUCTION

Managers, who are deal with investment are continuously processing to sustain with superior R & D performance for gaining competitive advantage. Insufficient investment on R & D results in less capable of compete in the perfect competition interrupts the regular business process and profitability. Being an increasing stress to build and up hold competitive advantages by means of customer-centered innovations, technology-based firms such as textiles and chemicals industry increasingly more depend on the proficient management of their R & D activities[1].

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Since, there is an extensive and universal acceptance that technological innovation is the key to economic growth in today's knowledge economy, the value created by giving paramount importance on R & D investments has been considered very seriously[2]. Technology-based firms constantly struggle for the effectiveness and efficiency of their R & D functions to meet increasing expectations from stockholders. The returns on these R & D investments are perceived by many to be unacceptably low[3].

A few particular research studies especially on the impact of R & D on profitability of technology-cum-chemical based firms are inadequate in India. Trusting this finding from literature and the better appreciation in the economy of developing countries, this study are considered as a diffident attempt in this direction and analyzes the impact of different R & D outcome variables affecting the profitability in chemical-based firms. The companies considered for analyses are listed in CMIE-Prowess and its data are likely to extend the literature on R & D performance of the chemical-based firms and enable the stakeholders to find the influencing variables of R & D and profitability of the selected firms.

EXPERIMENTAL

Scientific and Technological innovation is the most powerful source of competitive advantage for modern firms. Sadowski and Roth[4] found that technology-leading companies excelled in four areas of technology management including: strategy, portfolio management, planning, and development and transfer processes. Corporate level strategy to create and take advantage of a firm's technological properties has a strong impact on its long-run performance.

Basic assumption to technology portfolio strategy originated from the modern portfolio theory is that a firm can reduce risks and tap into business opportunities derived from economy of scope through holding a portfolio of very different businesses, markets, or resources. Consequently, Kfir[5] maintains that the management of technology assets and offerings requires clear strategic management of the process of technological innovation and proposes a portfolio approach for strategic management of investment in technology properties. Past research showed a significant positive market response to announced increases in R & D expenditures for firms operating in high-technology industries but a significantly negative market response for firms in low-technology industries[6,7].

The purpose of the research is to analyze the effect of R & D on the profitability of Chemical-based manufacturing sector. The study describes the analytical construct of data

analysis, which reveals the performance particularly on profitability of the firms and variables included in the study, the distribution patterns of the data and applied statistical techniques in experimenting the relationship between R & D and profitability. The financial statements of selected chemical-based manufacturing firms listed in Centre for Monitoring Indian Economy for a period of 5 years (i.e. 2007-08 to 2011-12) are the sources of the study. The data collected for 329 firms with the minimum Rs. 5000 lakhs capital. Table 1 shows the sector wise list of companies taken for this study.

Table 1: Sector-wise classification

S. No.	Sector	No. of Firms
1	Chemicals	119
2	Textiles	103
3	Metals	107
Total		**329**

The Gross Profit (GPT) is used as the dependent variable. Independent variables considered here are given in the Table 2, which gives the description of the independent variables.

Table 2: Details of independent variables used

Symbol of independent variable	Variable	Description
PATQUAL	Patent quality	Received citations per patent
PRD %	Patent/R & D Rate	Received patents per Rs. 10 Lakhs R & D investment
CRD %	Citation/R & D Rate	Received citations per Rs. 10 Lakhs R & D investment
RDINT	R & D Intensity	R & D investment to the total capital employed
TECHCON	Technology concentration	Degree of diversification of R & D activities

RESULTS AND DISCUSSION

Table 3 shows the descriptive statistics. GPT is on average Rs. 426.37 that is, the chemical-based industry shows profit. The patent quality found to be 79 percentage acceptance but only 47 percent PRD out of for 97 percent CRD, which implies that less citations results in lesser impact on profitability since these measures have not reached the limit of competency. Further, it is observed that more money to be spent relatively to arrive a patenting state.

Table 3: Descriptive statistics

Variables	Mean	Std. Dev.
GPT	Rs. 426.37	Rs. 141.24
PATQUAL	0.7952	0.6210
PRD%	0.4728	0.3941
CRD%	0.9784	0.4120
RDINT	0.0570	0.2932
TECHCON	0.3854	0.1248

Correlation analysis

Table 4 presents correlation coefficients at 5% critical value (two tailed) (= 0.0252) for all variables considered. There is a negative relation between GPT on one hand and measures metrics of R & D. This is consistent with the view that the time impact on the R & D investment and its outcomes such as patents and citations (PRD, CRD and PAT QUAL) and that decreasing this time lag increases profitability.

Table 4: Correlation matrix

	GPT	PATQUAL	PRD%	CRD%	RDINT	TECHCON
GPT	1	-0.0612	-0.0347	-0.0069	0.5341	-0.0059
PATQUAL		1	0.0326	0.5891	-0.0082	0.0215

	GPT	PATQUAL	PRD%	CRD%	RDINT	TECHCON
PRD%			1	0.2437	-0.0051	0.0241
CRD%				1	-0.0048	0.0343
RDINT					1	-0.0079
TECHCON						1

Regression analysis

From the results of regression analysis identified the significant variables influencing the dependent variable. The factors determining corporate profitability are calculated using Fixed Effects Model of Regression (FEMR). Fixed effects methods of computation expected to reflect the firm specific intercepts confine the results of selected variables those are very specific to respective industry and found unchanged over a period of time. A distinguished characteristic of the FEMR is that it focuses on variability within the firms. The fixed effects model (FEM) is estimated by (a) computing the means for each variable of firm, (b) subtracting the firm's mean from each variable and (c) running a regression on the transformed data. Fixed effects Regression estimation explains why the variables differ from their means, but not why the firm's mean differs from each other. A disadvantage of fixed effects estimation is that it eliminates anything that is time invariant from the model[8].

It is also estimated using Ordinary Least Square Regression (OLSR). Any regression would cause standard errors, which are estimated sector-wise, applying Wald test of Distribution-free for normality of residual by computing Chi-square. The outcomes reflect that the residual is normally distributed. The inflation factor of variance is understood to be < 10 for the variables considered represent that there is no multicol-linearity among the uncontrollable variables.

CONCLUSION

There are five R & D performance metrics used to meet the diverse interests on corporate R & D including: Patent Quality, Patent/R&D Rate, Citation/R & D Rate, R & D Intensity and Technology Portfolio. Both positive and negative results were found in the correlation results among the R & D Metrics. These measures represent different dimensions

of R & D performance and the relations among these measures found to be weak and negatively correlated. This result could be one of the worth-mentioning reasons that why there were inconsistent experimental results found in the previous studies regarding R & D performance. Results of regression models of the corresponding performance measures reveals that R & D performance is a complex function and must be investigated from multi-dimensional aspects.

The study has been conducted on chemical-based industries, irrespective of the operational differences. The analysis and outcomes have identified key areas where the competitive advantage could be gained in order to stabilize or improve the financial performance of their operation. The results of this study suggest that in Indian context, the firms have to maintain a comparatively reasonable patent and citation rates so as able to capitalise the R & D investments. Since the model is a general model, it might applicable or might not give the same findings in specific business sectors. The authors of this article are constantly focusing in constructing a model for the industries in this kind.

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