Characteristics of the IT Firms and their implications on Innovation: An Empirical Study of Indian IT Firms

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Abstract: Information Technology (IT) industry in India has been playing a vital role in the growth of the Indian economy and economies of other related countries. IT firms undergo many transformations over the years from an outsourced provider, providing Software Application Development and Maintenance (ADM) and Business Process Outsourcing (BPO) to partnering in business and services to co-innovator. Indian IT firms play critical roles due to sustained competitive cost advantage and availability of highly skilled resources. In the current scenario, Innovation plays a critical role in creating sustained competitive advantages. India is gaining its prominence in the innovation space and many international companies are building their Innovation Centers in India.

This research study explores the key characteristics of Indian IT firms and how they are influencing their innovation. We reviewed the current literature on various characteristics of Indian IT firms and Innovations. This research study uses Centre for Monitoring Indian Economy Pvt. Ltd (CMIE) Prowess database to collect data related to Indian IT firms. The study includes IT firms with the National Industrial Classification (NIC) codes 620 (Computer programming, consultancy, and related activities), 639 (other information service activities), and 829 (business support services). The period of study is from 2010 to 2016.

One of the key indicators considered by many previous studies is Research and Development expenditure. This variable is considered as an input measure of the innovation activities of the IT firms. The Research and Development expenditure is used as one of the independent variables in this study. The other characteristics of the firms, considered for this study are the firm age, firm size, total assets, and whether the firm is part of a conglomerate group or not. The Profit After Tax (PAT) is used as the proxy for the output of innovation activities of the firm and considered as dependent variable in this study.

This research study brings out the key influencing factors and how they are impacting the innovation. This study supports the postulate, an increase in the Research and Development expenditure results in increased

Snehal Raichur, Kaveri Hatti, Senthilkumar Thangavelu and Amalendu Jyotishi

innovation activities of the Indian IT firms and hence there is an increase in the PAT. The study also concludes that an increase in the firm's age, firm's size, and total assets also support to increase the firm's innovation activities and its profit.

Keywords: Innovation activities; IT Firms; Firm Characteristics; Firm Age; Firm size; PAT

JEL Classifications: L10, L86, M15

1. INTRODUCTION

The Indian software industry has been a remarkable success story over the years. One can very much compare Indian economy before IT and after IT revolution. On an average, it has grown more than 30% annually for 20 years till 2005 [13]. Information Technology industry in India is playing a vital role and transformed the slow moving economy into a home of innovative entrepreneurs and destination for foreign firms for skilled resources and sustainable competitive advantages.

IT service industry in India mainly consisting of two components: IT services and Business Process Outsourcing. The IT industry has increased its contribution to the India's GDP from 1.2% in 1998 to 7.5% in 2012. According to Nasscom, the sector aggregated revenues of US$147 billion in 2015, where export revenue stood at US$99 billion and domestic at US$48 billion, growing by 13% [14].

The objective of this study is to understand how innovation is the most important aspect for any IT firm to compete with the global leaders and to become one of them. The focus of this study is to find the key characteristics of the IT firms and how they are responsible for innovation. This topic is very much essential for the deep understanding of the key important factors which influence the innovation in IT firms. Along with that, we will get the insights of each characteristic and how they are important for different firms which are classified as product-based firms, service based firms, the combination of both and the BPOs.

2. LITERATURE REVIEW

2.1. Research and Development (R&D) Expenditure

The literature says that R&D activities that are honed by the firm are firmly connected to innovation results both quantitatively and qualitatively and vary for both product and process innovation [1]. Innovation activities are of two types. The first incorporates activities that are totally internal to the firm, e.g., setting up an internal R&D group and develop new products by using that group. These are called intramural activities [2] [3][4].

Research says that firm's innovation is mainly based on the internal R&D investment of a firm. Analysis of the Dutch firms demonstrated that investment on internal R&D is the main reason behind the firm's innovation [5]. The existing literature has proved that another imperative part of internal R&D is that it extricates benefits by external R&D. Specialists concur that external R&D is a vital contributor to firms' innovation result just within the sight of high internal R&D investment[5]. In the wake of dissecting the R&D endeavors of Canadian firms, Czarnitzki et al.[6] proposed that internal R&D venture fortified by tax credits given by the government led to higher innovation output for these firms. External funding and research as government R&D or extramural R&D can complement internal R&D however not go about as a substitute for it [7]. Essentially, the research tends to support the derivation that internal R&D spending by the firm altogether adds to new service and product development.

Here the distinction is based on whether the firm alone is participating in innovation or other agencies also participating with this firm at various stages of the innovation process [8][9]. Exclusive internal activities are those which are totally done internally from the stage of idea generation till the product

development. For example, we can take the development of Oculus1 VR's virtual reality device, which was completely designed and developed by the company [10]. The partial intramural activities are those that idea might have generated by institutions, academics or consultants etc. but then it was developed and implemented by the focal firm. Consulting firms participate in such activities so that they help in achieving greater innovation for their client firms.

2.2. Firm Size

The past literature showed that the positive effect of the firm size and the R&D expenditure: i.e., the firm's capacity to invest in R&D depends on its size, ceteris paribus [11][12]. Till now it was widely believed and accepted that the most of the innovations will be done by large firms. But if we see the current trend, most of the innovations are done by small firms which were backed up by venture capitalists and angel investors. So in today's era, we can't say that either the innovation is done by only large firms or it is done by small firms. We are deepening into this issue and try to find out in our research.

2.3. Firm Age

Does the age of the firm really influence the innovation capacity of the firm? Some literature says that most of the innovation will be done by old firms. But the current trend is totally different as new companies are also taking part in larger extent as they are backed up by large investors. We will find the relationship between these in our research to find the fine results.

2.4. Conglomerate Group

If a firm is part or member of a business group which has diversified business across many industries, it has many advantages to getting various resources, including best practices, support from corporate team to initiate new practices. Such a firm has a wider network of resources and has an advantage over the stand-alone firm.

3. OBJECTIVE OF THE STUDY

The objective of this study is to explore the influence of the key characteristics of the IT firm on its innovation activities and their impact on its financial performance.

- Research and Development expenditure
- Firm size
- Firm Age
- Part of a conglomerate group

4. THEORY AND HYPOTHESES

4.1. Theory

The innovation activities of a firm can be explained using Resource Based View (RBV) which is one of the most prominent theories of strategy. The knowledge bases assets are key sources of innovative ideas and sources of innovation. Enabling these resources will lead to increased innovation in the IT firms. There are many empirical studies of innovation and its impact on firm's performance. Gautam Ahuja and Riitta Katila studied the innovation in U. S. Chemical firms [35] and how the heterogeneity is created among the resources. In this study, the technically skilled resources and availability of research supporting environment can boost the innovation and the RBV of the firm can be used.

4.2. Hypotheses

There are many characteristics of IT firms which influence their innovative initiative and performance. Certain characteristics are internal to the firm and certain characteristics are external to them. The internal characteristics can be managed and controlled by the firm itself. The external characteristics are affected by the industry it belongs, the support providing by the government and other related institutions. There are many factors which influence the innovation in a firm which includes the number of highly skilled resources, access to high technology and tools, interaction and relationship with research institutes and organizations, research culture of the organization and support from management for research initiatives. A firm which allocates more funding to its research initiatives would create a better environment and favorable conditions for innovation activities. Higher funding will lead to more innovations and development of new and advanced products in the market. This leads to better sales and improvement in the market share. Hence we propose the following hypothesis.

Hypothesis 1: Innovative performance of an IT firm increases with the increase in R&D expenditure.

The experience of creating the favorable ecosystem in an IT firm will always foster the innovative culture in a firm. The learning experience brings improvement in the productivity and better allocation and utilization of resources. Hence an experienced firm can produce more innovation products and services. Hence we propose the following hypothesis.

Hypothesis 2: Innovative performance of an IT firm increases with the age of the IT firm.

An IT firm with more skilled resources can allocate more resources for many innovative projects and can produce more innovative products and services. The knowledge sharing among the innovators within the firm also aids to enhance the innovation activities. This leads to quicker launch of new products to the market and better sales and increases in the market share. Hence we propose the following hypothesis

Hypothesis 3: Innovative performance of an IT firm increases with the size (number of employees) of an IT firm.

The availability of required tangible and non-tangible resources or assets to an IT firm will always increase its ability to innovate, create more ideas and to reach to required sources of innovation. We propose total assets of an IT firm will help to increase the innovation and to develop more new products or enhance the current products with improved features to meet the emerging needs of the customers in a dynamically changing environment.

Hypothesis4: Innovative performance of an IT firm increases with the total assets of the firm.

The Figure 1 shows the conceptual model of the research study.
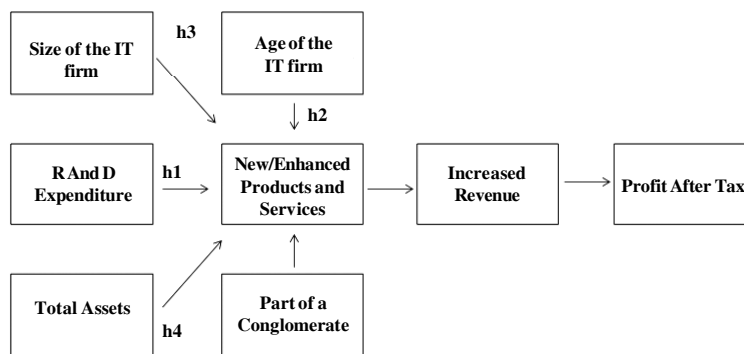
Figure 1: The Model

This study uses the GLS regression for the estimates. The generic form of the regression equation is given below:

Regression Equation is $Y_i = f(X_{1i}, X_{2i}..., X_{ki}) + u_i$

Where *Yi* is the DV, X_1i and X_2i are IV and u_i is the error term of Year$_i$ of firms 1, 2 etc.

Applying the Regression equation to the study variables we get the following equation

$$\ln PAT_{fi} = \beta_0 + \beta_1 RDexp_{fi} + \beta_2 Age_{fi} + \beta_3 Size_{fi} + \beta_4 Total\ Assets_{fi} + \beta_5 Conglomerate_{fi}$$

Where $_f$ is the firm and $_i$ is the year.

5. METHODOLOGY

This study uses the Random-effects Generalized Least Squares (GLS) regression using STATA version 12 to estimate the output variable. This study uses the logarithmic values of the study variables in order to reduce the skewness and for the easy interpretation of the results.

5.1. Data

This research study uses Centre for Monitoring Indian Economy Pvt. Ltd (CMIE) Prowess database to collect data related to Indian IT firms. The study includes IT firms with the National Industrial Classification (NIC) codes 620 (Computer programming, consultancy, and related activities), 639 (other information service activities), and 829 (business support services). The period of study is from 2010 to 2016. It is an unbalanced time series panel data. The variance inflation factors (vif) of the study variables are less than 5, which show there is no multicollinearity among them.

5.2. Variables and Measures

5.2.1. Dependent Variable
Profit After Tax (PAT)

This research study uses the firm's Profit After Tax (PAT) as a measure of its performance. It is a good measure of any firm's financial performance due to its innovation activities which lead to more sales and revenue. CMIE collects the PAT data from the publically available financial reports of the firms. This dependent variable is used as a proxy for the innovation output measure of the firm. The PAT value is transformed to natural logarithmic value in order to reduce the skewness of the PAT data. This variable measures PAT in Rs. Million.

5.2.2. Independent Variables
RDexp

This study uses the Research and Development (R&D) expenditure measured in Rs. Million as the key independent variable (RDexp) which is a good measure of R&D spending by the IT firms. The value of R&D expenditure has a direct influence on the innovation activities within the firm which lead to more new products and also significantly improved current products and services. These new products or services will lead to more revenue for the IT firms as they meet the current requirements of the customers and also with the latest technologies which are more compatible with other systems or applications used by the customers.

Age

This study uses the number of years in providing the service of the firm since its inception (Age of the IT firm as of 2016) as one of the independent variables. The experience gained by an IT firm will lead to

improved planning and effective utilization of its financial and human resources. This variable measures Age in a number of years.

Size

The number of employees of the firm (Size) is used as another independent variable in this study. When more resources are available, a firm can dedicate more resources to its R and D activities. Depending on the nature of the service provided by the IT firm the percentage of employees dedicated to R&D would vary. When more employees are dedicated to

R&D activities, this will lead to more innovation activities and new products and services to the market.

Total Assets

This study also uses the Total Assets of the firm including tangible and non-tangible assets as one of the independent variables. A firm can allocate more funds and resources to innovation activities when it has sufficient financial resources. This variable measures the Total Assets in Rs. Million.

5.2.3. Dummy Variable
Conglomerate Group

This study uses Conglomerate Group as a dummy variable. When an IT firm is part of a conglomerate group, it gets sufficient support in terms of financial, human resources and access to wider range of technology and support services. This variable is assigned with 1 when it is a member of a conglomerate group otherwise, it gets 0.

5.3. Descriptive Statistics of The Variables

The following table gives the descriptive statistics of the study variables.

Table 1
Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
PAT	132	15073.97	40523.47	-10636.70	229014.20
RDexp	111	822.87	1631.14	0.30	9070.00
Age	147	20.57	8.39	2.00	35.00
Size	62	47825.37	83122.66	54.00	355843.00
Totalassets	134	71953.64	154922.40	0.50	783031.30
lnPAT	104	6.54	3.39	-0.92	12.34
lnRDexp	111	4.91	2.30	-1.20	9.11
lnAge	147	2.85	0.72	0.69	3.56
lnSize	62	9.02	2.40	3.99	12.78
lnTotalassets	134	8.75	2.89	-0.69	13.57
Conglomerate	147	0.62	0.49	0.00	1.00

6. RESULTS AND DISCUSSIONS

The following table provides the correlation between the study variables.

Table 2
Correlation Matrix

	1	*2*	*3*	*4*	*5*	*6*
PAT	1					
RDexp	0.51	1				
Age	0.04	0.52	1			
Size	0.98	0.43	-0.02	1		
Totalassets	0.98	0.64	0.14	0.94	1	
Conglomerate	0.16	-0.28	-0.45	0.24	0.12	1

The regression equation of the model 1 is

lnPAT = -5.73 + 0.146 lnRDexp + 0.792 lnAge + 0.369 lnSize + 0.692 lntotalassets

Model 2 introduces the dummy variable Conglomerate. The regression equation of the model2 is

lnPAT = -6.14 + 0.153 lnRDexp + 0.909 lnAge + 0.293 lnSize + 0.744 lntotalassets + 0.288 conglomerate

Table 3
Models

lnPAT	*Model 1*	*Model 2*
Constant Coeff(SE)	-5.727512 (1.030583)	-6.141547 (1.158052)
lnRDexpCoeff(SE)	0.145891*** (0.0565776)	0.1525934*** (0.0591461)
lnAgeCoeff(SE)	0.7921887*** (0.3053724)	0.9086928*** (0.3472665)
lnSizeCoeff(SE)	0.3693011*** (0.1163765)	0.2933881** (0.1394852)
lnTotalassetsCoeff(SE)	0.69145*** (0.1030898)	0.7438566*** (0.1123119)
ConglomerateCoeff(SE)		0.2880045 * (0.3317511)
R-Square	0.9765	0.9760

* $p<0.10$; **$p<0.05$; ***$p<0.01$

All the four independent variables lnRDexp, lnAge, lnSize, and lnTotalassets are showing the statistically significant impact on the output variable lnPAT with 95% confident interval in both models. Both models explain 97% of changes in the output variable. The coefficient of the independent variable lnRDexp is 0.153 it means for each 1% increase in the RDexp the lnPAT increases by 0.15%. This result supports our hypothesis 1 which says that IT firm's profit after tax will increase with the increase in the Research & Development expenditure.

Similarly, 1% increase in the lnAge increases 0.91% in the output variable lnPAT. This supports our hypothesis 2 Innovative performance of the IT firm increases with the age of the IT firm. The size of the firm also aids to increase the innovative performance of an IT firm. This supports our hypothesis 3. The coefficient of lnTotalassets is 0.69 and it is statistically positive and hence it has a positive influence on the innovation in the firm. As per our study results, a firm being part of a conglomerate is not showing any significant impact on the innovative performance of a firm.

7.   FUTURE DEVELOPMENT

This study uses the data available in the CMIE database which has limited data on IT firms and their characteristics. This study can be further extended by collected more innovation-related data including the patents, copyrights, revenue information from innovations. Other characteristics of the IT firms including their interaction with research institutions, universities, alliances can be further studied and tested for their influence on the innovation.

8.   CONCLUSION

We submit that this research study extends our understanding of the role of R&D expenditure in the firm's innovation activities and firm's performance. Our model predicts that the firm's performance increases with a list of its characteristics. The list includes the R&D expenditure, the age of the firm, the size of the firm in terms of a number of employees, the total assets of the firm, and part of a conglomerate. To measure the firm's innovativeness the PAT is used as a proxy. Our study supports the postulate that when a firm increases its R&D expenditure its innovation activities increase. The other characteristics are the age, the size of the firm and total assets also help to increase the innovation activities in a firm resulting in improved PAT and market share.

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