Status and Trend of R&D Disclosures: A Study of Selected Organizations in India

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Abstract

The present study was undertaken to explore the R&D activities of selected companies in India. An attempt has been made to find out variations relating to R&D activities among various sectors and companies. R&D activities for the purpose of this study included the amount of R&D expenditure as well as other R&D disclosures made in the annual reports of the companies. Content analysis was used for measuring qualitative disclosures. Five companies each from five sectors, namely, biotechnology, pharmaceuticals, information technology (IT), food, and fertilizers, with the period of analysis covering 10 years from 2002-03 to 2011-12, were included in the study. Results indicate that pharmaceuticals and biotechnology are the leading sectors for R&D intensity in India. Overall, a positive growth was observed for R&D activities across the board. Significant positive correlation was found between R&D expenditure and qualitative R&D disclosures.

Keywords: **R&D, R&D expenditure, R&D intensity, qualitative disclosures, research and development**

JEL Classification: M11, M40, M41, M49

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There has been a shift in the sources of wealth creation and increasingly, the focus is shifting from material assets to intangible assets (Goldfinger, 1997). Research and Development (R&D) activities vary from company to company depending upon the cost, benefits, time, resources, and scope involved. In the fast-changing business environment and with fast paced technological development, product and process R&D have emerged as crucial factors for the survival of organizations. Careful selection of R&D activities by the managers is expected to lead to the long-run success of businesses. R&D disclosures may be related to the number of patents held by a company, or the R&D expenditure made by a company in a particular year, or the kind of tie-ups made for the purpose of R&D, or the copyrights or licenses with respect to R&D given or held by a company, and so forth. Companies (Disclosure of Particulars in the Report of Board of Directors) Rules, 1988 in India says that companies shall make disclosures about a number of issues. The same set of rules requires the disclosures related to R&D, technology absorption, adaptation and innovation under Form 'B'.

In India, the government accounts for majority of the investments in defense, agriculture, space, and infrastructure. Major areas involving R&D by multinational companies are IT, telecommunications, chemical and pharmaceuticals, consumer durables, and automotive. The country is fast emerging as a major center for cutting-edge R&D projects for global multinationals such as Microsoft and Motorola as well as Indian firms ("India Inc tops global R & D investment growth charts," 2013). Indian companies have come on the top globally when it comes to growth in their research and development (R&D) investments, leaving their counterparts in the U.S. and Europe far behind (European Commission, 2012). However, Indian firms rank far below when it comes to absolute R&D investments made by them and the top-ranked company from the country, IT major Infosys, was

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ranked at the 329th place globally ("Indian companies top global charts for investment in R&D," 2013). Business organizations in emerging economies are increasingly engaging in voluntary disclosure practices related to intellectual capital so as to disseminate maximum information to the stakeholders (Kang, 2006). Intangible asset intensive companies emphasize more on disclosures (Lang & Lundholm, 1993 ; Tasker , 1998).

The present study is aimed at exploring the R&D activities of selected companies in India. An attempt was made to find out variations among various sectors and companies relating to R&D activities. R&D activities for the purpose of this study include the amount of R&D expenditure as well as other R&D disclosures made in the annual reports of the companies. The present study is an attempt to contribute towards a relatively less explored domain in the context of R& D expenditure and disclosures in India.

Review of Literature

Margolis and Kammen (1999) concluded that energy technology funding levels have declined significantly throughout the industrial world. The U.S. R&D spending and patents, both overall and in the energy sector, have been highly correlated, and the R&D intensity of the U.S. energy sector has been extremely low during the past two decades. Chan, Lakonishok, and Sougiannis (2001) concluded that under the current U.S. accounting standards, financial statements do not report intangible assets and R&D spending was expensed and companies with high R&D to equity market value earned large excess returns. Goel and Ram (2001) found a much sharper adverse effect of uncertainty on R&D investments, which were likely to be highly irreversible, than non-R&D (and aggregate) investments. According to Griffith, Redding, and Reenen (2001), in addition to the conventional role of stimulating innovation, R&D enhances technology transfer by improving the ability of ? rms to learn about advances in the leading edge ('absorptive capacity'). They found evidence that R&D is economically and statistically important in the catch up process and is also stimulating innovation directly. Hall (2002) concluded that small and new innovative firms experience high costs of R&D capital that are only partly mitigated by the presence of venture capital. Lin and Saggi (2002) found that process R&D investments increase with the degree of product differentiation, and firms invest more in products' R&D when they could do process R&D than when they could not.

Zhang, Zhang, and Zhou (2003) showed that ownership was found to be a contributing factor in the cross-sectional variance of both R&D and productive efficiencies. The state sector had significantly lower R&D and productive efficiency than the non-state sector, and within the non-state sector, foreign firms had higher R&D and were productive. Belderbos, Carree, Diederen, Lokshin, and Veugelers (2004) found that the determinants of R&D cooperation differ significantly across cooperation types. The positive impact of firm size, R&D intensity, and incoming source-specific spillovers was weaker for competitor cooperation, reflecting greater appropriability concerns. Bloch (2005) found evidence that internal funds were important in explaining R&D investments, indicating that R&D investment decisions were affected by credit market imperfections. Darroch (2005) found that a firm with a knowledge management capability would use resources more efficiently and so would be more innovative and perform better. Lantz and Sahut (2005) found that the growth of technological firms was based on the exploitation of innovative products and services, thus forcing them to strongly invest in R&D. Lin, Lee, and Hung (2006) suggested that firms in different technology categories should have different technology commercialization strategies and that commercialization orientation and R&D intensity complement each other. Tikoria, Banwet, and Deshmukh (2006) conducted a study on the balanced scorecard for performance evaluation of R&D organizations, and found that a huge amount of money and other resources were deployed in R&D by government as well as private organizations.

Cetindamar and Ulusoy's (2008) research findings showed that Turkish firms had high-collaboration ties with other companies, in particular, but the existing partnerships had a weak impact on innovation performance. Zainol, Nair, and Kasipillai (2008) concluded that the companies in the consumer sector had a higher probability of reporting R&D costs as intangible assets (investment) than companies in the industrial sector. Negassi (2009) reported that spillovers drive the production of individual firms together and link it to incidences of innovation.

Othman and Ameer (2009) conducted a study on the determinants and persistence of R&D investments in Malaysia and found persistence in the firm-level R&D expenses. Anandarajan, Chiang, and Lee (2010) found that the R&D tax credit had an influence of operating performance and that the association of R&D tax credit with operating performance was moderated by the stage of the firm in its respective life cycle. Serrano - Bedia, López-Fernández, and García-Piqueres (2010) undertook a research to analyze the decision of institutional cooperation on R&D; determinants and sectoral differences confirmed that the differences were fundamentally related to transaction cost theory and resource-based view with respect to the costs. Hait and Jangili (2010) observed that R&D spending in India was becoming one of the critical drivers for both growth and employment in a sustained manner, therefore, it had become necessary to account for the increasingly sizeable portion of R&D spends as investment expenditures.

Hall, Mairesse, and Mohnen (2010) concluded that the private returns to R&D were strongly positive and somewhat higher than those for ordinary capital, while the social returns were even higher, although variable and imprecisely measured in many cases. Merkley (2010) found that current performance was negatively related to qualitative disclosure and also concluded that the firms' decision to provide earnings guidance was positively related to current performance. Boujelben and Fedhila (2011) found that there was a positive and significant effect of intangible assets on future OCF. While the effect of R&D activities and quality persists until the third lagged period, the effect of advertising expenditures was rapid and temporary. Bromiley and Washburn (2011) concluded that the cost cutting argument and R&D spending increases monotonically with performance relative to social aspirants. Koch (2011) conducted a research on firm-internal knowledge integration and the effects of innovation. The author proposed knowledge-relatedness as an important moderator for the relationship between operating routines and innovative performance. Andries and Wastyn (2012) confirmed that the use of KM techniques had an indirect positive impact on financial performance via increased innovation performance.

Doran (2012) conducted a research to provide an empirical analysis of whether differing forms of innovation act as complements or substitutes in Irish's production functions. The results suggested that there was a substantial degree of complementarity among different forms of innovation. Inauen and Wicki (2012) revealed that companies that emphasize inside-out open innovations were more likely to create radical innovations and tend to sell a greater number of new products. Rao, Chandra, and Shin (2012) found that the location of R&D off shoring was significantly determined by ownership of physical assets by MNCs in the host country and the host country's technological capability. Sharma (2012) reported that R&D intensity has a positive effect (15%) on total factor productivity. The results also confirmed that the performance of foreign firms operating in the industry is more sensitive towards R&D than the local firms.

Research Methodology

The population of the study consisted of large scale organizations in India. Two stage sampling was used for selecting the sample for the study. Firstly, 5 sectors namely Pharmaceutical, Biotechnology, Fertilizer, Information Technology, and Food sectors were included in the study. These sectors were included in the study on account of relatively higher R&D intensity. In the second stage, five companies were selected from each sector based on the availability of data for the past 10 years, thus making a total sample of 25 organizations (Table 1).

For fulfilling the objectives of the study, secondary data were used. An attempt was made to measure R&D activities of the selected organizations, both qualitatively as well as quantitatively. R&D intensity (ratio of R&D expenditure to sales) was taken as the quantitative measure. Content analysis was used to measure R&D activities qualitatively. Qualitative disclosure of R&D activities was measured by searching for some keywords related to R&D. These keywords included the words : Research & development ; R & D ; product development ; research ; development; research, engineering, and development ; research and product development . Merkley (2010) also used the same methodology for his study. The data were collected for the time period of 10 years, that is, from 2002-03 to 2011-12. Data related to R&D expenditure as well as other R&D disclosures was collected from the Form 'B' given in the annexure of the Director's Report and by sifting through the annual reports.

Table 1. Companies Considered for the Present Study

Sectors	Companies
Biotechnology (Biotech)	Monsanto India Ltd. (being Agri-biotech), Panacea Biotec Ltd., AstraZeneca India Ltd., Jubilant Life Sciences Ltd., Biocon Ltd.
Pharmaceuticals	Aurobindo Pharma Ltd., Dr. Reddy Laboratories. Ltd., Ranbaxy Labs. Ltd., Cipla Ltd., Zydus Cadila
Information Technology (IT)	Infosys, Wipro Infotech Ltd., Dell, Tata Consultancy Services Ltd., Hindustan Computers Ltd.
Food	Marico, Nestle India Ltd., PepsiCo Ltd., Dabur India Ltd., India Tobacco Company Ltd.
Fertilizer	Indian Farmers Fertilizers Co-operative Ltd., Gujarat State Fertilizers & Chemicals Ltd., Nagarjuna Fertilizers & Chemicals Ltd., Tata Chemicals Ltd., Deepak Fertilizers & Petrochemicals Corporation Ltd.

Secondary data was collected pertaining to the selected companies on: R&D expenditure, R&D intensity, and qualitative disclosures of R&D activities. Twenty five organizations selected in the sample were considered as the sample for the present study. Analysis of Variance (ANOVA) was used to find the differences among more than two sample means. Post-hoc analysis was used to find out differences in the individual means. Tukey-B test was used to find out the homogeneous sets. Linear trend analysis was carried out by using time as the independent variable, and the variables such as R&D expenditure, R&D intensity, and qualitative disclosure of R&D activities were considered as the dependent variables separately. Correlation analysis was used to find out the degree of association between the selected variables.

Analysis and Results

Results pertaining to analysis of R&D disclosures, in quantitative and qualitative measures, have been presented in the following sections.

➲ **R&D Intensity :** Results of ANOVA for sector-wise R&D intensity have been presented in the Table 2. It can be observed from the Table that the mean score of R&D intensity for the pharmaceutical sector was maximum, that is, 8.14 followed by the biotech sector, with a mean score of R&D intensity being 4.38. The fertilizer sector had the minimum mean score (0.10) of R&D intensity. The average mean score of all the sectors for R&D intensity was 2.82. Hence, it can be stated that the pharmaceutical sector was having the highest level of R&D intensity, followed by the biotechnology sector. The calculated *F*-value is 65.582, with *p*-value being less than 0.0001. This indicates that there was a significant variation across the concerned sectors in terms of R&D intensity. Post-hoc analysis was done by using the Tukey-B test. The Tukey-B test provides homogeneous subsets which are also shown in the Table 2 in the form of superscripts. It can be seen from the Table that fertilizer, food, and the IT sector belong to the same homogeneous subset. Company wise ANOVA results for R&D intensity have been shown in the Table 3. It can be observed from the Table that the mean score of R&D intensity for Zydus Cadila is maximum, that is, 10.90 followed by Ranbaxy, with a mean score of 10.40 for R&D intensity. Deepak Fertilizers, IIFCO, and GSFC had the minimum mean score of R&D intensity, that is, 0.10.

It can be observed that Zydus Cadila, Ranbaxy, Panacea, and Dr. Reddy's Laboratories Ltd. had the highest level of R&D intensity than the other organizations considered for analysis. Deepak Fertilizers, Tata Chemicals, and Marico were having relatively lower R&D intensity. The calculated *F*-value is 24.180, with highly significant *p*-value of <0.0001. This indicates that there was a significant variation across various companies in terms of R&D intensity. Post-hoc analysis was done by using the Tukey-B test.

➲ **Qualitative Disclosures in case of R&D Activities :** The sector wise comparison of qualitative disclosures of R&D activities of various sectors included in the study has been shown in the Table 4. It can be observed that the mean score of qualitative disclosure of R&D activities was the highest in case of the IT sector, that is, 11.62 followed by the food sector, with the mean score of qualitative disclosure of R&D activities being 9.84. The fertilizer sector had the minimum mean score of qualitative disclosure of R&D activities (6.48). The calculated

Table 2. Sector Wise Comparison of R&D Intensity

Sectors	Mean	Standard Deviation	*F*-value (*p* - value)
Pharmaceuticals	8.14[c]	3.89	
Biotechnology	4.38[b]	3.93	
Food	0.86[a]	3.69	65.582 (<0.0001)
IT	0.60[a]	0.67	
Fertilizers	0.10[a]	0.30	
Total	**2.82**	-	

Note : Superscripts in the 'Mean' column represent membership of homogeneous subsets, values with the same superscript do not differ significantly

F- value is found to be 4.309, with *p*-value being 0.002. This indicates that there was a significant variation across different sectors in terms of qualitative disclosures. The post-hoc analysis was done by using the Tukey-B test. It

Table 3. Company Wise Comparison of R&D Intensity

Company	Mean	Std. Deviation	*F* - Value (*p* - value)
Zydus Cadila	10.90[a]	3.35	24.180 (<0.0001)
Ranbaxy	10.40[a]	3.34	
Panacea	9.70[ab]	3.83	
Dr. Reddy's Lab.	8.70[ab]	3.40	
Cipla	6.80[bc]	3.26	
Biocon	6.70[bc]	2.16	
Aurobindo	3.90[cd]	1.10	
Nestle	2.60[de]	8.22	
Jubilant	2.60[de]	0.84	
Monsanto	1.90[de]	1.79	
Infosys	1.20[de]	0.63	
AstraZeneca	1.00[de]	0.47	
Dell	1.00[de]	0.00	
PepsiCo	0.70[de]	0.48	
Dabur	0.50[de]	1.27	
HCL	0.50[de]	0.85	
ITC	0.40[de]	0.52	
Nagarjuna	0.40[de]	0.52	
Wipro	0.30[de]	0.48	
GSFC	0.29[e]	0.00	
TCS	0.18[e]	0.00	
IFFCO	0.11[e]	0.00	
Marico	0.10[e]	0.32	
TATA Chemicals	0.10[e]	0.32	
Deepak Fertilizers	0.10[e]	0.00	
Total	**2.82**	-	

Note : Superscripts in the 'Mean' column represent membership of homogeneous subsets, values with the same superscript do not differ significantly

Table 4. Sector Wise Comparison of Qualitative Disclosure of R&D Activities

Sectors	Mean	Standard Deviation	F-value (p - value)
IT	11.62[a]	11.15	4.309 (<0.002)
Food	9.84[ab]	5.18	
Biotechnology	9.66[ab]	4.45	
Pharmaceuticals	9.32[ab]	4.36	
Fertilizers	6.46[b]	3.28	
Total	**9.38**	-	

Note : Superscripts in the 'Mean' column represent membership of homogeneous subsets, values with the same superscript do not differ significantly

can be observed from the Table 4 that there was a significant difference in qualitative R&D disclosures between the IT and fertilizer sectors.

The company wise comparison of qualitative disclosures of R&D activities of various sectors has also been included in the present study. It can be seen from the Table 5 that the mean score of qualitative disclosure of R&D activities was the highest in case of IT major Dell, that is, 24.60 followed by Dr. Reddy's Laboratories Ltd., with the mean score of qualitative disclosure of R&D activities being 16.30. IFFCO had the minimum mean score of qualitative disclosure of R&D activities (0.50). The results show that the IT sector made the maximum disclosure of R&D related information in its annual reports, and the fertilizer sector made the least qualitative R&D disclosures. The calculated *F*- value is found to be 10.623, with *p*-value being 0.0001. This indicates that there was a significant variation across companies in terms of qualitative disclosures of R&D activities. Results of the post-hoc analysis using the Tukey-B test indicate that the extent of qualitative R&D disclosures in case of Dell was significantly different from all other organizations included in the analysis.

➲ **R&D Expenditure :** The sector wise comparison in terms of R&D expenditure has been shown in the Table 6. It can be observed from the Table that the mean score of R&D expenditure for the period of analysis was the highest in case of the IT sector, that is, ₹ 625166.0 million followed by the food sector, with the mean score of R&D expenditure being ₹ 325372.0 million. The fertilizer sector had the minimum mean score of R&D expenditure, that is, ₹ 6279.6 million. The calculated *F*- value was found to be 9.043, with *p*-value = 0.0001. This indicates that there was a significant variation across various sectors in terms of R&D expenditure. The post-hoc analysis indicates that the IT sector differed significantly from the other sectors in terms of R&D expenditure.

The company wise comparison of R&D expenditure of various organizations included in the study has been shown in the Table 7. It can be observed from the Table that Dell has the highest mean score value of R&D expenditure, that is, ₹ 2666606.6 million followed by PepsiCo, with a mean score of ₹ 133094 million. IFFCO had the minimum mean score of R&D expenditure, that is, ₹ 471.0 million. The calculated *F*- value is found to be 39.959, with *p*-value being 0.0001. This indicates that there was a significant variation across various companies in terms of R&D expenditure. Post-hoc analysis was done by using the Tukey-B test, which indicates that with the exception of Dell and Pepsi Co, all other organizations included in the study were part of the homogeneous subset at 5% level of significance in terms of absolute R&D expenditure. Furthermore, it can be seen from the Table 7 that there was a significant difference in terms of absolute R&D expenditure between Dell and Pepsi Co as well.

Trend Analysis

Results of the trend analysis for R&D expenditure, R&D intensity, and qualitative disclosure of R&D activities have been shown in the Table 8. Value of coefficient of determination (R^2) and *t*-value for the trend coefficients have also been presented. It can be observed from the Table 8 that the trend coefficients in case of absolute R&D expenditure are positive and significant for all the sectors. This indicates that there has been a rise in R&D

Table 5. Company Wise Comparison of Qualitative Disclosure

Company	Mean	Std. Deviation	*F* - Value (*p* - value)
Dell	24.60[a]	18.18	10.623 (<0.0001)
Dr. Reddy's Lab.	16.3[0b]	3.65	
Jubilant	14.50[bc]	2.84	
Panacea	13.90[bcd]	2.42	
Nestle	13.60[bcd]	1.51	
Dabur	13.50[bcde]	5.40	
Infosys	11.50[bcdef]	3.21	
TCS	9.90[bcdefg]	7.20	
AstraZeneca	9.60[bcdefg]	0.97	
Zydus Cadila	9.50[bcdefg]	3.27	
Marico	8.90[cdefg]	2.69	
Nagarjuna	8.80[cdefg]	1.48	
GSFC	8.70[cdefg]	1.77	
HCL	8.20[cdefg]	3.62	
Aurobindo	7.90[cdefg]	0.99	
PepsiCo	7.20[cdefgh]	7.10	
Deepak Fertilizers	7.20[cdefgh]	0.42	
TATA Chemicals	7.10[cdefgh]	0.88	
Cipla	6.90[defgh]	1.85	
ITC	6.00[efgh]	1.05	
Ranbaxy	6.00[efgh]	0.00	
Monsanto	5.60[fgh]	0.516	
Biocon	4.70[fgh]	1.06	
Wipro	3.90[gh]	0.99	
IFFCO	0.50[h]	0.53	
Total	**9.38**	-	

Note : Superscripts in the 'Mean' column represent membership of homogeneous subsets, values with the same superscript do not differ significantly

Table 6. Sector Wise Comparison of R&D Expenditure

Sectors	Mean (in ₹ Millions)	Standard Deviation	*F* -value (*p* - value)
IT	625166.0[a]	108580.65	9.043 (<0.0001)
Food	325372.0[b]	71875.44	
Pharmaceuticals	260706.6[bc]	16051.48	
Biotechnology	41633.8[bc]	4363.91	
Fertilizers	6279.6[c]	736.29	
Total	**251831.6**	-	

Note : Superscripts in the 'Mean' column represent membership of homogeneous subsets, values with the same superscript do not differ significantly

expenditure across the board for the last 10 years for the organizations included in the study.

A similar trend can be seen in the case of qualitative disclosures as well, with the exception being the fertilizer sector. Trend coefficients, in case of the fertilizer sector, are not significantly different from 0, indicating that the

Table 7. Company Wise Comparison of R&D Expenditure

Company	Mean (in ₹ Millions)	Std. Deviation	*F* - Value (*p* - value)
Dell	2666607.0[a]	70389.64	39.959 (<0.0001)
PepsiCo	1330940.0[b]	99790.69	
Ranbaxy	438519.0[c]	12482.46	
Dr. Reddy's Lab.	359391.0[c]	15104.29	
Infosys	243137.0[c]	22175.92	
Cipla	226916.0[c]	6398.88	
Nestle	206490.0[c]	61779.05	
Zydus Cadila	179370.0[c]	10633.73	
HCL	100403.0[c]	23248.05	
Aurobindo	99337.0[c]	5454.27	
ITC	72781.0[c]	3794.92	
Panacea	68594.0[c]	4098.75	
Wipro	66666.0[c]	6345.19	
Jubilant	65637.0[c]	4243.50	
Biocon	64286.0[c]	4249.93	
TCS	49017.0[c]	4544.30	
Nagarjuna	11276.0[c]	996.99	
Dabur	9765.0[c]	1343.76	
GSFC	9711.0[c]	262.49	
TATA Chemicals	8979.0[c]	841.16	
Monsanto	7147.0[c]	635.66	
Marico	6884.0[c]	671.25	
AstraZeneca	2505.0[c]	58.28	
Deepak Fertilizers	961.0[c]	44.052	
IFFCO	471.0[c]	27.86	
Total	**251831.6**	-	

Note : Superscripts in the 'Mean' column represent membership of homogeneous subsets, values with the same superscript do not differ significantly

trend is absent. The sharpest increase in R&D expenditure was found for the food sector amongst all the sectors. The sharpest increase in R&D intensity was observed for the biotechnology sector ; while the sharpest increase in qualitative disclosures was found in the case of the IT sector.

By introducing the dummies for various sectors coupled with their interaction effects with the trend variable in the original trend equation, we estimated the regression equation by pooling the data for all the sectors. This methodology was used for testing the difference between the regression coefficients for different groups. Significant *F*-statistics indicate that there is a significant difference in the regression coefficients of various groups. Results for testing the difference between trend coefficients for various sectors have been presented in the last row of the Table 8. Significant *F*-statistics were found for all the three variables, that is, R&D expenditure, R&D intensity, and qualitative disclosures.

Results of the correlation analysis have been presented in the Table 9. It can be seen from the Table that for the whole data, significant positive correlation was found between R&D expenditure and qualitative R&D disclosures. This indicates that qualitative R&D disclosures increase with an increase in R&D expenditure. Furthermore, the sector-wise analysis reveals that except for pharmaceuticals, there was a significant positive correlation between R&D expenditure and qualitative disclosures. Maximum value of the correlation coefficients

Table 8. Results for Linear Trend Analysis

Sector	R&D Expenditure	R&D Intensity	Qualitative Disclosure
Biotech	TE: **24.58+314.02 *T***, R^2=0.91	TE: **2.56+0.29 *T*,** R^2=0.50	TE: **40.93+1.34 *T*,** R^2=0.56
	t = 8.84 (<0.0001)	*t* = 2.85 (0.0214)	*t* = 3.17 (0.0133)
Pharmaceuticals	TE: **5454.17+1378.39 *T*,** R^2 = 0.92	TE: 9.352-0.26 *T*, R^2=0.20	TE: **37.27+1.69 *T*,** R^2 = 0.55
	t = 9.66(<0.0001)	*t* = -1.41(0.195)	*t* = 3.08(0.0152)
IT	TE:**15821.73+2904.83 T,** R^2=0.78	TE: 1.01+0.003 *T*, R^2=0.003	TE: **25.4+5.95 *T***, R^2=0.54
	t = 5.26(0.0008)	*t* = 0.17(0.871)	*t* = 3.07(0.0155)
Food	TE: **7294.69+4284.23 *T***, R^2=0.81	TE: **0.007+0.12 *T***, R^2=0.66	TE: **26.8+4.11 *T***, R^2=0.86
	t = 5.79(0.0004)	*t* = 3.93(0.0044)	*t* = 6.89 (0.0001)
Fertilizers	TE: **0.83+56.94 *T***, R^2=0.80	TE: 0.11+0.01 *T*, R^2=0.31	TE: 35.8-0.64 *T*, R^2=0.37
	t = 5.64(0.0005)	*t* = 1.87 (0.0977)	*t* = -2.17 (0.06)
F- Statistics (9,40)	66.321 (*p* = <0.0001)	65.359 (*p*= <0.0001)	11.765 (*p* = <0.0001)

TE: Trend Equation, *t*-values for trend coefficients have been shown, Trend equations in bold represent significant trend coefficients

Table 9. Correlation Between Selected Variables

Companies	R&D Expenditure & Qualitative Disclosure	R&D Intensity & Qualitative Disclosure
All	0.510*** (<0.0001)	0.071 (0.266)
Biotech	0.381** (0.006)	0.205 (0.154)
Pharmaceuticals	0.220 (0.124)	- 0.005 (0.972)
IT	0.691 *** (<0.0001)	0.315* (0.026)
Food	0.092 (0.523)	0087 (0.546)
Fertilizers	0.514 *** (<0.0001)	0.199 (0.166)

* significant at 5 %, ** significant at 1 %, *** significant at 0.01, *p*-values have been presented in parentheses

between R&D expenditure and qualitative disclosures were found in the case of the IT sector. The correlation coefficients for R&D intensity and qualitative disclosures were not significant (except for the IT sector). A significant positive correlation between R&D intensity and qualitative disclosures was also observed for the IT sector.

Discussion

Results of the trend analysis indicate that R&D activities are gaining pace in India as the majority of the trend coefficients were found to be positive and significant. Maximum positive trend coefficients were found in case of the IT sector, indicating the relatively high growth in R&D intensity. Furthermore, trend coefficients of the IT and pharmaceutical sectors were not significantly different from 0, indicating that R&D intensity was stabilized for these sectors. Importantly, a positive trend was witnessed for qualitative R&D disclosures and R&D expenditures across the board. This indicates that businesses in India are realizing the intentions and initiatives in context of R&D.

The available results indicate significant variations across sectors and organizations for all the three variables included in the study, that is, R&D expenditure, R&D intensity, and qualitative R&D disclosures. Maximum R&D intensity was observed in case of the pharmaceutical sector, with a 10 year average of 8.14. The biotechnology sector was having a relatively modest R&D intensity at 4.38. On the other hand, food, IT, and the fertilizer companies were investing less than 1% of their sales in R&D. It can be stated that R&D activities in these sectors were at a low level. Qualitative disclosures also provide helpful information to investors and other stakeholders. It can be seen from the available results that maximum R&D disclosures were made by the IT sector followed by the

Table 10. R&D Growth Rate in Different Countries

Countries	R&D Growth Rate (in %)
India	35.1
China	28.1
US	9.0
EU	8.9
Japan	1.6
Switzerland	1.4

Source: Adapted from European Commission. (2012). EU R & D scorecard. The 2012 EU industrial R & D investment scorecard. Retrieved from http://www.iri.jrc.ec.europa.eu/docs/scoreboard/2012/SB2012.pdf

food and biotechnology sectors. Although food and IT sectors were low on R&D intensity, but these sectors were found to be active in terms of qualitative disclosures. Furthermore, a significant positive correlation was found between R&D expenditure and qualitative disclosures. This indicates that the companies with higher R&D expenditure tend to make qualitative disclosures aggressively.

According to the World Intellectual Property Report (2011), Indian companies have a long way to go to go before matching the world leaders in R&D activities. Only two Indian companies figured in the global list of top 1000 R&D spenders in 2005. In 2009, this number doubled to four. Even in 2009, no Indian organization was able to make it to the top 500 list. India as a country spends less than 1% of its GDP on R&D, while the world leader Israel spends 4.7% of its GDP on R&D activities (WIPO Economics and Statistics Series, 2011).

The Table 10 provides the industrial R&D growth rates in different countries. It can be seen from the Table that India and China had their growth rates pegged at 35.1% and 28.1% respectively. For the U.S. and Japan, the R&D growth rates were around 9%, with marginal R&D growth being witnessed in case of Japan. While interpreting the data, one must take into account the difference in bases for various countries, and especially for India, whose base is on the lower side. Nevertheless, these figures clearly demonstrate the increased orientation and progress made by India on the industrial R&D front.

Managerial Implications

The present paper has shown that R&D spending in India is becoming one of the critical drivers of both growth and employment in a sustained manner, therefore, it has become necessary to account for the increasingly sizeable portion of R&D spends as investment expenditure (Hait & Jangili, 2010). R&D not only affects productivity of the organization, but also leads to improvement in the firm's performance. R&D is a key element of many organizations, and when well planned and used, it enables a business to generate increased wealth over a period of time. R&D is essential to keep oneself ahead of one's peers. It helps firms to gain a competitive advantage over its competitors in many ways such as by bringing innovative products into the market, aids in producing quality products at cheaper costs, and so forth. High R&D intensities were observed in case of the pharmaceutical and biotechnology sectors. On the other hand, lower R&D intensities were observed for food, IT, and the fertilizer sectors.

Higher R&D intensities and the resultant outputs can be used as entry barriers. Therefore, managers operating in the pharmaceutical and biotechnology sectors should maintain the level of R&D intensity to reap strategic benefits and remain competitive. Results of the study indicate significant variation across sectors and companies for the variables included in the study. Furthermore, significant differences in trend coefficients of various sectors were found for all the variables included in the study. This shows that R&D activities and their trends are affected by sector specific conditions.

Phenomenon of voluntary disclosures of intangible assets information is gaining pace globally. Kang and Gray (2011) studied the content of voluntary disclosures of intangible asset information communicated by the world's leading 200 emerging-market companies. The detailed assessment of the variety, nature, and extent of intellectual assets disclosures in annual reports using an index based on the value chain scoreboard was studied. It was found that a majority of the companies engage in intellectual assets voluntary disclosure practices. In the emerging knowledge economies, intangible assets based on R&D output, such as patents and copyrights, are fast replacing physical assets. Therefore, managers should invest smartly and timely in R&D activities in the wake of changing paradigms.

Conclusion

The present study is an attempt to measure R&D disclosures, both quantitatively and qualitatively, across various sectors in India. R&D disclosures have been measured using R&D expenditure, R&D intensity, and qualitative disclosures. Comparisons of R&D disclosures and trend coefficients have been made across the selected sectors and organizations. There has been a positive trend of making qualitative R&D disclosures by the companies in India. This positive trend is an indication of the realization on part of Indian organizations that R&D is the key to future growth and profitability. In spite of this increasing trend, significant differences in trend coefficients were found across the sectors. Significant differences in R&D activities and related trends are indicative of sector specificity in the R&D domain in India.

It can be concluded that pharmaceuticals and biotechnology are the leading sectors for R&D intensity in India. The IT and food sectors have been the most active in terms of making qualitative R&D disclosures. Significant positive correlation between R&D expenditure and qualitative disclosure suggests that the companies with higher R&D expenditure tend to make qualitative disclosures aggressively. Overall, a positive growth was observed for R&D activities across the board. India has to traverse some distance to catch up with global averages on the R&D front, but certainly, it is taking strides in the right direction.

Limitations of the Study and Scope for Further Research

The present research attempts to explore R&D activities of business organizations from various sectors in India. The findings of the present study are based on the data obtained from annual reports of business organizations. Therefore, the accuracy of the findings is limited to the accuracy of the reported data. Disparity on the basis of R&D intensity, qualitative R&D disclosures, and R&D expenditure has also been established across firms and sectors. Future research can focus on finding out the reasons for this disparity. Also, attempts can be made to compare R&D activities of Indian firms with global benchmarks. Sector specific studies with a large sample size can also add to the existing body of knowledge.

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