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INTERPLAYS OF RESEARCH AND DEVELOPMENT EXPENDITURE ON PATENTS IN ENERGY, IT AND AUTO SECTOR: EMPIRICAL EVIDENCE FROM NIFTY LISTED COMPANIES.

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Abstract:
Industries and governments of various countries, as well as groups, devote a significant portion of their earnings to research and development activities in order to develop products and also acquire patent protection for them. The short-term goal is to obtain patents, while the long-term goal is to impact countries' economic growth. Thus far, empirical evidence is ambiguous regarding the impact of research and development (R&D) expenditure. Data for the Interplays of R&D Expenditure on Patents in the Energy, IT, and Auto Sectors were gathered from the companies' published financial statements. The study period was confined to 2015–2021. Collected data was analysed and identified the percentage of research expenditure against revenue. Further data was also analysed with patents published with the F-test. The study identified that expenditure on research and development will boost the growth of the organisation and also acquire patents will lead to accomplishing organisational goals. Inversely, it also builds confidence for investors.
Keywords: R&D Expenditure, Patents, F-test, Industries, Energy, IT, Auto sector

Introduction:

Numerous attempts in research and development (R&D) generate perpetual intellectual capital, which serves as a foundation for intrinsic growth in the economy. A nation's physiological monetary base enables it to grow thru the production of knowledge, to expertise financing being regarded as just a related to greater of physical capital. Patent applications are used to safeguard innovative products made via R & d. Additional new study results in the formation of new goods that serve as production factors for subsequent innovations and advancements. There is a continuing process of product design within the framework of a monopolistic tendencies competitive market. Manufacturing dwellings or research and development companies acquire

patent claims for their own technological breakthroughs under patent laws and monopolise the industry to increase profits.

There are additional advantages. Increased R&D on merchandise innovation and technology leads to increased possibilities for generating more revenue on any and all frontiers due to reduced manufacturing cost via spill overs, which benefits both the threshold and increase in public income levels in individual countries. as a result overall (Gulmez, & Yardmcoglu, F., 2012; Gocer, 2013; Gumus & Celikay, 2015; Das & Mukherjee, 2019) Thus, Research and innovation activity enables the principle of increasing returns to also be applied to a manufacturing systems, leading to high output at minimal costs, and thus influencing earnings at least at a certain nation tiers.

Nevertheless, there really are two costs associated with this exchange. Nordhaus (1969) noted that because technology conditions that cause that can be placed to certain other purposes thru the Expenditure, as the considerable cost decrease from relatively long intellectual property duration increment, society must wait longer again for full pension of the advancements to materialise. That's also why empirical evidence, such as that provided by Levin, Klevorick, Nelson, and Winter (1997), Heller and Eisenberg (1998), Ballot, Fakhfakh, and Taymaz (2001), Hall (2007), Jaffe and Lerner (2004), Samimi and Alerasoul (2009), Boldrin and Levine (2013), Bozkurt (2015), Williams (2017), and Das and Mukherjee (2019), demonstrates that Expenditure does not just enhance a country'.

Returning to an era of financial growth models, this same post-Keynesian Harrod-Domra growth model emphasised the importance of saving and investment in stimulating the economy. Solow and Swan's neoclassical growth models criticised post-Keynesian modelling techniques for their inability to generate long-run effects on growth from increases in private savings. Solow (1956) and Swan (1956) argued that external technological advancement was critical to a growing process since it could lower the iterative wealth proportion as well as increase the capital effectiveness. Afterward on, Romer (1990) but rather Lucas (1988) introduced the development of intrinsic technological advancement, incorporating Research and innovation advancement as just an endogenous construct throughout economic models and demonstrating that the expansion is self-perpetuating.

Grossman and Help man (1991), Barro (1991), and Aghion and Howitt (1992) all contributed to further development of endogenous growth model in a globalised world, but instead about their attempts still were bearing fruit in aspects of rise in income. Aghion and Howitt elucidated this same relationship among Investment in r&d and income growth (1992). Every technology, they believe, creates unique intermediate products that can be used to produce the finished products more cheaply. Economy happens as a result of technological advancements, a skilled workforce, and indeed the efficiency of studies. In later periods, research findings such as Blackburn, Huang, and Pozzolo (2000), Lee (2005), Grossmann (2007), and Khan, J., & Khattak, N.U.R. (2013) accompanied this same aforementioned concept.

Literature Review:

Almeida and Teixeira (2007) discovered conflicting findings that patent protection has a negative influence on R & d inside a committee of 88 countries covering the period 1996–2003. Intellectual property accumulation has a significant impact also on R&d expenditures of a group among less developed nations, but it has no statistical significance impact on the group of more advanced connect teams. Danguy, de Rassenfosse, and van Pottelsberghe de la Potterie (2009) reassessed this same quantitative inability to establish connection among R & d and intellectual property qualifies across 18 businesses but also 19 regions and discovered that R&D–patent connection is influenced by the factors including such teaching and research, collective bargaining predisposition, and corporate strategy predisposition, and also that the patent law excitement is mainly a result of globalisation.

Boldrin and Levine (2013) noted there was no verifiable research which patent rights increased advancement or efficiency, unless efficiency was defined solely in terms of patent applications conferred. Additionally, users affirmed that although patent laws has a partial equilibrium impact of raising incentive schemes to invent, their overall impact on advancement could be negligible, and therefore they advocated for intellectual property abolition and emphasised the importance of those other statutory provisions. Sierotowicz (2015) investigated the efficiency of Expenditure inferred from intellectual property interaction in 28 European Union (EU) countries from 1999 to 2013 and deduced that increase in overall interscholastic Expenditure inside the ten largest EU countries' commercial business industries contributed to a sector's patent applications inside the longterm.

Otomo (2017) evaluated the influence of patent claims but also Expenditure in the United States and the European Union, taking into account firm size, government interference, and financial results. It divulged that patent rights have been constantly increasing while yielding diminishing returns, and therefore it would be quick to conclude that patent rights have been disadvantageous to R&D expenditure because they influenced a crucial component of offering financial assistance for prospective creators.Altuzarra (2019) provides information on the relationship among companies' R&D expenditure and intellectual property registration numbers over the time frame 1990–2013 in either a panel of Spanish manufacturing industries. The findings support a bi - directional causality relationship among research and development and patent rights.

Levin et al. (1997) demonstrated in a ground-breaking research that strengthening intellectual property rights is often not helpful to society. The mechanism through which monopoly operates results in an imperfect market, which means that patent victories are not beneficial to the economy in the long run. Heller and Eisenberg (1998) expressed concern that the recent emergence of patent rights throughout biomedical research inferred a distinct tragic incident, a pro, wherein limited resources are underutilised. Thus, they believe that privatisation of biomedical should be more meticulously orchestrated; otherwise, increased intellectual property rights may result in a smaller number of useful products for human health improvement.

Ballot et al. (2001) investigated the impacts of research and development and human resources stock on company performance in France and Sweden using panel data for the years 1987–1993. The findings indicate that R&D and also the stock of human capital play an important role in determining a company's production efficiency in both nations.Chou (2002) investigated this same source of economic growth in Australia from 1960 to 2000 using an adaptation of the notion of 'global discovery of new ideas.' He demonstrated that the Economic growth is obviously not its fairly constant growth path, despite gains in education level but instead study frequency.

Kwack and Lee investigated the impacts of spending and investment, R&D, training, and government effectiveness on long term economic expansion in Korea from 1971 to 2002. (2006). The research reveals that public and private spending on education and R&D investments were the primary drivers of innovation and improvements in labour quality. Falk (2007) observed that increased R&D investment was positively related to growth domestic product (GDP) growth in working-age populations when examining the R&D–economic growth relationships in Organization for Economic Cooperation and Development (OECD) countries. Samimi and Alerasoul (2009) investigates the impact of R&D spending on economic growth in 30 developing nations from 2000 to 2006. It established that Expenditures seemed to have no straightforward effect on the economy and stated that underlying cause was indeed the chosen countries' inadequate funds apportioned to R&D activities. Wu (2010) examined the role of Research and innovation in China using province data. It was discovered that R&D increased national innovation rates and that invention productivity gains and, consequentially, growth in china.

Gocer (2013) discovers a strong correlation among R&D expenditure as a proportion in 11 asian Developing countries from 1996 to 2012. Likewise, it was noted that a 1% rise in R&D expenditures resulted in a 0.43 percent acceleration of economic growth. Inekwe (2014) evaluated the influence of research and development spending on growth in the economy in emerging economies from 2000 to 2009. The findings indicated that Expenditure has a favorable impact on growth in the economy. R&D spending has a positive impact on growth in middle upper economies but is non - significant in relatively low economic systems.

Bozkurt (2015) examined the relationship between R&D expenditure to gdp in Turkey from 1998 to 2013, and the empirical findings indicated that the country experienced pre-emptive cause and effect from growth in the economy to R&D. Williams (2017) contended that, despite the limitations of existing literature, there was still no believable empirical proof on the seemingly straight question of whether greater patent protection incentivised study investment opportunities in developing technologies. Gumus and Celikay (2015) recently examined the relationship among R&D expenditures and economic growth for a panel of 52 countries with varying levels of development from 1996 to 2010. The study concluded that in the long run, Expenditure used to have a favourable and significant impact on economic growth in all countries.

Freimane Blia (2016) examined the empirical relationship between research and development expenditure to gdp in a board of European Union member states from 2000 to 2013, completing that aforementioned used to have a major impact on that. Choi and Yi (2018) examined the effects of the social on the interrelationships among R and d expenditure in a board of 105 countries from 1994 to 2014. It disclosed that Internet technology had a beneficial impact on the impacts of Research and innovation expenditure. Das and Mukherjee (2019) concluded, without erroneous adjustments, that R&d investment and the per capita Economic growth possess lengthy affiliations for elevated and middle upper groups, as well as Japan, Germany, South Korea, France, the United Kingdom, India, and Brazil. Likewise, per capita earnings growth drives Research in the OECD, middle upper countries, and relatively low and intermediate countries, as well as Japan, while R&D drives per capita growth rate in India, Russia, and Brazil. Additionally, the bi - lateral cause and effect between the two is established for the United States of America, China, and South Korea.

Objective of the study

To access the relationship between organizational Research and development expenditure against revenue of companies and also to evaluate patents acquisition in relation to research and development expenditure.

Methodology adopted for the study

The study considered select energy, information technology, and automobile sector companies. The NIFTY listed companies were selected for the study. The confined company's information was collected from financial statements of the companies related to revenue, research and development expenditure, and patents published. If relevant information was not available in financial statements, the related data would be considered to be zero. Further, the ratio of research and development was identified with revenue and research expenditure. Later in the study, the F-test was considered to identify the relationship between patents and research expenditure. Finally, financial report data from 2015 to 2021 were considered for the study.

Study Results:

Table 1.1 Revenue and Research and Development expenditure of Energy sector companies

Particular		BPCL		GAIL		IOCI		NTPCL	
			%		%		%		%
2017	R	189346.5	0.026	49773.39	0.027	387176.7	0.028	79342.3	0.205
	R&D	49.48		13.44		109.57		162.28	
2018	R	210388.9	0.040	54712.17	0.032	435418.9	0.020	85207.95	0.217
	R&D	83.19		17.24		85.77		184.98	
2019	R	239011.9	0.042	77056.08	0.014	545999.6	0.025	92179.56	0.056
	R&D	100.72		10.94		137.15		51.42	
2020	R	301961.7	0.031	73898.38	0.016	509091.6	0.032	100478.4	0.134
	R&D	92.18		12.03		161.04		134.36	
2021	R	287920.9	0.030	58195.15	0.000	398360	0.057	103552.7	0.156

	R&D	86.64		0		226.16		161.34	

Source: Researcher Compilation, R-Revenue, R&D - Research and Development Expenditure, % - Percent of R&D Expenditure of Total revenue.

Table 1.2 Revenue and Research and Development expenditure of Energy sector companies

Particular		PGCIL		Reliance		ONGC	
			%		%		%
2017	R	26576.7	0.010	255573	0.567	387176.7	0.114
	R&D	2.63		1448		441.659	
2018	R	30766.32	0.004	301494	0.605	435418.9	0.110
	R&D	1.33		1824		478.72	
2019	R	35618.07	0.036	383732	0.619	545999.6	0.092
	R&D	12.67		2377		501.188	
2020	R	38317.97	0.025	350442	0.724	509091.6	0.136
	R&D	9.54		2538		693.681	
2021	R	40527.11	0.011	279865	0.919	398360	0.139
	R&D	4.55		2572		554.1	

Source: Researcher Compilation, R-Revenue, R&D - Research and Development Expenditure, % - Percent of R&D Expenditure of Total revenue.

Chart 1 – Research expenditure of Energy sector companies against their revenue from year 2017 to 2021.

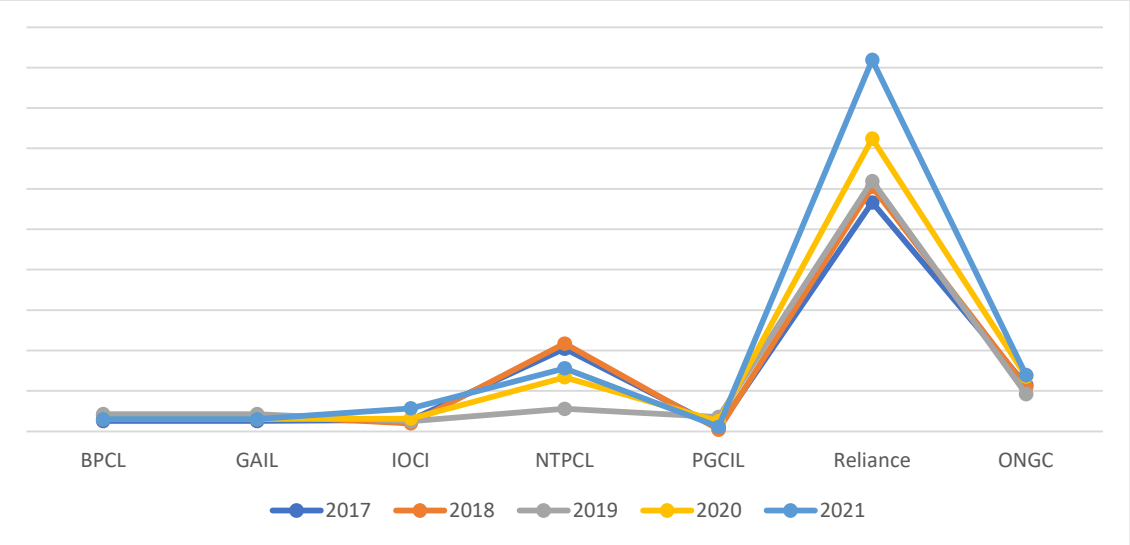

Table 1.1 articulates that BPCL's R & D expenditure for 2019 was found to be 100.72 crores, and 0.042 per cent of the revenue of the company. In contrast, R&D expenditure in 2017 was found to be 49.48 crore, or 0.026 percent of the company's revenue during the study period. GAIL's R & D expenditure in 2018 was found to be 17.24 crores, or 0.032 per cent of the revenue of the company. On the contrary, R&D expenditure in 2021 was found to be nil against the revenue of the company during the study period. IOCL's R&D expenditure in 2018 was

85.77 crore, representing 0.020 percent of the company's revenue. On the other hand, R&D expenditure for 2021 was found to be 226.16 Cr and 0.057 percent of the company's revenue during the study period. NTPCL's R & D expenditure in 2019 was 51.42 crores, with 0.056 per cent against the revenue of the company. On the other hand, R&D expenditure in 2018 was found to be 184.98 Cr, or 0.217 percent of the company's revenue during the study period.

Table 1.2 signifies that PGCIL R& D expenditure for 2018 was found to be 1.33 Cr and 0.004 per cent of the revenue of the company. On the other hand, R&D expenditure for 2019 was discovered to be 12.67 Cr and 0.036 percent of the company's revenue during the study period. Reliance's R&D expenditure in 2017 was found to be 1448 Cr, or 0.567 percent of the company's revenue. On the other hand, R&D spending for 2021 was estimated to be 2572 Cr, or 0.036 percent of the company's revenue during the study period. ONGC R & D expenditure for 2019 was found to be 501.18 Cr and 0.0.092 per cent against the revenue of the company. On the other hand, R&D expenditure for 2021 was found to be 554.1 Cr, or 0.139 percent of the company's revenue during the study period.

Table 2.3 Revenue and Research and Development expenditure of Information technology sector companies.

Particular		**HCL**		**INFY**		**TCS**		**TECH**		**WIPRO**	
			%		**%**		**%**		**%**		**%**
	R	2027	0.56	6235	0.56	97261	0.29	24058	0.033	48529.	0.68
	R&	115	7	351	3	282	0	7.843		333.8	8
201	R	2277	0.56	6596	0.56	10315	0.28	25420	0.173	47131.	0.64
8	R&	128	2	374	7	298	9	44		304.1	5
201	R	2681	0.85	7595	0.59	13079	0.23	28187	0.110	50747.	0.77
9	R&	229	4	451	4	308	5	31.1		394.2	7
202	R	3319	1.14	8174	0.57	13938	0.22	31591	0.070	52723.	0.87
0	**201**	381	8	470	5	306	0	22.1		461.9	6
202	R	3663	1.29	8837	0.57	14136	0.21	30562	0.033	52647.	0.70
1	R&	473	1	512	9	303	4	10.082		370.3	3

Source: Researcher Compilation, R-Revenue, R&D - Research and Development Expenditure, % - Percent of R&D Expenditure of Total revenue.

Chart 2 – Research expenditure of Information technology sector companies against their revenue from year 2017 to 2021.

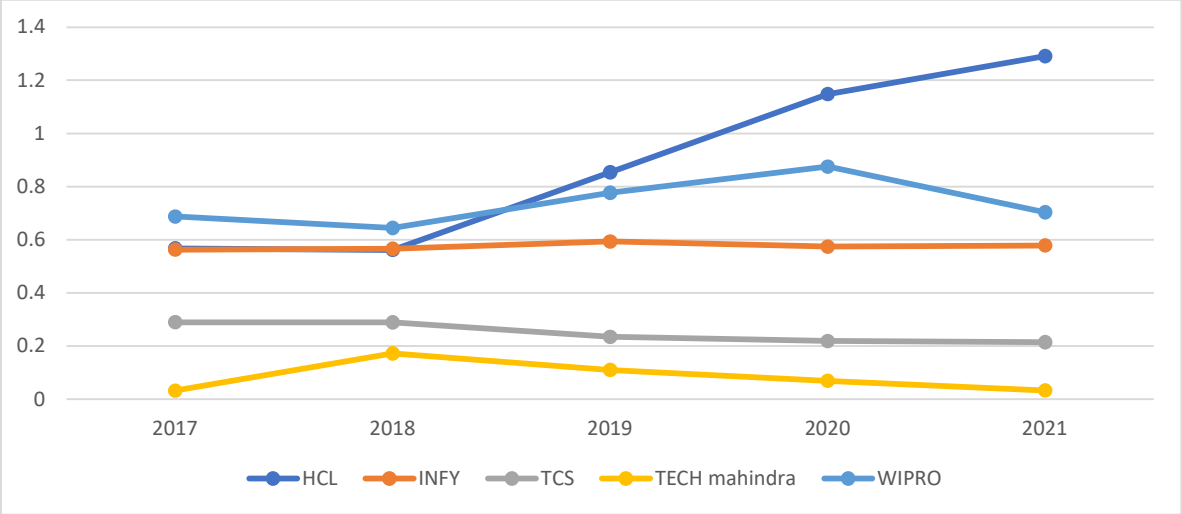

Table 2.3 formulates that HCL R & D expenditure for 2020 was found to be 381 Cr and 1.148 per cent against the revenue of the company. On the other hand, R&D expenditure in 2018 was found to be 128 crore or 0.562 percent of the company's revenue during the study period. Infosys' R&D expenditure for 2020 was determined to be 512 Cr, or 0.579 percent of the company's revenue. On the other hand, R&D expenditure in 2017 was found to be 351 Cr or 0.563 percent of the company's revenue during the study period, and R&D expenditure is consistent by company. TCS R&D expenditure has been found to be consistent, with expenditure in 2017 totalling 282 Cr, or 0.290 percent of the company's revenue. On the other hand, R&D expenditure for 2021 was found to be 303 Cr, or 0.214 percent of the company's revenue during the study period. Tech Mahindra's R&D expenditure for 2019 was discovered to be 44 Cr and 0.173 percent of the company's revenue. the contrary, R&D expenditure in 2017 and 2021 was found to be 7.84 Cr and 10.082 Cr respectively, and 0.033 per cent of the revenue of the company during the study period. Wipro's R & D expenditure for 2020 was found to be 461.9 Cr, or 0.876 percent of the revenue of the company. On the other hand, R&D expenditure in 2018 was found to be 304.1 Cr, or 0.645 percent of the company's revenue during the study period.

Table 2.4 Revenue and Research and Development expenditure of Automobile sector companies.

Particular		Bajaj		Eicher		Hero	
			%		%		%
2017	R	23032.33		7279.78		28959.72	
	R&D	367.64	1.596	128.7	1.768	701.09	2.421
2018	R	26502.49		9321.41		32779.46	
	R&D	372.69	1.406	237.56	2.549	493.51	1.506
2019	R	32194.84		10500.98		34370.17	
	R&D	456.35	1.417	354.94	3.380	549.71	1.599
2020	R	31715.22	1.498	9582.46	2.686	30521.69	2.333

	R&D	475.06		257.36		712	
2021	R	29237.02		9225.83		31523.93	
	R&D	424.47	1.452	299	3.241	540	1.713

Source: Researcher Compilation, R-Revenue, R&D - Research and Development Expenditure, % - Percent of R&D Expenditure of Total revenue.

Table 2.5 Revenue and Research and Development expenditure of Automobile sector companies.

Particular		**M&M**		**Maruthi suzuki**		**Tata motors**	
			%		**%**		**%**
2017	R	46111.55		70715		45549.54	
	R&D	2,075.78	4.502	640.4	0.906	2,047.24	4.495
2018	R	49960.65		81767.5		59546.96	
	R&D	2,066	4.135	831.6	1.017	2,702.00	4.538
2019	R	56851.45		88370.5		71945.68	
	R&D	2,643	4.649	712.8	0.807	2,963.01	4.118
2020	R	48113.15		79269.5		44661.57	
	R&D	2,975	6.183	184.5	0.233	3,269.11	7.320
2021	R	46760.62		73005.8		49788.86	
	R&D	2,164	4.628	188.9	0.259	3,901.33	7.836

Source: Researcher Compilation, R-Revenue, R&D - Research and Development Expenditure, % - Percent of R&D Expenditure of Total revenue.

Chart 3 – Research expenditure of Automobile sector companies against their revenue from year 2017 to 2021.

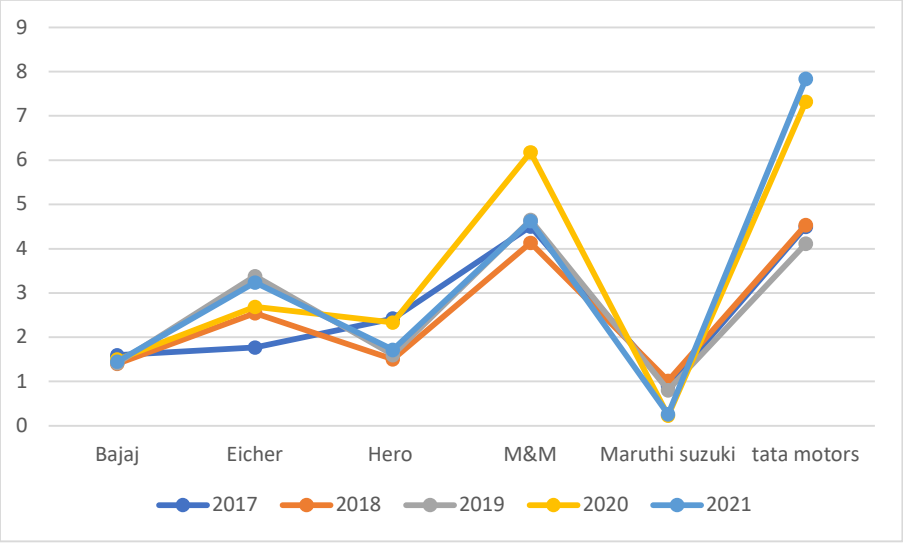

Table 2.4 and 2.5 articulates that Bajaj R&D expenditure in 2017 was found to be 367.64 Cr, or 1.596% of the company's revenue. On the other hand, R&D expenditure in 2018 was found to be 372.69 Cr, or 1.406 percent of the company's revenue during the study period. Eicher Motors' R&D expenditure for 2019 was found to be 354.94 Cr, or 3.380 percent of the

company's revenue. In contrast, R&D expenditure in 2017 was found to be 128.7 Cr, or 1.768 percent of the company's revenue during the study period. Hero Motors R & D expenditure for 2017 was found to be 701.09 Cr and 2.421 per cent against the revenue of the company. On the other hand, R&D expenditure for 2018 was found to be 493.51 Cr, or 1.506 percent of the company's revenue during the study period.

Mahindra and Mahindra R & D expenditure for 2020 was found to be 2975 Cr and 6.183 per cent against the revenue of the company. On the other hand, R&D expenditure in 2018 was found to be 2066 Cr, or 4.135 percent of the company's revenue during the study period. Maruthi Suzuki R & D expenditure for 2018 was found to be 831.6 Cr and 1.017 per cent against the revenue of the company. In contrast, R&D expenditure in 2020 was found to be 184.5 Cr, or 0.259 percent of the company's revenue during the study period. Tata Motors' R&D expenditure for 2021 was determined to be 3901.33 Cr, or 7.836 percent of the company's revenue. On the other hand, R&D expenditure for 2019 was found to be 2963.01 Cr, or 4.118 percent of the company's revenue during the study period.

Table - 2.6: The consolidated 5-year list of energy sector R & D expenditure and patents with the F-test.

	R&D (Cr)	Patents	P(F<=f) one-tail
BPCL	412.21	23	0.023
GAIL	53.65	0	0
IOCL	719.69	486	0.462
NTPCL	694.38	41	0.006
PGCIL	30.72	0	0
Reliance	10759.00	654	0.001
ONGC	2669.35	24	0.012

Source: Researcher Compilation

Table 2.6 shows that BPCL's P-Value is (0.023), which is less than (0.05), a significant level of the study, with R&D expenditure of 412.21 crores and patents acquired constituting 23 during the study period. whereas GAIL's P-Value is (0.000) which is less than (0.05) of the study, with R&D expenditure of 53.65 crores as well as no patents acquired during the study period. Nevertheless, the IOCL P-Value is (0.426) greater than (0.05), indicating that the study is significant at 719.69 crores in R & D expenditure and 486 patents were acquired during the study period. While the P-Value of NTPCL is (0.006), it is less than (0.05) for the study, under which R&D expenditure was 694.38 crores and patents were acquired for 41 during the study period.

However, the PGCIL P-Value is (0.00) less than (0.05), a significant level for the study, where R & D expenditure was 30.72 crores and no patents were acquired during the study period. However, the reliance P-Value is (0.001), which is less than the study's (0.05), where R & D expenditure totaled 10759.00 crores and 654 patents were acquired during the study period. However, ONGC's P-Value is (0.012), which is less than the study's threshold of (0.05), where R & D expenditure totals 2669.35 crores and 24 patents were acquired during the study period.

It signifies that energy sector company research and development expenditure have impacted on possessing patents which leads to consistent growth in profit level of the business.

Table - 2.7: The consolidated 5-year list of Information technology sector R & D expenditure and patents with the F-test.

	R&D (Cr)	Patents	P(F<=f) one-tail
HCL	1326	37	0.005
INFY	2158	0	0
TCS	1497	5269	3.817
TECH Mahindra	115.125	155	0.123
WIPRO	1864.3	3186	0.02

Source: Researcher Compilation

The table 2.7 articulates that P-value of HCL is (0.005) is less than (0.05), the study's level of relevance, where R & D expenditure totals Rs 1326.00 Cr and 37 patents were acquired during the study period. The P-Value of INFY is (0.001). is less than (0.05) a significant level of the study, in which R & D expenditure totals 2158.00 Cr and no patents were acquired. TCS P-Value is (3.817). is greater than (0.05) of the study, where R & D expenditure was 1497.00 crores and 5269 patents were acquired during the period of study. Tech Mahindra's P-Value is (0.123) is greater than (0.05) of the study, where R & D expenditure amounted to 115.13 crores and 155 patents were acquired during the study period. The P-Value of WIPRO is (0.020), which is less than (0.05) a significant level of the study, where R & D expenditure amounted to 1864.30 crores and 3186 patents were acquired during the study period. It clearly signifies that Information technology companies have shown phenomenal growth in companies' value by acquiring good number of patents exclusively by TCS company and Wipro company.

Table - 2.8: The consolidated 5-year list of Automobile sector R & D expenditure and patents with the F-test.

	R&D (Cr)	Patents	P(F<=f) one-tail
Bajaj	2096.21	0	0
Eicher	1277.56	0	0
Hero	2996.31	347	0.018
M&M	11923.78	0	0
Maruthi Suzuki	2558.2	57	7.448
Tata motors	14882.69	463	0.001

Source: Researcher Compilation

The table 2.8 shows that P-Value of Bajaj is (0.001) is less than (0.05) a significant level of the study, with 2096.21 Cr in R & D expenditure and no patents were acquired during the study period. In comparison, the Eicher P-Value is (0.001), which is less than (0.05), a significant level of the study, with 1277.56 Cr in R & D expenditure and also no patents acquired during the study period. The P-Value of a Hero is (0.018). is less than (0.05) a significant level for the study, with 2996.31 Cr in R & D expenditure and 347 patents were acquired during the study

period. The P-Value of M & Ms is (0.001), which is less than (0.05), a statistically significant level for the study, where R & D expenditure totals 11923.78 Cr and no patents were acquired during the study period. The P-Value of the Maruthi Suzuki is (7.448), which is greater than (0.05) a significant level of the study, with 2558.20 Cr in R & D expenditure and 57 patents were acquired during the study period. Tata Motors' P-Value is (0.001), which is less than the study's threshold of (0.05), where R & D expenditure totals 14882.69 crores and patents total 463 during the study period. The Automobile companies have acquired various patents in relation to research and development expenditure inversely which leads to wealth creation of the companies.

Conclusion:

The study examined how that relationship between revenue and research expenditure impacts patents acquired to accomplish a specific objective of the organisation. Nifty50 companies from the energy, information technology, and automobile sectors were included. The study signifies that there is an increasing trend in research expenditure by select companies. Reliance companies in the energy sector have shown a phenomenal growth in research expenditure compared with other companies. HCL companies in information technology have shown exponential growth in research expenditure compared with other select companies. Tata Motors in the automobile sector has increased their research expenditure, which is exceptional when compared to others, paving the way for successful market share growth.

Research expenditure provides a platform for developing new technologies that safeguard intellectual capital. In the energy sector, Reliance and IOCL companies have 654 and 486 published patents with a research expenditure of 10759 Cr and 719.69 Cr, respectively, for the last 5 years. Patents help businesses grow with unique features. Likewise, TCS and Wipro companies have 5269 and 3186 published patents in the information technology sector, with research expenditure of 1497 Cr and 1864.3 Cr, respectively. Patents help to increase the market share. Whereas, Tata Motors and Hero Motors have 463 and 347 published patents with research expenditure of 2558.2 Cr and 2996.31 Cr respectively. The study signifies that there is a relationship between revenue, research expenditure, and patents publication.

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