



State of Industry R&D in India

An R&D investment and disclosure analysis of Indian and global firms in six key strategic sectors

Software and Services

Foundation for Advancing Science and Technology India FAST India in collaboration with IIFL Securities This brief builds upon the findings of the State of Industry R&D report that presented overall and sector-level findings for selected firms. The present brief provides a detailed examination of the Software and Services (hereinafter Software) Sector at the firm level, comparing the findings of Indian and Global firms. The continuity between these reports ensures a thorough understanding of macro and micro factors influencing R&D in Indian Software sector firms.

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Software and Services

Key takeaways

- Global firms outperformed Indian firms for Research and Development (R&D) intensity by **32.0x** and by **6.1x** in proportion of PhD employees.
 - Shopify ranked first among all firms in both the input parameters. It had
 26.8% R&D intensity, 15.8x the highest ranked Indian firm, Tata Elxsi.
 - Tata Elxsi ranked first among Indian firms in both parameters. It showed a strong performance in proportion of PhD employees with 0.68%, ranking fifth overall.
 - All ten global firms have a higher R&D intensity than the top ranked Indian firm.
- Global firms produced 12.1x patents per USD billion revenue as compared to Indian firms. Indian firms outperformed global firms in publications per USD billion revenue, producing 2.6x publications by revenue.
 - IBM ranks first among all firms in both output parameters. It has 328 publications by revenue and 1451 patents by revenue.
 - Cyient shows an impressive performance in the publications by revenue parameter, ranking second overall. However, no patent information was available for Cyient.
 - TCS ranks first among Indian firms and fifth overall in the patents by revenue parameter, with 654 patents by revenue.

1.1 Introduction

The software and technology sector forms 7.5% of Indian Gross Domestic Product (GDP) and accounts for 53% of Indian service exports.¹ Indian firms in the sector have high profitability but do not invest their profits for R&D proportionate to the global firms.²

Post-COVID-19, the world is witnessing an increased demand for technological development and adoption. As such, the R&D programs of software firms gain even greater importance. R&D activity is believed to be higher in product-led firms as compared to service-led firms.³ In general, product-led firms tend to spend the most on R&D. Product-led firms focus on creating and selling a product to customers, where the product could be tangible or a software that they provide. Service-led firms on the other hand provide their expertise to customers to meet some IT requirements that they may have. The increased R&D expenditure by product-led firms is possibly due to them being driven by their customers pushing them to spend more on innovation and a need to attract customers to a flagship product line.

There is a third category of firms who provide R&D services to other firms. Engineering Research and Development (ER&D) services involve designing and developing products or applications for sale through software or manufacturing processes⁴. The ER&D services market comprises primarily of product engineering and process engineering services.

Using the S&P Global classification⁵ for identifying firms, FAST India focused on software and services sector firms and excluded media, communication and service firms from the study. For example, some well known global firms such as Google and Meta are excluded from the study as they fall under *Interactive Media and Services* under GICS, while Apple falls under *Hardware*.

We now present our findings on R&D-related inputs and outputs for software sector firms.

¹NASSCOM (2023). "Priming for a no normal future: Technological Sector in India". In: URL: https://nasscom.in/knowledge-center/publications/technology-sector-india-2023-strategic-review (visited on 03/29/2024).

²Centre for Technology, Innovation and Economic Research (CTIER) (2023). *CTIER Handbook: Technology and Innovation in India*. Tech. rep. URL: http://www.ctier.org/handbook2023.html (visited on 03/29/2024).

³This is based on FAST India consultations with sectoral experts.

⁴Zinnov (2023). *Industry Report: ERD Services Market Overview*. Accessed: 2024-07-24. URL: https://tlwebassets.tatatechnologies.com/app/uploads/2023/11/B-32.-Industry-Report-ERD-Services-Market-Overview.pdf.

1.2 India vs. Global Comparison

For inputs, we study R&D intensity and PhD employees as a proportion of total employees. R&D intensity, defined as the ratio of a firm's R&D expenditure to its revenue, helps us to identify the proportion of revenue input in R&D activities, while the PhD employee number represents an approximate number of researchers in the firm. For outputs, we present our findings on the number of patents and publications per billion USD in revenue. The information regarding input parameters, i.e. R&D intensity and proportion of PhD employees is presented for the latest available year, while the information regarding outputs, Patents and Publications per billion USD revenue is presented for the study period i.e. FY 2015-16 and FY 2022-23. For firms that do not provide information on a financial year basis, corresponding annual years are considered.



Figure 1.1 presents the performance of all firms studied on the input parameters.

Figure 1.1: India vs. Global Software Sector Firms Comparison on R&D intensity and proportion of PhD employees

All ten global firms have a higher R&D intensity than the top ranked Indian firm,

Tata Elxsi. This shows that global software firms have a high emphasis on investing in R&D. Shopify ranks first among global firms with 26.8%, **15.8x** the intensity of the Tata Elxsi, the highest ranked Indian firm.

Shopify ranks first in proportion of PhD employees with 1.38%. Tata Elxsi ranks first among Indian firms with 0.68%, followed by Cyient. Among the top ten ranked firms in proportion of PhD employees, only two are Indian.



Figure 1.2 presents the performance of all firms studied on output parameters.

Figure 1.2: India vs. Global Software Sector Firms Comparison on publications per USD billion revenue and patents per USD billion revenue

IBM ranks first among all firms studied in publications per USD billion revenue with 328 publications by revenue. Cyient closely follows with 298 publications by revenue. Among the top ten ranked firms, six of them are Indian, showing an impressive performance in comparison to their global counterparts. However, this could be a function of the difference in the revenues of global and Indian firms.

IBM also ranks first among all firms in patents per USD billion revenue with 1451 patents by revenue, **1.3x** the second ranked firm, ServiceNow. TCS ranks first among Indian firms and fifth overall with 654 patents by revenue, closely followed by Wipro with 594 patents by revenue.

1.3 India Software Sector: A Firm-Level Analysis

To enhance the depth and relevance of our analysis of the Indian software sector, we have segmented the firms into high-revenue and low-revenue clusters. This bifurcation is based on the median of the average revenue of firms within the sector. By categorising the firms in this manner, we aim to provide a more nuanced and meaningful examination of their innovation inputs and outputs. Following is the cluster-wise firm-level comparative analysis of the top market capitalisation software sector firms in India.

1.3.1 High Revenue Cluster

1.3.1.1 R&D Intensity

Figure 1.3 below compares R&D intensity among the software sector firms in the high revenue cluster.



Figure 1.3: R&D intensity: High Revenue Cluster

As shown in Figure 1.3, Tata Consultancy Services (TCS) and HCL Technologies (HCL) lead in this cluster with 1.3% and 1.2% respectively. TCS's R&D expenditure is very

high compared to its peers, which could be due to the inclusion of its innovation center expenditure in the annual reports. With the R&D and innovation expenditure combined, it brings TCS's total R&D expenditure to 292.0 USD MM, more than **3.5x** the second highest R&D spender, Infosys with 78.9 INR MM.

1.3.1.2 PhD employees as a proportion of total employees

Figure 1.4 shows the number of PhD employees as a proportion of total employees for the high revenue cluster.

TCS has the highest number of PhDs among software firms with 459. However, they also having the largest number of employees (608,985), **1.8x** the next software firm (Infosys). Due to this, as a proportion it ranks last in the high revenue cluster. HCL is the leader in this metric with 0.14%.



Figure 1.4: PhD per Total Employees: High Revenue Cluster

1.3.1.3 Patents by USD billion revenue

Figure 1.9 below depicts patents per billion USD revenue for high revenue cluster firms.

TCS ranks first in this cluster with 654 patents by revenue, closely followed by Wipro with 594. Comparatively, Infosys has a low number of patents by revenue compared to its competitors with 37. Infosys had just 353 patents published in the study period, whereas TCS had 10,012 patents.



Figure 1.5: Patents by Revenue: High Revenue Cluster

1.3.1.4 Publications by USD billion revenue

Figure 1.6 below presents the publications per billion USD revenue in the high revenue cluster firms.

TCS has the highest number of publications by revenue, more than **2x** that of Wipro, which has the second highest number of publications by revenue. Tech Mahindra and Infosys have 29 and 19 publications by revenue respectively, while HCL has the least number of publications by revenue with 9.



Figure 1.6: Publications by Revenue: High Revenue Cluster

1.3.2 Low Revenue Cluster

1.3.2.1 R&D Intensity

Figure 1.7 below compares R&D intensity among the Indian software firms in the low revenue cluster.

Tata Elxsi and Cyient are the leaders with 1.7% and 1.2% respectively. Tata Elxsi and Cyient also have the highest R&D spend in the low revenue cluster with 6.4 USD MM and 3.2 USD MM respectively. There is a sharp drop off after this with Persistent Systems at 0.3%. Tata Elxsi and Cyient spent 7.1% and 7.4% of their profits respectively on R&D, the highest among all software firms in the study.



Figure 1.7: R&D intensity: Low revenue cluster

1.3.2.2 PhD employees as a proportion of total employees

Figure 1.8 below illustrates the percentage of total PhD-holding employees across Indian software sector firms in the low revenue cluster.

Tata Elxsi is the clear leader with 0.7% of employees with a PhD, with Persistent Systems coming in second with 0.3%. The median percentage for the low revenue bracket is 0.3%, whereas it is 0.1% for the high revenue bracket. This may be due to the lower overall employee size of the firms in the low revenue cluster.



Figure 1.8: PhD per Total Employees: Low Revenue Cluster

1.3.2.3 Patents by USD billion revenue

Figure 1.9 below illustrates the patents by USD billion revenue across Indian software firms in the low revenue cluster.



Figure 1.9: Patents by Revenue: Low Revenue Cluster

Zensar Technologies is ranked first by a big margin, 4.9x of the second highest,

Tata Elxsi. Zensar Technologies had 31 patents published in the study period, while Tata Elxsi had 8 patents published. LTIMindtree had just one patent published during the study period, while there was no patent information available for Cyient.

1.3.2.4 Publications by USD billion revenue

Figure 1.10 below presents the publications per USD billion revenue of low revenue cluster firms.

Cyient is much ahead of the other firms with 298 publications by revenue, the most among all the software firms. Zensar Technologies and Tata Elxsi have a comparable number of publications by revenue, with 70 and 65 respectively. After that, there is a sharp drop off for LTIMindtree with 4 publications by revenue.



Figure 1.10: Publications by Revenue: Low Revenue Cluster

In summary, figures 1.11 and 1.12 below present a graphical representation of a firm's performance across four parameters, R&D intensity, PhD employees as a proportion of total employees, patents and publications per USD billion revenue for high revenue and low revenue cluster firms.



Figure 1.11: Indian Software Sector Firms' performance in the High Revenue Cluster



Figure 1.12: Indian Software Sector Firms' performance in the Low Revenue Cluster

1.3.3 Conclusion

Global software firms outperform Indian firms in R&D intensity, proportion of PhD employees, and patents by revenue. While Indian software firms show an impressive performance in publications by revenue, they lag behind considerably in patents and R&D intensity. Notably, while Accenture ranks last among global firms in R&D intensity, it ranks higher than the highest ranked Indian firm, Tata Elxsi.

The considerable difference in these metrics highlights the need for increased focus on innovation and intellectual property in order to compete against global firms.

Annexure

S.No.	Firm	Market Cap	Avg.	Revenue Cluster
		(USD Bn)	Standalone	
			Revenue (USD	
			MM)	
1	Tata Consultancy Services	148.1	15,317	High
2	Infosys	68.3	9,657	High
3	Wipro	24.1	6,199	High
4	HCL Technologies	41.5	3,556	High
5	Tech Mahindra	11.8	3,499	High
6	LTIMindtree	17.9	1,598	Low
7	Persistent Systems	5.7	304	Low
8	Tata Elxsi	5.6	216	Low
9	Cyient	2.6	188	Low
10	Zensar Technologies	1.5	171	Low
	Median	14.9	2548.5	

Table	1.1:	Firms	included	in	the	study	v
			monaca		~~~	Sector	

Note: Market Capitalisation data obtained from https://www.capitaliq.com/ as of May 2023. Revenue data for the latest year as obtained from Company Annual Reports and Bloomberg.

No.	Firm	Region	Rationale for exclusion
1	Mphasis Limited	Indian	Unable to sight R&D data
2	Oracle Financial Services	Indian	Unable to sight complete data for study period
	Software Limited		(FY16-23)
3	Coforge	Indian	Unable to sight R&D data
4	KPIT	Indian	Unable to sight R&D data
5	Happiest Minds Technologies	Indian	2020 IPO; Unable to sight complete data for
	Limited		study period (FY16-23)
6	Sonata Software Limited	Indian	Unable to sight R&D data
7	Tanla Platforms Limited	Indian	Unable to sight R&D data
8	Birlasoft Limited	Indian	Unable to sight R&D data
9	Route Mobile Limited	Indian	2020 IPO; Unable to sight complete data for
			study period (FY16-23)
10	L&T Technology Services	Indian	Unable to sight R&D data

Table 1.2: Firms excluded from the study and rationale

Sectoral Comparisons: Inputs & Outputs

R&D Intensity



% PhD Employees



Publications per revenue



Sectoral Comparisons: Inputs & Outputs

Patents per revenue



R&D Disclosures



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Notes:

1. % PhD Employees is the number of PhD employees as a proportion of total employees.

2. The publications per revenue metric indicates the number of publications in the study period per billion USD revenue.

3. The patents per revenue metric indicates the number of patents published in the study period per billion USD revenue.

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