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# State of Industry R&D in India

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

## Automobile and Components

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 Automobile and Components Sector at the firm level, comparing 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 Automobile and Component sector firms.

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# Automobile and Components

## Key takeaways

- Global firms outperformed Indian firms for Research and Development (R&D) intensity and for proportion of PhD employees by **3.1x** and **3.4x** respectively.
  - Ferrari N.V. performed best in three of the four indicators studied. It had the highest R&D intensity (15.2%), the largest number of PhD employees as a proportion of total employees and the largest number of publications per USD billion revenue (935) overall. BYD performed best in patents per USD billion revenue.
  - Mahindra & Mahindra stand out for its high R&D intensity amongst Indian firms, investing significantly in innovation compared to its peers. It spends the highest among all Indian firms on R&D amounting to 335 USD MM, more than **3.5x** the second highest Indian R&D spender, Maruti Suzuki.
  - TVS Motors ranks third amongst all firms (global and Indian) for the proportion of PhD employees indicators.
- Global firms produced **29.8x** patents per USD Billion revenue and **1.6x** publications per USD Billion revenue as compared to Indian firms.
  - TVS Motors displays an exceptional number of patents relative to revenue. It ranks second amongst all firms (Global and Indian) on the parameter. It has the highest patent count across Indian firms, 2548, around **6.2x** the second highest, Mahindra & Mahindra.
  - Bosch has the highest number of publications per billion USD revenue count across Indian firms and ranks second on this parameter amongst all firms, Global and Indian. Bosch has **2.4x** publications per USD Billion revenue than Tesla which ranks next.
  - The top two firms in terms of publications per billion USD revenue amongst Indian firms feature in the low revenue cluster—Bosch and TVS Motors.

## 1.1 Introduction

India is the third-largest automobile market globally. In the financial year 2023-2024, the Automobile industry manufactured 28.43 million cars, including passenger cars, commercial vehicles, three-wheelers, two-wheelers, and quadricycles.<sup>1</sup> India is a dominant player in the global heavy vehicles industry, being the largest producer of tractors, the second-largest producer of buses, and the third-largest producer of heavy trucks worldwide.<sup>2</sup> Increasing purchasing power of the middle class and a large youth population is estimated to cause a significant surge in demand.

India is responsible for 40% of the total USD 31 billion spent globally on engineering and research and development (R&D) in the automobile sector.<sup>3</sup> The sector also accounts for 8% of the country's total R&D expenditure.<sup>4</sup> More than half of the automotive corporations' total R&D expense is directed towards achieving emission compliance and advancing electrification technologies.<sup>5</sup> The investment inflow into electric vehicle (EV) companies in 2021 reached an unprecedented peak, surging by about 255% to a total of INR 3,307 crore (USD 444 million). The global EV market was valued at around USD 250 billion in 2021 and is expected to expand by a factor of 5, reaching USD 1,318 billion by 2028.<sup>6</sup> The Indian government has pledged that by 2030, EVs will account for 30% of all new vehicle sales in India. India is projected to become the leading market for EVs by 2030, with a significant investment potential of over US\$ 200 billion in the next 8-10 years.

By way of a collaborative effort between the Government of India and the Indian automobile sector, a strategic plan for the advancement of the industry, the Automobile Mission Plan (2016-26), has been launched.<sup>7</sup> To bring the automotive sector in line with international standards, the Indian government initiated the "National Automotive Testing and R&D Infrastructure Project" (NATRiP) as part of the Automotive Mission Plan

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<sup>1</sup>Invest India (2024). *Invest in Indian Automobile Industry, Auto Sector Growth Trends*. en. URL: <https://www.investindia.gov.in/sector/automobile> (visited on 06/17/2024).

<sup>2</sup>Ibid.

<sup>3</sup>Ibid

<sup>4</sup>UNIDO and GoI DST (Mar. 2023). *INDIAN AUTOMOTIVE SECTORIAL SYSTEM OF INNOVATION (IASSI)*. tech. rep. Austria: United Nations Industrial Development Organization. URL: [https://dst.gov.in/sites/default/files/Indian%20Automotive%20Sectorial%20System%20of%20Innovation%20IASSI%29%20Report\\_0.pdf](https://dst.gov.in/sites/default/files/Indian%20Automotive%20Sectorial%20System%20of%20Innovation%20IASSI%29%20Report_0.pdf) (visited on 06/17/2024).

<sup>5</sup>Ibid.

<sup>6</sup>IBEF (2024). *India's Automobile Industry: Growth & Trends*. en. URL: <https://www.ibef.org/industry/india-automobiles> (visited on 06/17/2024).

<sup>7</sup>SIAM (2024). *Society of Indian Automobile Manufactures*. URL: <https://www.siam.in/cpage.aspx?mpgid=16&pgid1=17&pgidtrail=83> (visited on 06/17/2024).

(2006-2016). The NATRiP has successfully finished constructing 21 of the 22 authorised facilities.<sup>8</sup> Among these 22 facilities, six fully equipped testing centres have been established in close proximity to the leading automotive hubs throughout the country.

Two phases of the Faster Adoption & Manufacturing of Electric Vehicles (FAME) Scheme have been completed by March 2024, with phase III likely to be announced soon.<sup>9</sup> Nevertheless, there is intense rivalry in worldwide automotive research and development. India's primary competitors include Mexico and Brazil in Latin America, Malaysia, Thailand, Vietnam, and Indonesia in Southeast Asia, as well as Poland, Romania, Czech Republic, and Slovakia in Eastern Europe.

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

## 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 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 input parameters. Ferrari N.V. has the highest R&D intensity at 15.2%, significantly ahead of other firms. The global automotive firms show higher R&D intensity compared to the Indian firms. Mahindra and Mahindra has the highest R&D intensity amongst Indian firms studied (3.3%), while Bosch had the second best R&D intensity (2.9%) amongst Indian firms.

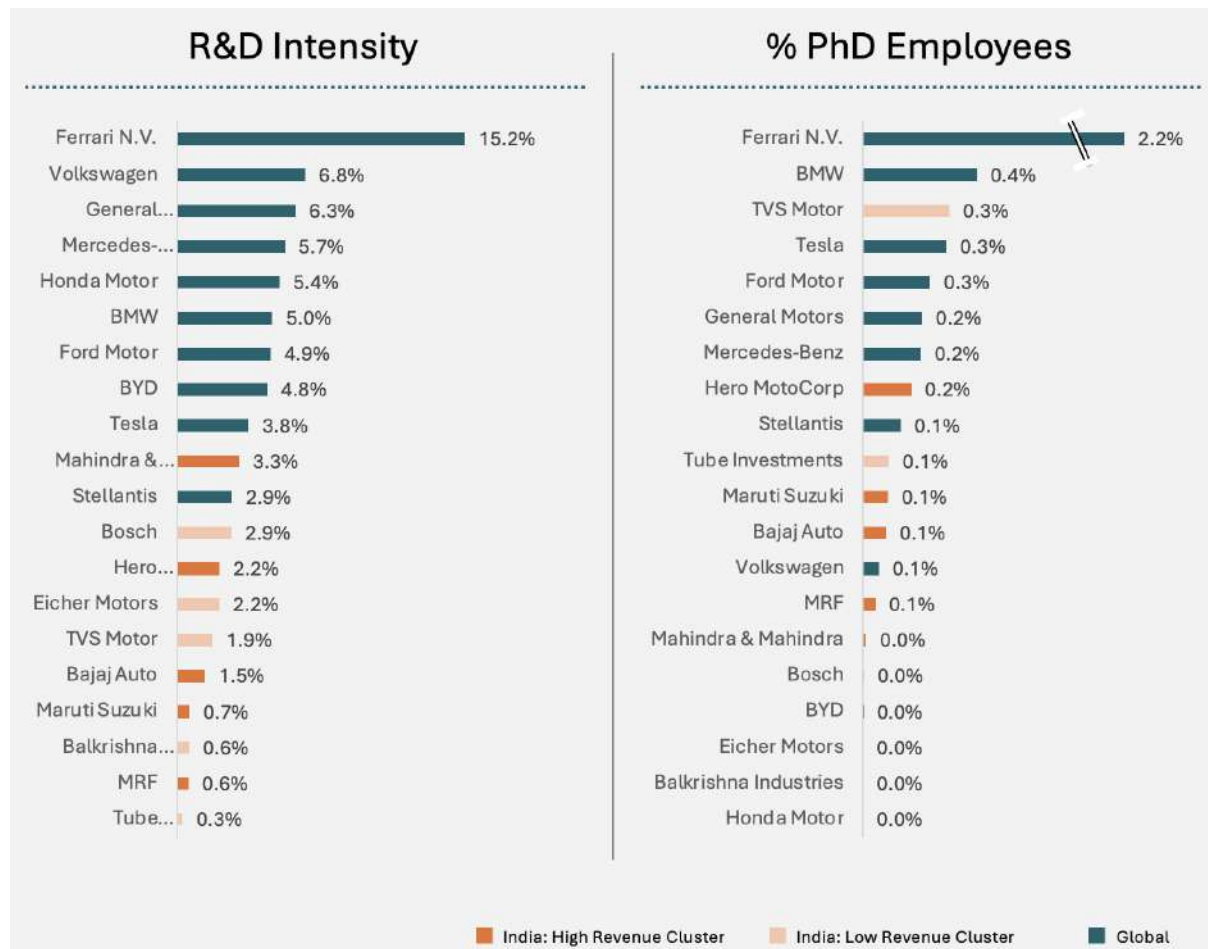
Ferrari N. V. also leads in the percentage of PhD employees at 2.2%. TVS Motors

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<sup>8</sup>UNIDO and GoI DST (Mar. 2023). *INDIAN AUTOMOTIVE SECTORIAL SYSTEM OF INNOVATION (LASSI)*. tech. rep. Austria: United Nations Industrial Development Organization. URL: [https://dst.gov.in/sites/default/files/Indian%20Automotive%20Sectorial%20System%20of%20Innovation%20%28IASSI%29%20Report\\_0.pdf](https://dst.gov.in/sites/default/files/Indian%20Automotive%20Sectorial%20System%20of%20Innovation%20%28IASSI%29%20Report_0.pdf) (visited on 06/17/2024).

<sup>9</sup>Nitin Kumar (June 2024). "FAME-III likely to be released on Budget day with Rs 10,000 crore outlay". en-US. in: *Business Standard*. URL: [https://www.business-standard.com/budget/news/fameiii-likely-to-be-released-on-budget-day-with-rs-10000-crore-outlay-124061400124\\_1.html](https://www.business-standard.com/budget/news/fameiii-likely-to-be-released-on-budget-day-with-rs-10000-crore-outlay-124061400124_1.html) (visited on 06/19/2024).

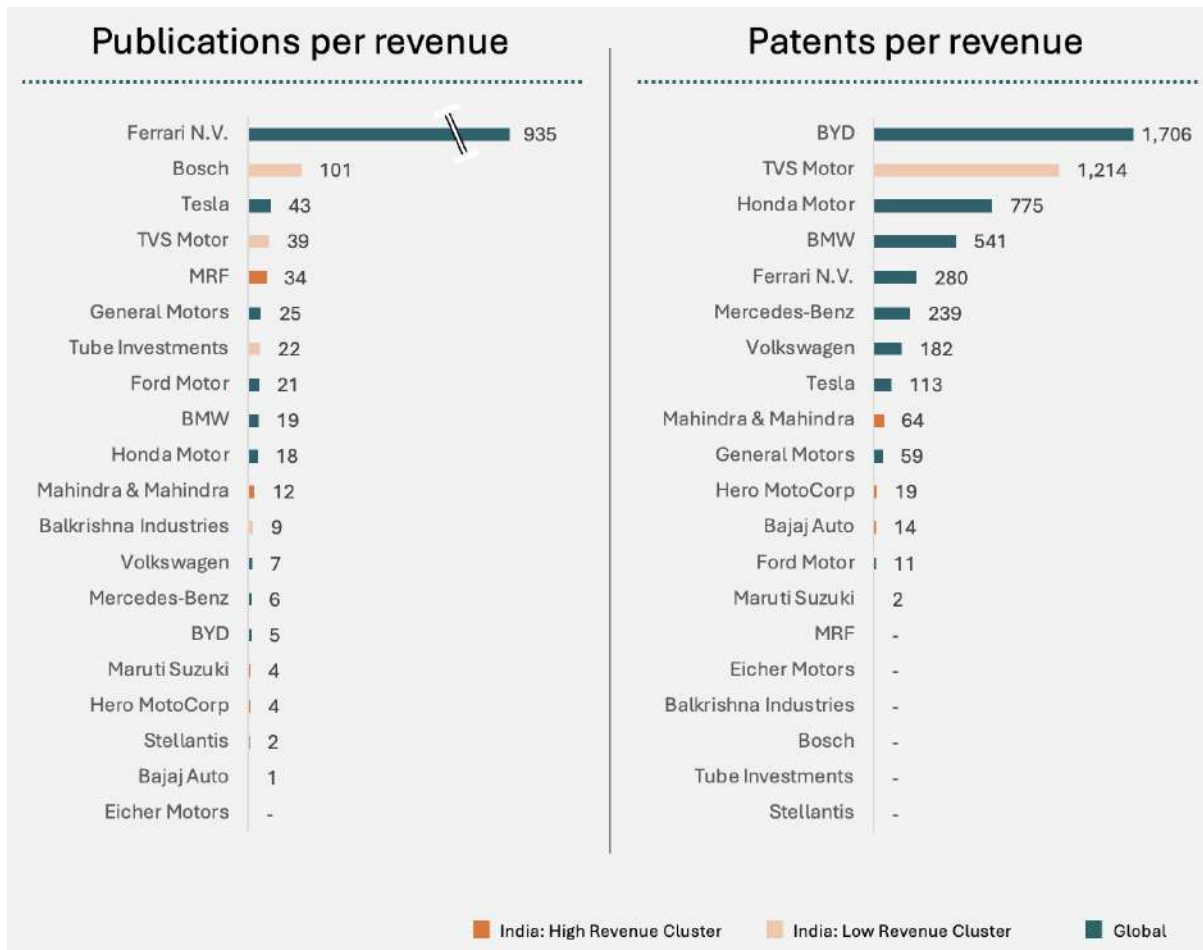
ranks third amongst all firms (global and Indian) for the proportion of PhD employees indicator. Many firms, especially in the Indian low-revenue cluster, have negligible to no PhD employees.



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

Figure 1.2 presents the performance of all firms studied on output parameters. Ferrari N.V. maintains its first rank in publications per USD billion revenue by publishing more than **9.3x** the second ranked firm, Bosch, indicating a strong focus on research and dissemination. TVS Motor and MRF rank fourth and fifth in publications per revenue.

BYD tops the list with 1,706 patents per USD billion revenue, showcasing a strong emphasis on innovation and intellectual property. The global automotive firms generally have a higher number of patents per revenue compared to Indian firms.



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

### 1.3 India Automobile Sector: A Firm-Level Analysis

To enhance the depth and relevance of our analysis of the Indian automobile and components 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 top market capitalisation automobile 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, defined as the ratio of a firm's R&D expenditure to its revenue, across Indian automobile sector firms forming a part of the high revenue cluster.

Mahindra & Mahindra performs best on R&D intensity with second highest revenue of USD 10,236.2 MM and R&D spend of USD 335.0 MM, which is the highest among all the firms. Hero MotoCorp ranks second for R&D intensity. Maruti Suzuki features in the lower half of the high revenue cluster despite the highest revenue of USD 14,159.4 and the second highest R&D spend of USD 92.2 MM.

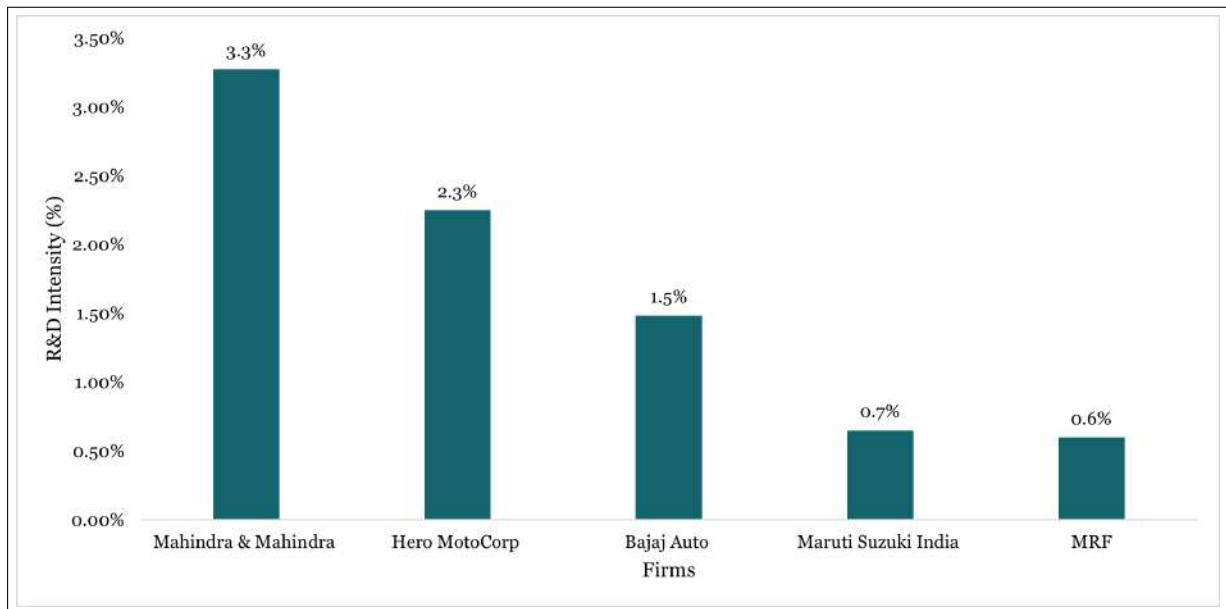


Figure 1.3: R&D Intensity: High Revenue Cluster

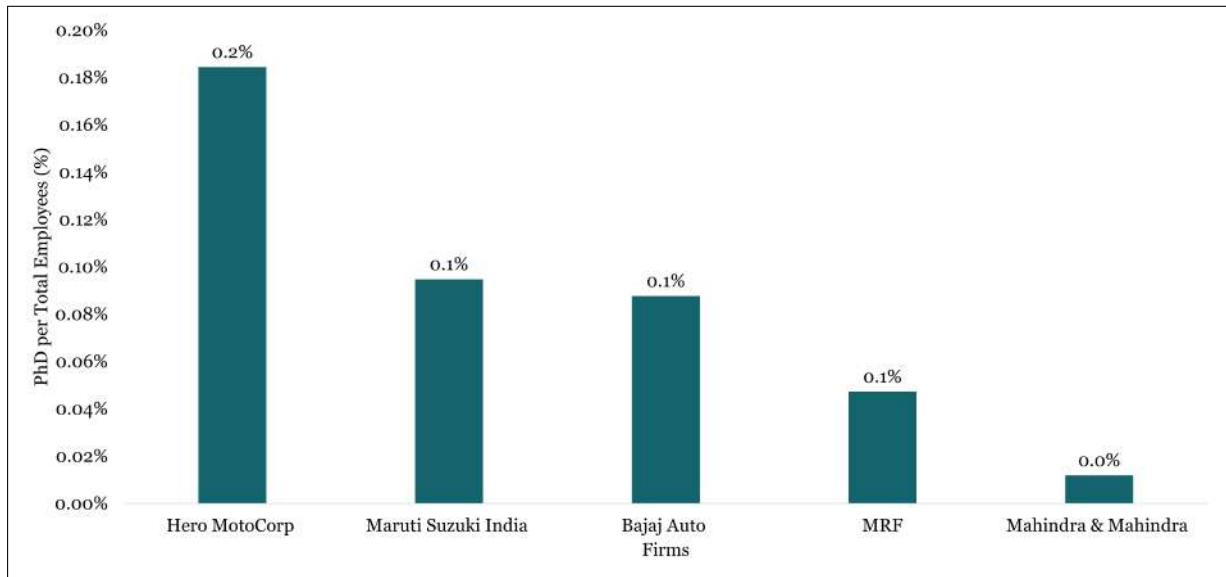
#### 1.3.1.2 PhD employees as a proportion of total employees

Figure 1.4 below presents the number of employees with PhDs as a percentage of the total employees attributed to various Indian automobile sector firms in a high-revenue cluster.

Hero MotoCorp performs best for the proportion of PhD employees, whereas Mahindra & Mahindra ranks last. Maruti Suzuki holds second rank, closely followed by Bajaj Auto for the parameter.

Mahindra & Mahindra, with the highest number of employees with PhD across clusters, is positioned last in the high revenue cluster when adjusted for total employee

count. It has a huge workforce of 2,60,000 which is around **6.7x** of Bosch, the firm with the second highest employee count (placed in the low-revenue cluster).



**Figure 1.4: PhD per Total Employees: High Revenue Cluster**

Hero MotoCorp which ranks first in the high revenue cluster, had 17 employees with PhD with a comparatively low total employee count of 9,215.

### 1.3.1.3 Patents by USD billion revenue

Figure 1.5 below depicts patents per billion USD revenue for high-cluster firms.

Mahindra & Mahindra ranks first in patents per billion USD revenue in the high revenue cluster, with 64 patents by revenue. Its score is **3.3x** the second highest scoring firm, Hero MotoCorp. MRF ranks last amongst the cluster with zero patents by revenue for the study period.

Mahindra & Mahindra also has the highest absolute number of patents count, **5.6x** of the second highest patent count of Hero MotoCorp.

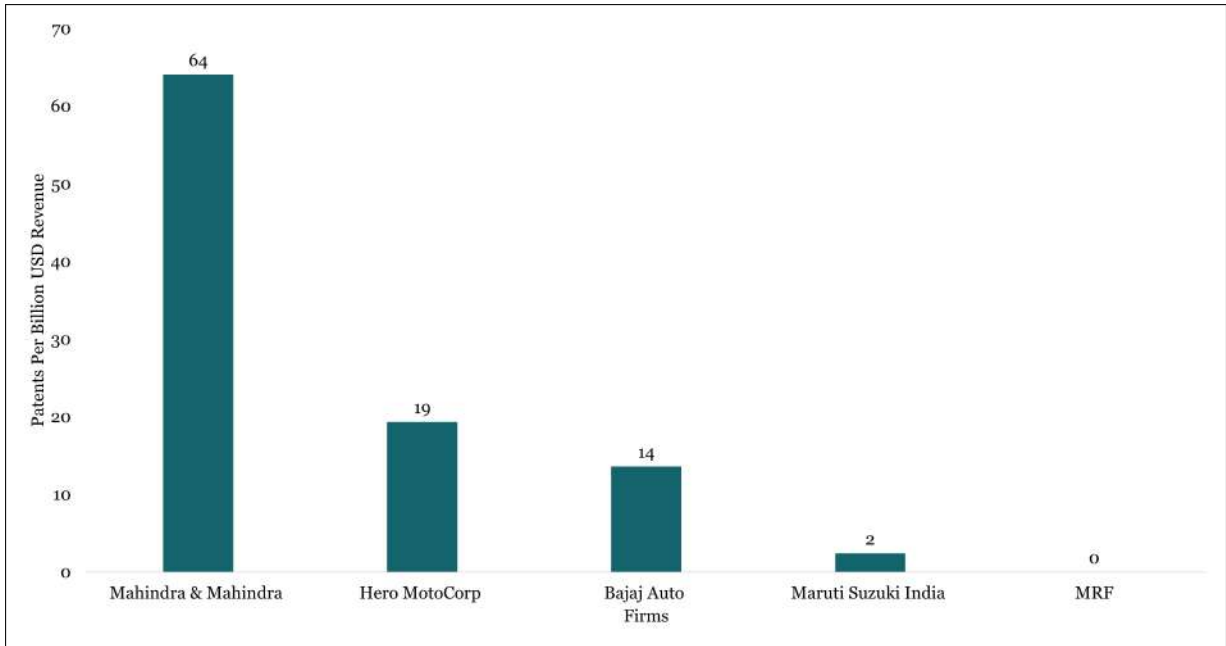


Figure 1.5: Patents per Revenue: High Revenue Cluster

#### 1.3.1.4 Publications by USD billion revenue

Figure 1.6 below presents publications per USD billion revenue of high-revenue cluster firms.

MRF ranks first amongst its peer for the parameter, publishing **2.8x** articles as compared to Mahindra & Mahindra that ranks second. Maruti Suzuki and Hero MotoCorp have the same number of publications per USD billion revenue.

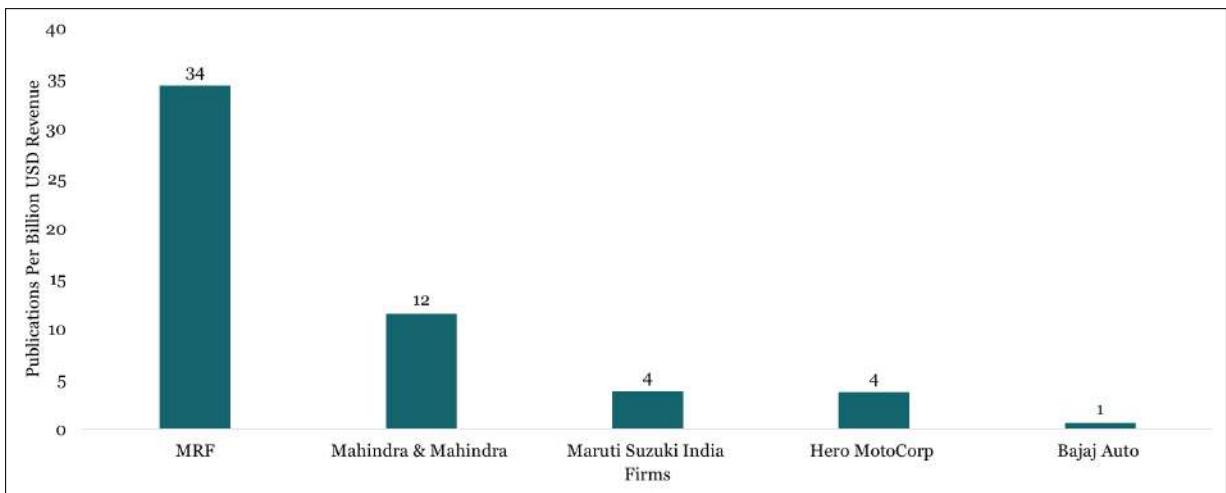


Figure 1.6: Publication per Revenue: High Revenue Cluster

MRF and Mahindra & Mahindra, the top two firms in terms of publications

per revenue in the high-revenue cluster, are also the top two firms in terms of absolute publications count in the cluster. Bajaj Auto, with one publication per USD billion revenue, has the least number of publications across the high revenue and low 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 automobile sector firms in the low-revenue cluster. The highest R&D intensity for the cluster is 2.9%. Within this cluster, Bosch ranks first while Eicher Motors and TVS Motors rank second and third respectively for R&D intensity.

Tube Investments ranks last on R&D intensity with the lowest revenue in the cluster. It also spends the least on R&D, USD 2.4 MM.

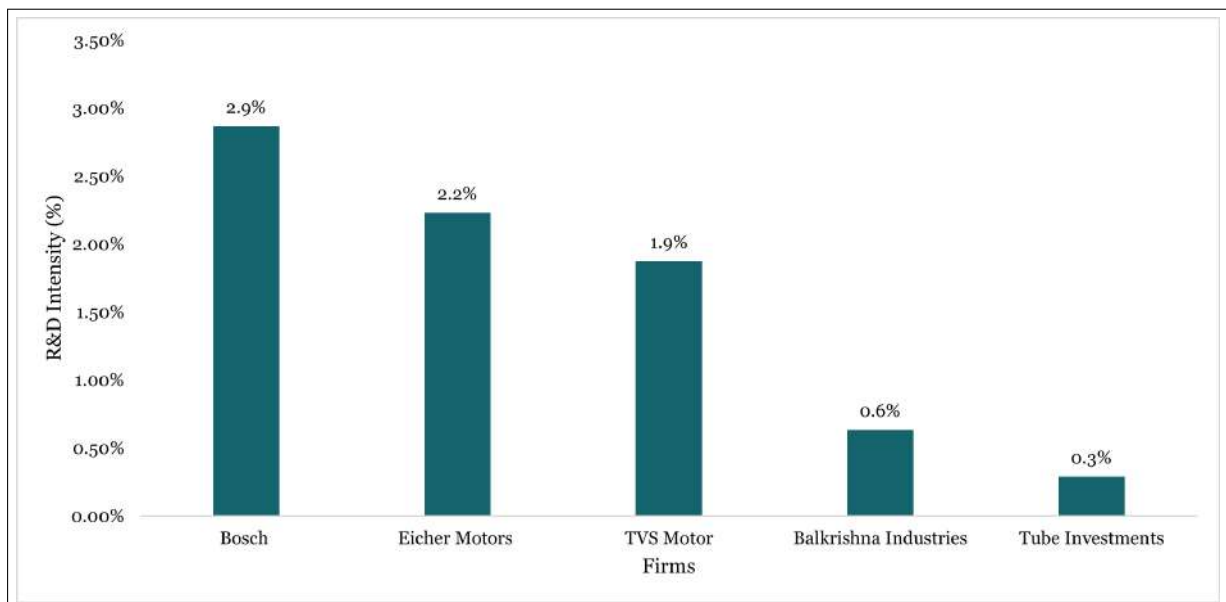


Figure 1.7: R&D Intensity: Low Revenue Cluster

#### 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 automobile sector firms in the low-revenue cluster. TVS Motors ranks first for this parameter amongst its peers. Balkrishna Industries and Eicher Motors have zero employees with PhD. Bosch ranks third for this parameter. However, Bosch has one employee with PhD, while having a comparatively high total employee count.

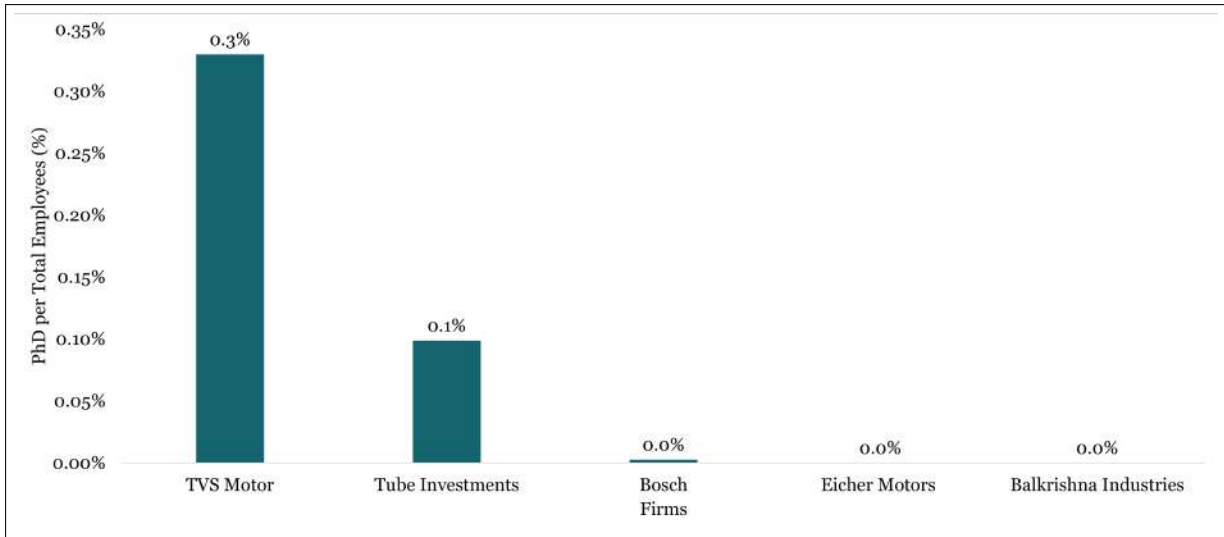


Figure 1.8: PhD per Total Employees: Low Revenue Cluster

### 1.3.2.3 Patents by USD billion revenue

Figure 1.9 below illustrates the patents by USD billion revenue across Indian automobile sector firms in the low-revenue cluster. No patent information was available for Bosch and Tube Investments, while Balkrishna and Eicher Motors have zero patent count recorded.

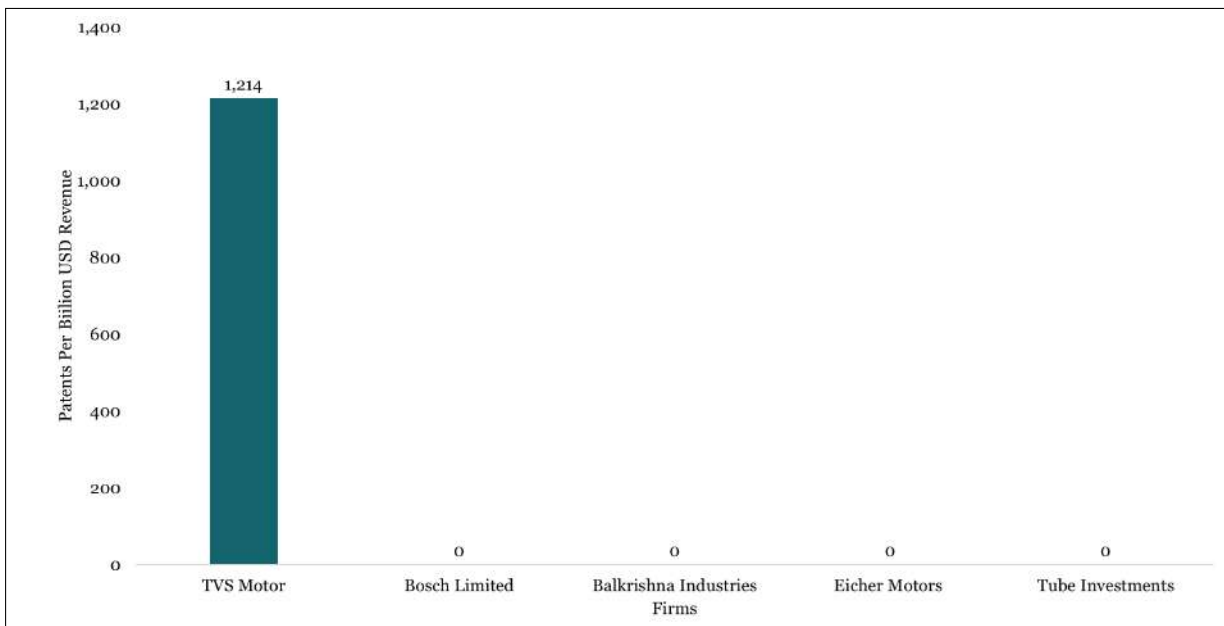


Figure 1.9: Patents per Revenue: Low Revenue Cluster

TVS Motors has the highest patent count across clusters, 2548, around 6.2x Mahindra & Mahindra, which ranks second. When adjusted for revenue, it ranks first in the low revenue cluster.

### 1.3.2.4 Publications by USD billion revenue

Figure 1.10 below presents the publication per USD billion revenue of low-revenue cluster firms. Bosch, ranking first in the low revenue cluster, has the highest publication count across clusters.<sup>10</sup> It is followed by TVS Motors and Tube Investments.

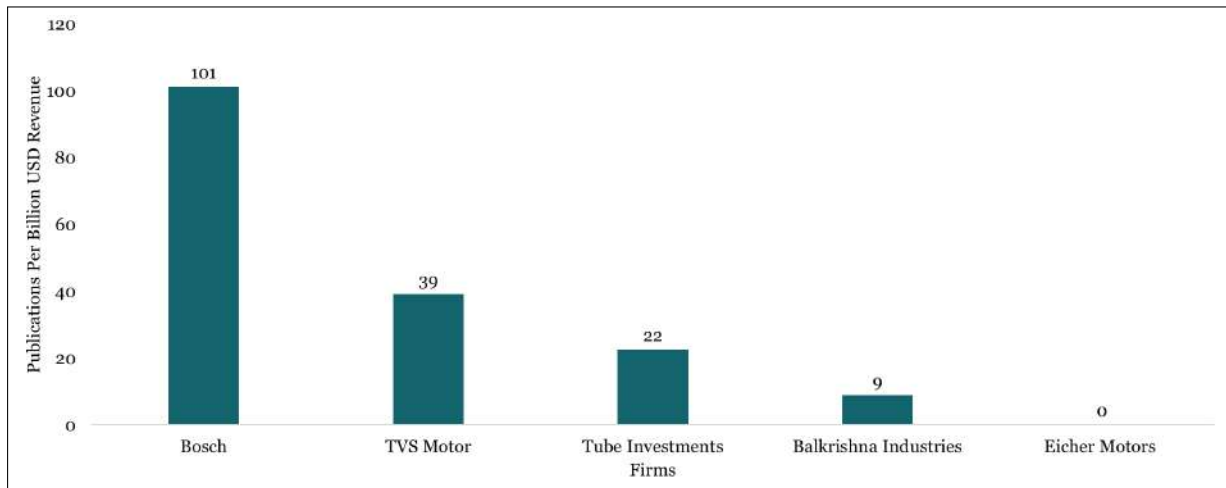


Figure 1.10: Publication per Revenue: Low Revenue Cluster

In summary, figures 1.11 and 1.12 below present a graphical representation of a firm's performance across the 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.

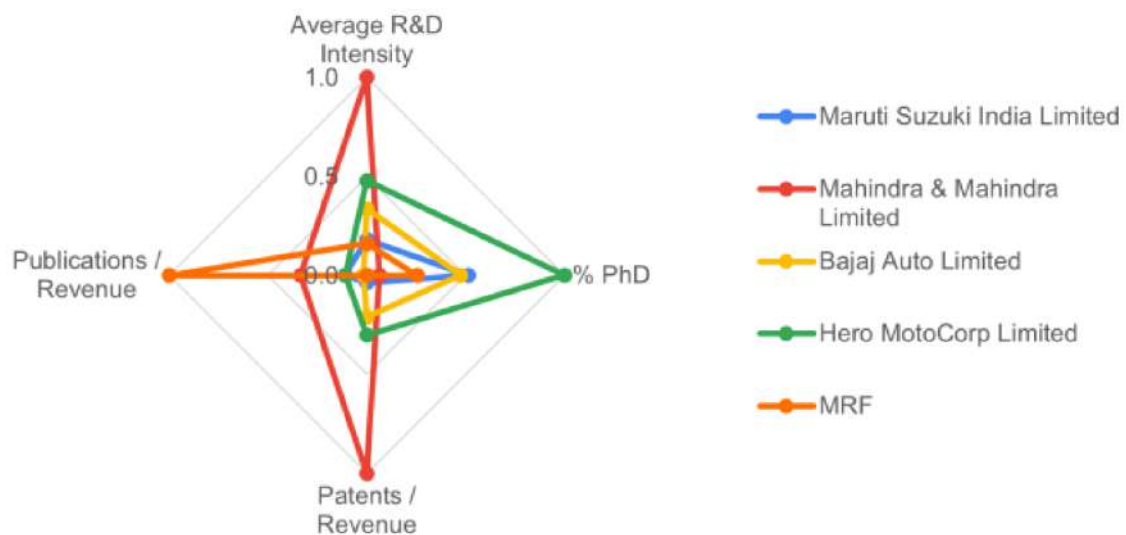


Figure 1.11: Indian Automobile Sector Firms' performance in the High Revenue Cluster

<sup>10</sup>No information on publication count was available for Eicher Motors.

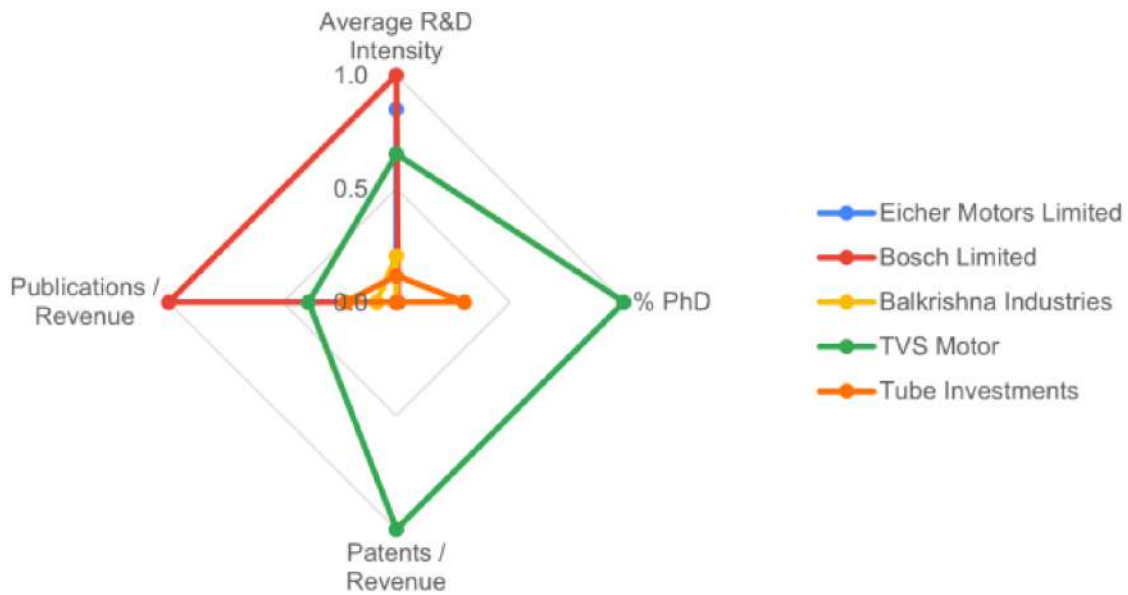


Figure 1.12: Indian Automobile Sector Firms' performance in the Low Revenue Cluster

## 1.4 Conclusion

The Indian automobile sector, being the third-largest market globally, showcases a dynamic landscape marked by significant achievements and areas for growth. Firms like Mahindra & Mahindra and TVS Motors demonstrate outstanding performance in innovation, with substantial investments in R&D and a high number of patents relative to revenue.

However, when compared to global counterparts, Indian firms generally have fewer patents and publications per revenue, highlighting the need for increased focus on innovation and intellectual property.

# Annexure

**Table 1.1:** Firms included in the study

No.	Firm	Market Cap (USD Bn)	Avg. Standalone Revenue (USD MM)	Revenue Cluster
1	Maruti Suzuki	34.2	9,971	High
2	Mahindra & Mahindra	17.3	6,430	High
3	Hero MotoCorp	6.3	3,777	High
4	Bajaj Auto	15.6	3,382	High
5	MRF	5	2,130	High
6	TVS Motor	7.1	2,099	Low
7	Bosch	6.8	1,384	Low
8	Eicher Motors	12.1	1,133	Low
9	Balkrishna Industries	5.2	683	Low
10	Tube Investments	6.5	578	Low
	Median	7.0	2,114	

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.

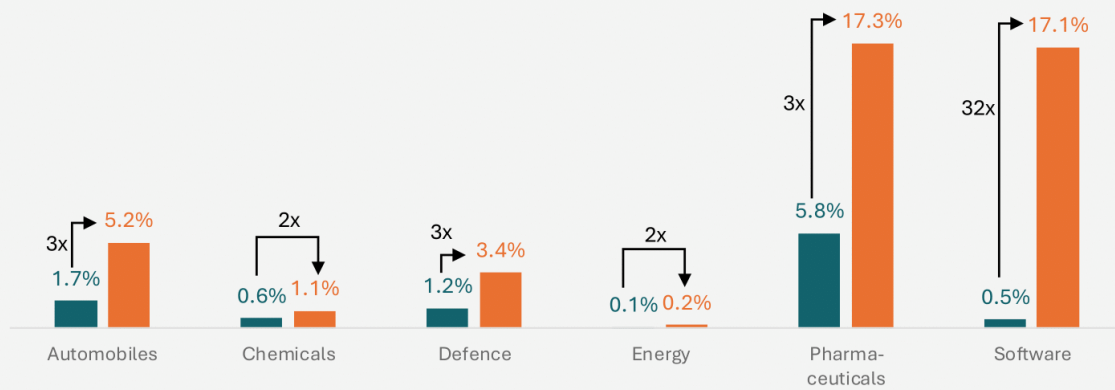
**Table 1.2:** Firms excluded from the study and rationale

No.	Firm	Region	Rationale for exclusion
1	Tata Motors Limited	Indian	Accounting mismatch; data not available as per accounting standards used by other firms
2	Samvardhana Motherson International Limited	Indian	For FY22 and FY23, specifies R&D expenses were considered in annual budget and cost and is not separately identifiable

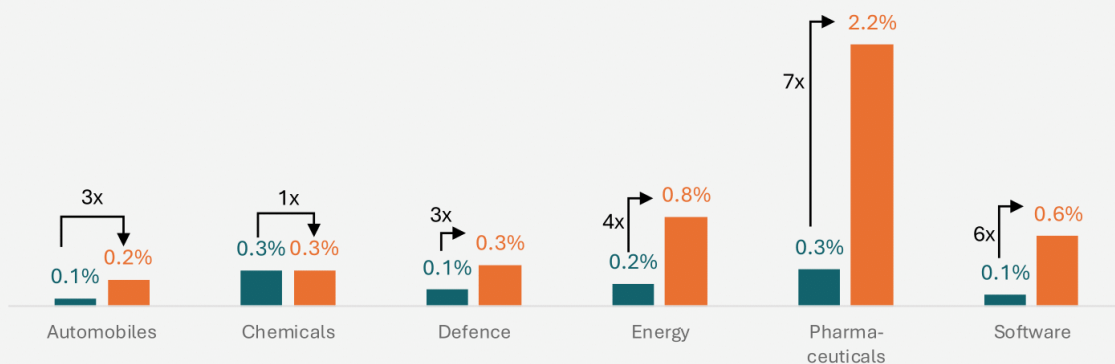


# Sectoral Comparisons: Inputs & Outputs

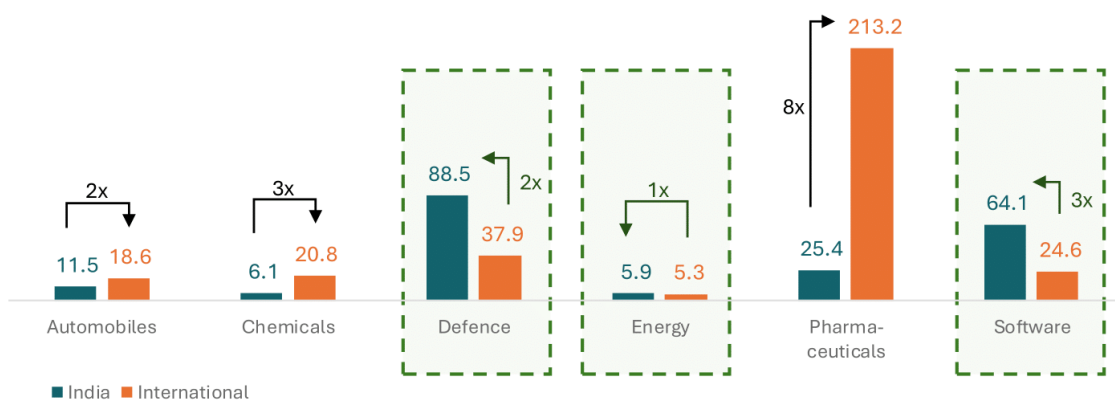
## R&D Intensity



## % PhD Employees

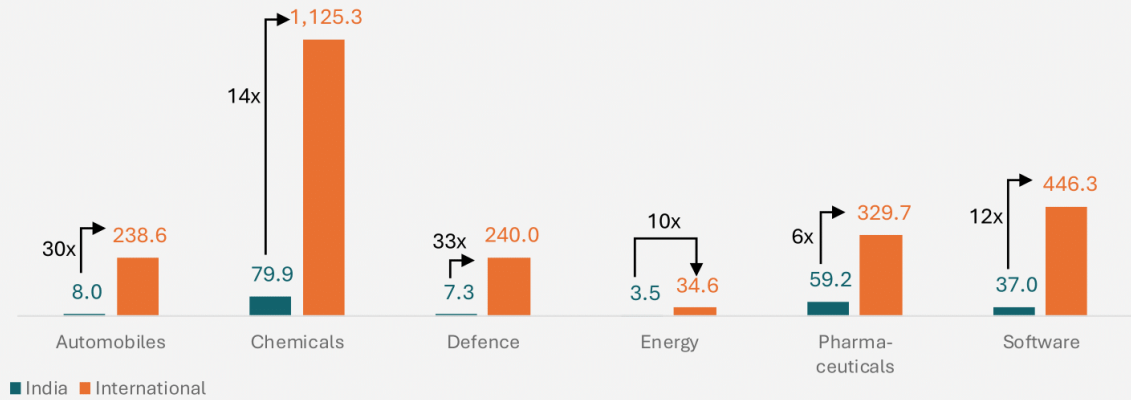


## Publications per revenue

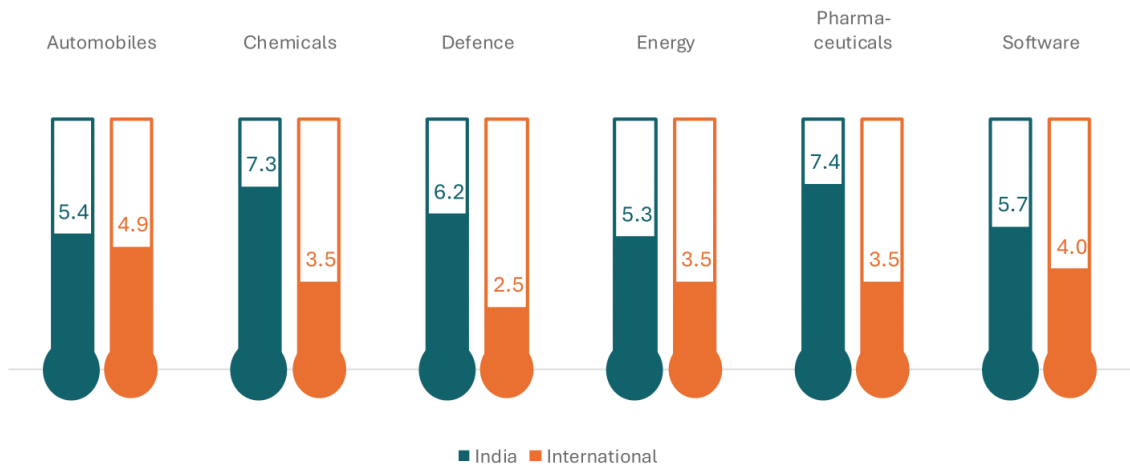


# Sectoral Comparisons: Inputs & Outputs

## Patents per revenue



## R&D Disclosures




**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.

# Bibliography

- IBEF (2024). *India's Automobile Industry: Growth & Trends*. en. URL: <https://www.ibef.org/industry/india-automobiles> (visited on 06/17/2024).
- India, Invest (2024). *Invest in Indian Automobile Industry, Auto Sector Growth Trends*. en. URL: <https://www.investindia.gov.in/sector/automobile> (visited on 06/17/2024).
- Kumar, Nitin (June 2024). "FAME-III likely to be released on Budget day with Rs 10,000 crore outlay". en-US. In: *Business Standard*. URL: [https://www.business-standard.com/budget/news/fameiii-likely-to-be-released-on-budget-day-with-rs-10000-crore-outlay-124061400124\\_1.html](https://www.business-standard.com/budget/news/fameiii-likely-to-be-released-on-budget-day-with-rs-10000-crore-outlay-124061400124_1.html) (visited on 06/19/2024).
- SIAM (2024). *Society of Indian Automobile Manufactures*. URL: <https://www.siam.in/cpage.aspx?mpgid=16&pgid1=17&pgidtrail=83> (visited on 06/17/2024).
- UNIDO and GoI DST (Mar. 2023). *INDIAN AUTOMOTIVE SECTORIAL SYSTEM OF INNOVATION (IASSI)*. Tech. rep. Austria: United Nations Industrial Development Organization. URL: [https://dst.gov.in/sites/default/files/Indian%20Automotive%20Sectorial%20System%20of%20Innovation%20%28IASSI%29%20Report\\_0.pdf](https://dst.gov.in/sites/default/files/Indian%20Automotive%20Sectorial%20System%20of%20Innovation%20%28IASSI%29%20Report_0.pdf) (visited on 06/17/2024).



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