

# Commercial Vehicle Industry in India: An Investigation of the Innovation and Business Trends (2000-2015)

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## Abstract

India is the seventh largest producer of commercial vehicles in the world. The commercial vehicle industry has grown significantly since the turn of the new millennium, which is evident from the fact that the industry could increase its sales by more than 4-folds to 685,704 units in fiscal year 2015-16 compared to 150,452 units in 2000-01. In this study we analyze the innovation and business profile of Indian commercial vehicle industry. The study is based on indicators such as sales and revenues, R&D expenditure, types of innovations and their impact, open innovation activities, product portfolio and product selling points. These data were collected from annual reports, press releases and other publically available sources.

This study revealed that companies have relied mainly on product innovations compared to other types of innovations for growth. Most of these product innovations resulted in the incremental improvements of the products. These incremental innovation activities resulted in different products and variants which met growing needs of customers. In addition, various open innovation moves were made by companies which helped them to acquire new markets and increase their revenue. These innovations have arguably given a new direction to Commercial Vehicle industry in India.

**Keywords:** Commercial Vehicles; Innovation; Open Innovation; Indian automobile industry; Frugal Innovation; India

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## **1. Introduction**

India's automobile industry contributes about 7% to the country's gross domestic product (GDP), as per a report by India Brand Equity Foundation (IBEF, 2016). The cumulated gross turnover of all members of the Society of Indian Automobile Manufacturers (SIAM) in India stood at Rs. 3,593.5 billion (around USD 58.7 billion) in fiscal year (FY) 2014-15, out of which the contribution of four-wheeled vehicles was about 71% (SIAM, 2016d). Around 20.4 million two-wheelers, three-wheelers, passenger vehicles and commercial vehicles (CVs) were produced in India in FY 2015-16 (SIAM, 2016a).

According to the International Organization of Motor Vehicle Manufacturers (OICA) India was the seventh largest producer of CVs in the world in 2015, after the United States, China, Mexico, Japan, Canada and Thailand, in that order (OICA, 2016). CVs are those vehicles which are used for commercial transportation of passengers and/or goods. They are classified based on gross vehicle weight (GVW) as shown in Table 1 (based on: ICRA, 2015).

<b>CV segment</b>	<b>GVW (in metric ton)</b>
LCV (Light Commercial Vehicle)	Less than 7.5
MCV (Medium Commercial Vehicle)	7.5 to 16.2
HCV (Heavy Commercial Vehicle)	More than 16.2

**Table 1: Classification of CVs**

India has made a long journey from being almost a non-entity in the global automotive industry prior to the launch of economic reforms in 1991 (Krueger, 2010; Wolf, 2010) to becoming a lead market for small cars (Tiwari and Herstatt, 2014), but it is the passenger car industry that has mostly received scholarly attention due to its higher visibility and probably due to larger-scale involvement of global players. Developments in the CV industry, which remains dominated by domestic players such as Tata Motors, Mahindra & Mahindra, and Ashok Leyland, have by and large remained "invisible" outside the world of subject-matter experts. As a result, little is known of the in-depth business and innovation profile of the world's 7<sup>th</sup> largest CV industry. Not many know that India's Tata Motors has been home to two of the most successful disruptive, frugal innovations in the CV industry; namely the Tata 407 prior to economic liberalization (Maira, 2015) and the Tata Ace in

2005 (Palepu and Srinivasan, 2008). The Tata Ace, a small commercial vehicle (SCV) from the stable of Tata Motors “was launched in May 2005 as India's first mini-truck with a sub-one tonne payload” (TML, 2010). It proved to be a resounding commercial success (TML, 2012b; 2013b), which was not only able to create a completely new space in the domestic CV industry (Palepu and Srinivasan, 2008; TML, 2015a), but also has fared quite well in the export market (Tiwari and Herstatt, 2012). Export of products from the Tata Ace family, according to company information, crossed the mark of 100,000 units in 2015, “with a foot print spanning 28 countries across South Asia, Africa and the ASEAN regions” (TML, 2015a).

A primary aim of this study, therefore, is to analyze the business profile of Indian CV industry and the types of innovations introduced by different companies in the years from 2000 to 2015. Companies, which are members of SIAM, have been selected for the purpose of the study as that helps us cover all manufacturers known to produce automobiles domestically. The investigated set of companies comprises of Tata Motors Ltd., Ashok Leyland Ltd., Mahindra and Mahindra Ltd., Force Motors Ltd., Eicher Motors Ltd., SML Isuzu Ltd., Piaggio group, Daimler India Commercial Vehicle (DICV), Scania Commercial Vehicle India (SCVI) and Asian Motors Works (AMW). The profile study is based on analysis of product portfolios, financial data, research and development (R&D) expenditure on in-house R&D, royalty fees and license fees for technical know-how, innovative products/features and processes, open innovation in innovative products, launch of products and product selling points. Data for profile study is collected from annual reports, press releases, official websites and other publically available sources. We make use of “thick description” (Barzelay, 1993) for this qualitative study, which has been conceptualized as containing small vignettes (“nested cases”) within a larger single case (Eckstein, 1975; Dyer and Wilkins, 1991; Gibbert, Ruigrok, and Wicki, 2008).

The paper is structured as follows: After this brief introduction, we familiarize the reader with India’s CV industry covering macro-economic trends and developments in section 2. This section contains key profile information for top-3 players that jointly control about more than three-quarters of the CV industry. In section 3 we provide some examples of innovations that we were able to observe based on publically available information. The section exemplifies the innovative solutions along the typology of innovation in accordance with the Oslo Manual (OECD and

Eurostat, 2005). Section 4 contains the aggregated analysis at industry level. The paper concludes with section 5.

## **2. Indian Commercial Vehicle Industry**

### **2.1. Industry Developments**

Indian automobile industry has come a long way after India became independent. Growth of the post-Independence Indian automobile industry is generally thought to have occurred in four phases (see, e.g., Kathuria, 1987; D'Costa, 1995; Narayanan, 1998; 2004; Tiwari, Herstatt, and Ranawat, 2011). The first phase (1947-1965) saw policies which protected domestic companies from foreign competition. In the second phase (1966-1979), policies were designed to overcome economic problems of India. These policies aided particular automobile segments such as Two-wheelers and tractors. In the third phase (1980-1990) certain relaxations were provided to encourage technological acquisitions and foster joint ventures. This increased competition in the industry. In the ongoing fourth phase (since 1991) the automobile industry was opened up successively for foreign direct investments (FDI) and has been fully liberalized in the course of time. Today there are about 10 main players in the CV industry, who are spread throughout India. Figure 1 shows cluster of CV manufacturers in India.

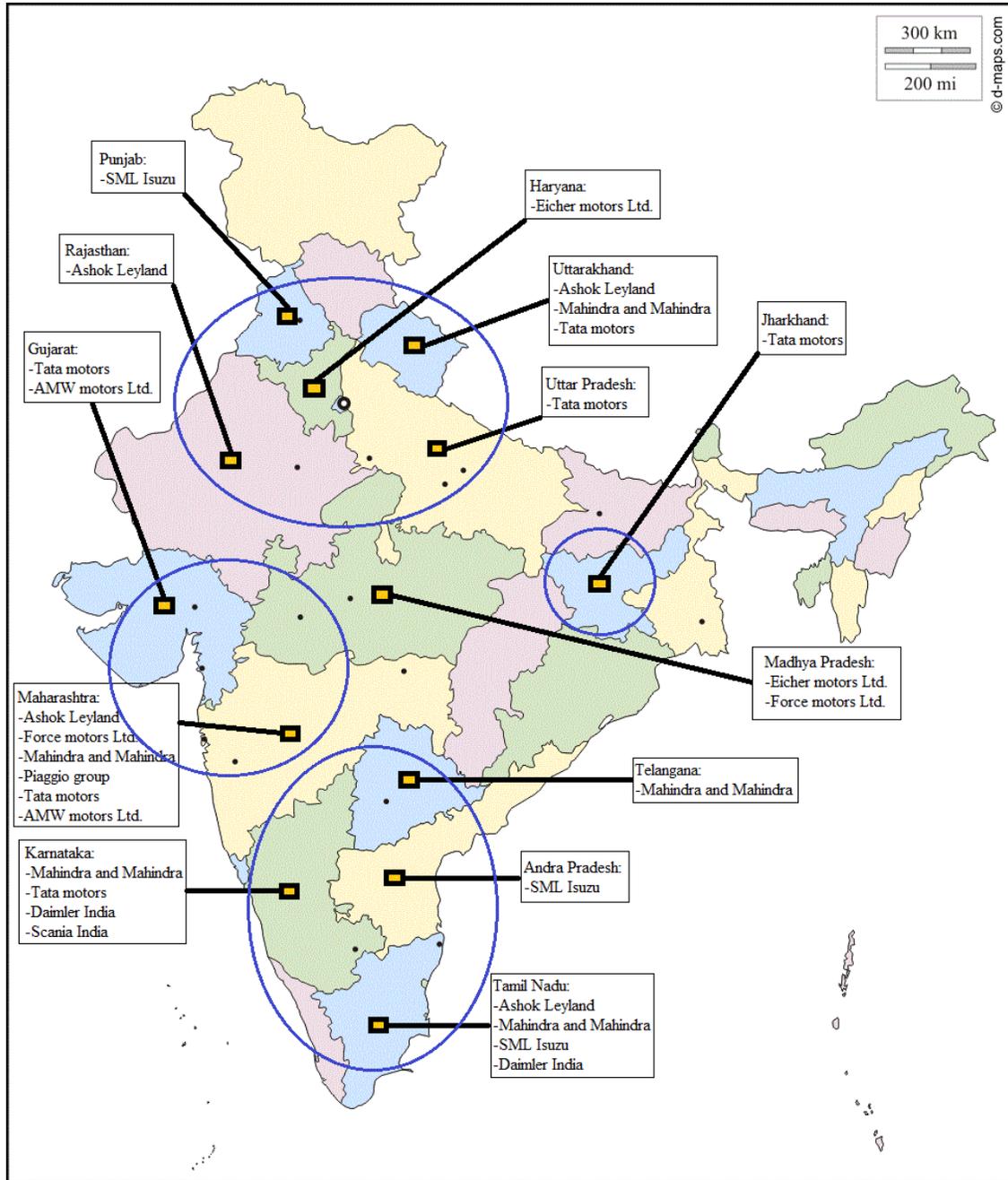


Figure 1: Cluster of companies in India<sup>3</sup>

<sup>3</sup> Source: Self construction based on data collected from different companies chosen for this study.

The improvement in the road infrastructure has also played a part in the development of the CV industry. While India, after Independence, had a road network of less than 400,000 KMs in FY 1950-51, the road network size had increased to 2.3 million KMs by FY 1990-91 by the time economic liberalization program was launched. The network more than doubled to 5.2 million KMs by FY 2012-13 (SIAM, 2016e). The length of the national highways alone has increased from 33,650 KMs in FY 1990-91 (SIAM, 2016e) to more than 100,000 KMs according to the latest official figures by the Ministry of Road Transport and Highways (GOI, 2006). This has enabled faster transportation of vehicles and has increased the number of possible trips per vehicle for (business) customers reducing the total cost of ownership (TCO). In a press release to mark the 10<sup>th</sup> anniversary of the Tata Ace, the manufacturer claimed that “the Ace family has helped uplift many lives and has been a strong contributor to the growth of many entrepreneurs and small scale businesses in India” (TML, 2015a). The increase in the road network has, thus, facilitated CV manufacturers to assist their customers in increasing their own sales and revenue (Roy, 2014).

As a result of liberalization the competition in the CV industry has intensified. This increased involvement of companies in innovation activities (Narayanan, 2001; 2004). Thus efforts in in-house R&D activities and technological agreements increased (Ranawat and Tiwari, 2009). In FY 2014-15, the automobile industry in India spent close to USD 1 billion on R&D up from USD 860 million in the previous year (SIAM, 2016d). Companies have apparently also realized the importance of open innovation in creating “frugal solutions” that are based on creating affordable excellence. This has resulted in significant efforts to involve innovation from different sources into their products (Wielgat, 2002; Khanna, Lal, and Manocaran, 2005; Palepu and Srinivasan, 2008). These, partly pioneering, activities have enabled companies to successfully launch products that are technologically advanced, have high fuel efficiency and are available at affordable price.

With these developments companies have been able to offer different products fulfilling specific customer needs. This has not only helped companies to expand their product portfolios but also increased the number of units sold and the revenues generated. In addition, technological agreements, joint ventures, acquisitions and mergers have assisted companies to enter into new

markets. Consequently revenue from exports has significantly increased. These agreements have also resulted in change of organizational practice and business environment.

Apart from providing unique product features, different strategies like celebrity endorsement, race championships and road shows have been put in practice to market products. Even if this is a something completely new to the world, many of such practices have been at the very least new to the concerned firm, fulfilling the definitional criteria for innovations (Garcia and Calantone, 2002; OECD and Eurostat, 2005). Emphasis on process innovation has also helped companies to manufacture high-quality products at low cost. Thus, it is a reasonable inference that different innovations in products, processes, organization structure and marketing have helped CV industry to develop.

<b>Fiscal Year</b>	<b>Units Sold</b>	<b>Domestic</b>	<b>Export</b>	<b>Percentage change (Units sold)</b>
2000-01	150,452	N.A.	N.A.	N.A.
2001-02	143,676	N.A.	N.A.	-(5)
2002-03	202,937	190,682	12,255	41
2003-04	277,546	260,114	17,432	37
2004-05	348,378	318,438	29,940	26
2005-06	391,641	351,041	40,600	12
2006-07	517,648	467,882	49,766	32
2007-08	549,488	490,494	58,994	6
2008-09	426,747	384,122	42,625	-(22)
2009-10	576,404	531,395	45,009	35
2010-11	760,735	684,905	74,043	31
2011-12	929,136	809,499	92,258	20
2012-13	832,649	793,211	80,027	-(3)
2013-14	699,035	632,851	77,050	-(19)
2014-15	698,298	614,948	86,939	-(1)
2015-16	782,814	685,704	101,689	(12)

**Table 2: Sales figures of Indian CV industry<sup>4</sup>**

Table 2 shows number of units sold by Indian CV industry from 2000 to 2015. It can be observed from the table that the relative fluctuation in the volume of domestic sales is higher compared to that of exports. Products like the Tata Ace and the Ashok Leyland Dost have significantly contributed to sales increase of industry. Products based on the Ace-platform crossed sales landmark of 1.5 million in 2015, ten years after the launch (TML, 2015a). In a press release the company said that “Today, one in every five commercial vehicle sold in India, is from the Tata Ace Family” (TML, 2015a).

Ashok Leyland’s Dost sold the one-hundred thousandth unit four years after launch in 2015 (Rishi Kumar, 2015). A top company representative said that the truck was being exported to around one-dozen countries and that “several features of Dost, including higher mileage and reliability and low total cost of ownership have helped achieve” commercial success (Rishi Kumar, 2015). Generally speaking, Bangladesh, Sri Lanka, Kenya, Nepal and South Africa belong to the top-5 destinations for Indian CVs meant for transport of goods (SIAM, 2016e).

About 80% of M&HCV market segment is held jointly by Tata Motors and Ashok Leyland, whilst close to 88% of LCV market segment is shared by Tata Motors and Mahindra & Mahindra (Autobei, 2015). Other important companies like Eicher Motors Ltd., Force Motors Ltd., AMW Motors Ltd. and SML Isuzu Ltd. offer products for specific applications. Market shares of leading players in India’s CV industry based on their sales in the domestic and export markets in FY 2014-15 are shown in Figure 2. As can be seen, the top-3 players dominate the CV industry almost completely with a market share of about 85%.

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<sup>4</sup> Source: Data for FY 2000-01 to 2008-09 was retrieved from Annual reports of Tata Motors Ltd., for 2009-10 to 2014-15 was retrieved from the website of SIAM (e.g., 2016a; b; c).

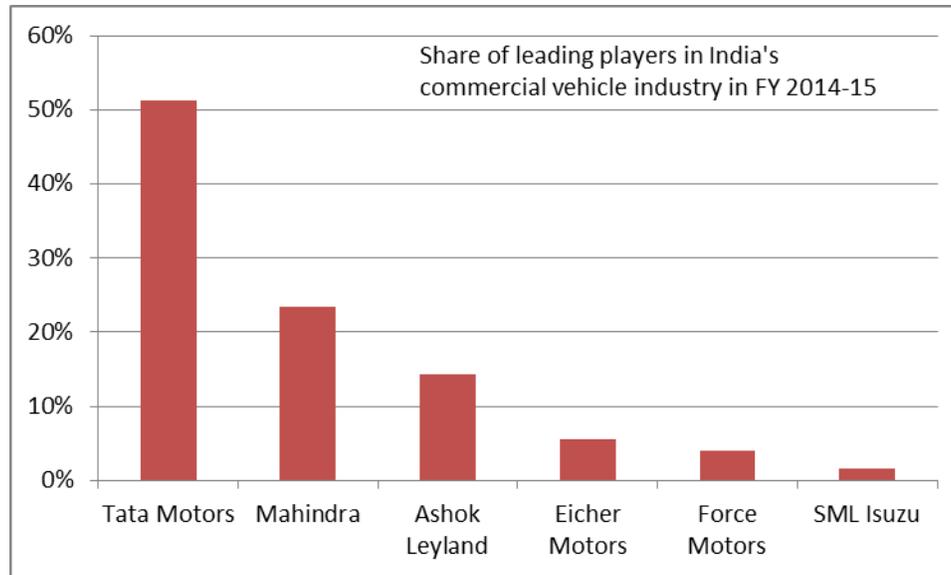


Figure 2: Share of leading players in India's CV industry

## 2.2. Select Company Profiles

In this section we describe profiles of top-3 companies from India's CV industry. Data are based – unless specified otherwise – on the annual reports of the respective companies. Aggregated data for all companies in the sample are provided in section 5.

**Tata Motors Ltd.** was established in 1945 as Tata Engineering and Locomotive Co. Ltd. The company produces full range of four-wheeled vehicles. Between 2000 and 2015 Tata Motors launched 23 vehicles in the CV segment. Among these, 17 vehicles are currently offered to customers in more than 204 variants; prices vary depending on the model between € 4,200 and € 104,000. It sold more than 377,000 units of CVs in FY 2014-15 compared to 82,000 units in FY 2000-01. Cumulative revenues of Tata Motors in FY 2014-15 from its automotive business in India (including exports) stood at € 5.1 billion, which was about 2.5 times higher in comparison to FY 2000-01. The share of exports stood at 15% in 2014-15. The company has the largest market share in India. Export destinations are mostly located in other emerging markets like Bangladesh, Sri Lanka, Nepal, South Africa and Indonesia. Saudi Arabia, UAE and Qatar are also major export destinations of the company. It has grown in global market through various acquisitions and joint ventures. For instance, Tata Motors acquired Daewoo Commercial Vehicles Company in South Korea which has a significant local market share in the truck market segment. The company also

acquired Hispano Carrocera in Spain, which is a reputed bus and coach manufacturer. Moreover the company has joint venture with Thonburi Automotive in Thailand which is known for pickup. The company has R&D centers in India, UK, Italy, Spain and South Korea. These centers are responsible for developing vehicles that are suitable for different climatic conditions and customers. In FY 2014-15, it spent more than 6% of its turnover on R&D. In absolute terms, the expenditure on R&D and royalties stood at about € 360 million. Many of its innovative solutions (e.g. Ace, Xenon) have become known for enabling fuel efficient, affordable mobility.

**Mahindra & Mahindra** can also look back at a firm history that goes back to 1945. In FY 2014-15 it sold 172,566 units of CVs (export share: 15%), apart from passenger vehicles and two-wheelers; and generated cumulative revenues worth € 5.2 billion. In FY 2000-01 its revenues had stood at € 1.1 billion. It is a global firm with a strong presence in Europe including in Germany. In FY 2014-15 the company spent close to € 200 million on R&D, which was about 3.65% of its total turnover. Between 2000 and 2015 the company has launched 15 models, which are currently offered in more than 70 variants, which are sold for prices varying between approx. € 2,700 and € 50,000. Products like Maxximo (Pickup trucks) and Navistar trucks have helped the company to increase exports. With various products, the company has been exporting vehicles to South Africa, UAE, Uruguay and Malaysia. Apart from this, it also exports vehicles to Europe, South America and Australia. Mahindra's Annual Report for 2015 states that it has well established markets in Italy, Chile and Bangladesh. Pickup trucks of Mahindra & Mahindra are also reported to have considerable market share in Sri Lanka, Peru and Tunisia.

**Ashok Leyland** has a history, which can be traced back to 1948. It has a strong presence in M&HCV segment. In FY 2014-15, Ashok Leyland sold 104,902 CVs and generated € 1.9 billion in revenues. The company revenue in FY 2000-01 had stood at € 485 million, which means the company could increase its revenues four-folds within 15 years. Since 2000, Ashok Leyland has introduced 23 series of vehicles in the markets. Currently it offers 15 models in more than 90 variants for a price that ranges between € 6,500 and € 53,000. The net sales increased from 32,475 units in FY 2000-01 to 104,902 units in FY 2014-15. The company places emphasis on innovation and has a design and development center with close to 1,000 engineers in Chennai (India). The company spent 1.36% of the total turnover on R&D activities in FY 2014-15. In absolute terms the company spent about € 29 million on R&D, royalties and license fees for technical knowhow. It

reportedly was “the first to introduce three-axled trucks, full-air brakes and a host of innovations like the rear-engine and articulated buses in India, the country’s first CNG bus and the first Hybrid Electric Vehicle” (Gopalakrishnan, 2008). In 2006, Ashok Leyland formed a joint venture with Avia which is based in Prague (Czech Republic). AALM (Avia Ashok Leyland Motors) offers D series trucks in Czech Republic, Spain, Slovakia, Ireland, UK and Hungary. Furthermore, Ashok Leyland has entered into a joint venture with Ras Al Khaimah which has a bus assembly unit in UAE. With the help of this unit Ashok Leyland has secured footprints in Middle East. In addition, the Hinduja group, owner of Ashok Leyland, has a support division in Germany namely Albonair GmbH and this division has small scale sales office at Shanghai (China). Apart from this, Ashok Leyland has exported vehicles to several emerging markets like Sri Lanka, Africa and Russia.

### **3. Select Examples of Innovations from India’s CV Industry**

In this section we provide select examples of innovations from India’s commercial vehicle industry. The examples are organized along the dimension of “innovation type” in accordance with the Oslo Manual (OECD and Eurostat, 2005).

#### **3.1.Product innovations**

Tata Motors has developed several innovative products. Products like Tata Ace has created new market segment in CV industry (Palepu and Srinivasan, 2008; Pradhan, 2015). Tata Ace operates on a two cylinder Common Rail Diesel Engine (CRDe) which reduces noise and vibration levels (Palepu and Srinivasan 2008). In addition, the design ensures that electronic system is avoided. Apart from this, a rotary fuel injection pump was developed for Tata Ace which met the emission standards. This system reduces overall complexity of system and enables easy maintenance. It also has also resulted in significant cost reductions (Palepu and Srinivasan, 2008).

Force Motors developed vehicles using carbon fibers (FML, 2015). This has reduced the weight of vehicles, which in turn increases the fuel efficiency. Furthermore, an innovative arrangement was designed for hot and cold air option, mainly used in the Traveller and the Gurkha (FML, 2013). Instead of providing different openings for air conditioning, air was directed from dashboard. These new materials and techniques have reportedly improved product performance. In 2015, Force

Motors launched a new, “fully indigenous” model of its flagship carrier, the Trax, which is a CV for passenger transport aimed at rural buyers and with its robust features seeks to provide “connectivity from large cities to poorly connected villages and talukas” (Singh, 2015). To increase its appeal to its target customer groups, it has been fitted with a “wide extended foot-board on the sides” to ensure “comfortable entry and exit for sari clad women, children and the elderly” and is sold with a claimed “unmatched” warranty of 3 years / 300,000 KMs and 7 free services (Singh, 2015).

### **3.2.Process innovations**

Tata Motors have developed a new coating process for increasing corrosion resistance (TML, 2007). This coating process utilizes “T-coat” mainly used for large components. This coating helps to reduce powdering and cuts cost of manufacturing. In addition, the blast furnaces are modified to decrease slag volume which in turn reduces viscosity of slag and increases productivity of blast furnaces.

Mahindra & Mahindra focuses on process innovations in order to conserve energy and reduce manufacturing costs. It reportedly utilizes renewable energy sources such as solar in manufacturing process (Mahindra, 2013; 2015). An innovative, wet-on-wet painting process used by Mahindra & Mahindra, which is a three stage filtration process which reduces, reuses and recycles waste from paint process. In addition, the performance of paint guns and paint circulation pumps are optimized which have increased process efficiency. Apart from this, Mahindra and Mahindra is using a new 4 layered semiconductor rectifier known as thyristor for heating furnaces. This semiconductor reduces consumption of energy. These new processes decrease manufacturing cost and increase efficiency of production process.

### **3.3.Organizational innovations**

Xenon was developed by **Tata Motors** in joint venture with Thonburi Automotive Assembly Plant, Thailand (TML, 2008). Buses like Tata Divo and Xerus were developed by Hispano Carrocera S.A. (HC), Spain which was acquired by Tata Motors (TML, 2012a). Tata motors have played different role in developing these products. In addition, the company developed new technology

for mass production of buses by forming joint venture with Marcopolo, Brazil (TML, 2007). Thus the company has modified organizational practices to increase innovation activities.

Various types of agreements (like joint ventures, acquisitions) have assisted **Eicher Motors Ltd.** in developing new products. For example in joint venture with Polaris industries (USA), Eicher Motors Ltd. is involved in design, development, manufacture and marketing (EML, 2015).

### **3.4. Marketing innovations**

Tata Motors address innovative features of a vehicle during launch of a product. These features create interest in customers and in turn help the company to connect with customers. For instance, during the launch of Prima trucks, the company addressed it as a “World truck”. This assisted the company to inform customers that various truck components were developed in different parts of the world (TML, 2013a). Furthermore, the company started Truck racing championship in 2014 which was the first of its kind in India (TML, 2015b). These new promotion techniques assisted Tata Motors to differentiate themselves from competitors and grab attention of potential customers.

Mahindra & Mahindra has taken “pioneering initiatives” regarding warranty of vehicles. The company claims to be the first to offer a 5 year transferrable warranty to customers. The company also presented some vehicles to the members of Indian cricket team. For example, the first Bolero Stringer was presented to Indian batsman Gautam Gambhir (Mahindra 2015b) and Bolero special edition was handed over to another Indian batsman Robin Uthappa (Mahindra 2015c). Thus the company utilizes new pricing and promotion methods to address customers. While these measures may not sound radically innovative, they do qualify as innovations and document innovation efforts if they are new to the firm (cf. OECD and Eurostat, 2005).

## **4. Aggregated Analysis at Industry Level**

After analyzing business and innovation profile of different companies, profile of Indian CV industry is assessed. It was evident from the study that various innovation activities have assisted companies to develop new products and variants. In addition, the companies have also increased

their footprint at global level. As a result, profile of CV industry depends on strategy and tactics of these firms.

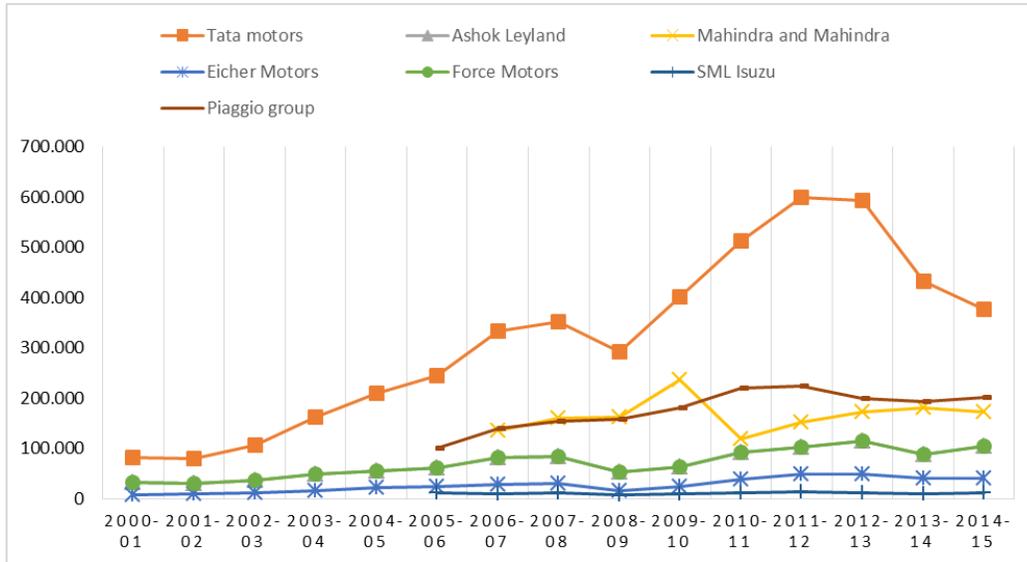


Figure 3: Number of units sold by Indian CV industry and different companies<sup>5</sup>

It can be observed from the above figure that there was a steady growth from 2000 to 2007. After a decline during 2008, the industry picked up the pace and grew rapidly till 2011, since then the sales have been somewhat erratic, though on a higher level.

Table 3 shows the number of product launches as well as those innovations that we could observe based on publically available reports and documents.

Company	Products of companies			Innovations of companies				
	Discontinued products	Current products	Total	Product innovation	Process innovation	Organization innovation	Market innovation	Total
Ashok Leyland Ltd.	8	15	23	6	2	1	2	11
Tata Motors Ltd.	6	17	23	7	4	3	3	17

<sup>5</sup> Self-construction based on data collected for CV industry and from respective annual reports of companies.

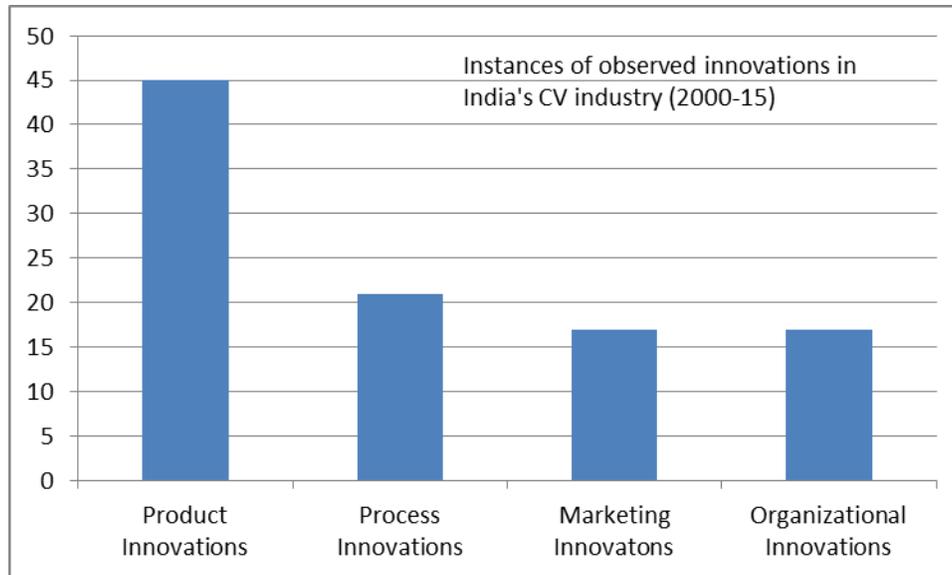
Mahindra & Mahindra Ltd.	0	16	16	6	3	2	3	14
Force Motors Ltd.	0	16	16	4	2	3	3	12
Eicher Motors Ltd.	4	27	31	5	1	2	3	11
Piaggio group	5	5	10	3	4	N.A.	N.A.	7
SML Isuzu Ltd.	1	16	17	4	5	2	N.A.	11
Daimler India	0	17	17	3	N.A.	1	N.A.	4
Scania India	0	8	8	5	N.A.	3	N.A.	8
AMW Motors Ltd.	3	7	10	2	N.A.	N.A.	3	5
Total	27	144	171	45	21	17	17	100

**Table 3: Different types of innovations of Indian CV industry<sup>6</sup>**

In this study, it was observed that most of the companies invest in in-house R&D activities. These activities have enabled the companies to offer more than 170 vehicles in the market today. Figure 4 depicts Types of innovations observed in India's CV industry from 2000 to 2015. It can be seen from that product innovation was the most dominant form of innovations, followed by process innovations. All companies engaged in product innovations in the period of analysis. A closer look at these innovations showed that they often aimed at improving fuel efficiency, providing alternate fuel options, increasing torque and power delivered by engines, developing new steering mechanisms (reduces fatigue of driver) and improving safety features.

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<sup>6</sup> Data summarized based on analysis of companies selected for this study.



**Figure 4: Types of innovations observed in India's CV industry from 2000 to 2015**

Seven out of 10 companies also engaged in process innovations. These innovations focused on using renewable energy sources, increasing efficiency in paint shops and heating systems (blast furnaces) which help reduce manufacturing costs.

Companies have also emphasized on Open innovations. These innovations have led to different types of agreements such as joint ventures, acquisitions, mergers, technical collaborations etc. In order to fulfill different roles in these agreements, the companies have made Organizational innovations. Organization innovation activities aim at developing new product components or process improvement to offer better solutions to customers. They have enabled the companies to enter new markets and increase revenue. These activities have also helped companies to improve existing products and provide different variants. As a result companies rely on product improvements which are due to Incremental innovations for their growth. Some of the companies adopt different marketing tactics to attract customers. These different Market innovation activities include celebrity endorsement, attractive warranty offers, road shows and truck racing championships.

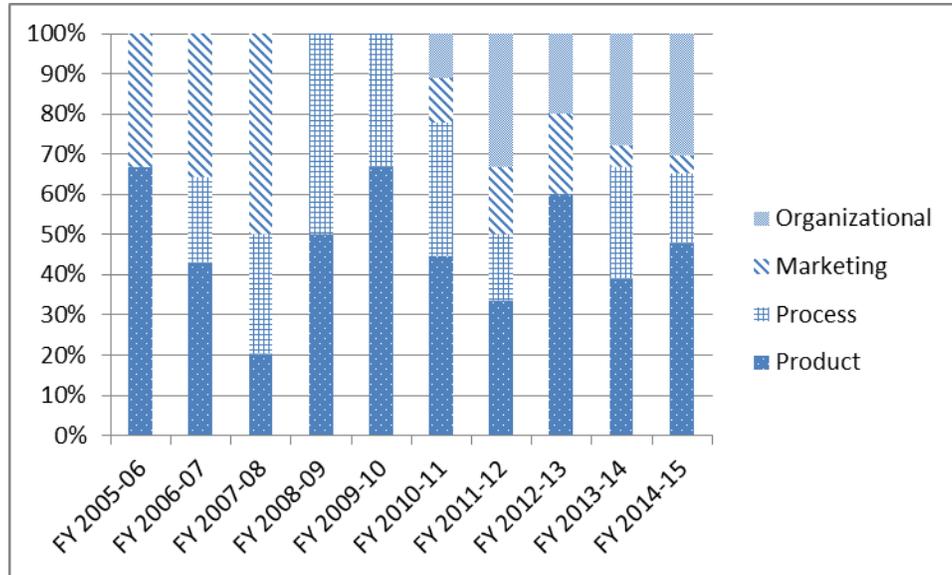


Figure 5: Share of the different types of innovations in all observed innovations

Figure 5 shows the relative share of the different types of innovations in all observed innovations for FY 2004-05 to FY 2014-15. One interesting thing to note is that the innovation portfolio has, apparently, become more balanced or broad-based. While companies earlier engaged primarily in product innovations, of late, we can observe instances of all types of innovations. This, probably, can be interpreted as a sign of growing sophistication of the industry.

## 5. Conclusion

This study sought to investigate the innovation and business profile of Indian CV industry. It was observed that the industry has grown tremendously since the turn of the new millennium. Intensified innovation and R&D activities have, apparently, played a crucial role in strengthening the CV industry. These activities have resulted in new product components which provide unique value to customers. In addition, the companies have invested heavily on in-house R&D activities compared to expenditure on royalties and technical know-how.

R&D activities have led to various types of innovations. Many of the observed product innovations aimed at continuous improvement of product performance. These incremental innovation activities have assisted companies to increase their market share, revenue, profit and create new market

segments. The focus has been, apparently, less on radical innovations, which also does not need to be an objective unto itself.

Apart from this, companies were found to be actively utilizing open innovation as an important source to develop new solutions. Companies have even changed their business practices (implemented organizational innovation) to integrate open innovation activities. These have also helped companies to increase number of units exported. Asian and African markets have a major share of these exports as customer needs are probably similar. This confirms the lead market character of affordability-driven, frugal solutions being created in India.

With the help of intensified innovation activities, Indian CV industry has increased its footprint across the globe. Furthermore, these have also assisted companies to offer unique value and meet specific customer needs. The industry is shifting towards improving fuel efficiency, providing alternate fuel options and reducing cost of manufacturing. This approach encourages total cost of ownership strategy to increase sales and revenue of companies.

A note of precaution must be added before concluding the study. The findings must be treated as preliminary, as they are only based on observance of publically available (secondary) data. In a next step, we intend to gather first-hand primary data through expert interviews with various stakeholders to further ascertain the validity of these results. Nevertheless, there is reason to believe that the findings point in the right direction and that India's commercial vehicle industry, just as its cousin – the passenger car industry, is driven by frugal solutions and possesses a strong lead market potential in regional markets and beyond.

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