Outward FDI as a Strategy for Technology Catch-Up: A Case Study of Two Indian Automotive Firms

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ISID
Institute for Studies in Industrial Development
4, Institutional Area, Vasant Kunj Phase II, New Delhi - 110 070
Phone: +91 11 2676 4600 / 2689 1111; *Fax:* +91 11 2612 2448
E-mail: info@isid.org.in; *Website:* http://isid.org.in

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Reji K. Jospeh[*]

[***Abstract**: Liberalisation of outward FDI (OFDI) in India in the beginning of this millennium had resulted in a spurt in OFDI flows from India. Automotive was one of the leading sectors of origin of OFDI. Interestingly, it was also found that nearly half of the total innovation-oriented greenfield OFDI, originating from the manufacturing sector of India, had come from this sector alone. This paper, which looks into the factors leading to OFDI from Indian automotive sector and the impact of such investments through a case study of two Indian automotive firms, finds that acquisition of technology was a major driver of OFDI. Fast-changing preferences of Indian consumers necessitated going outward for the acquisition of technology and know-how. This has resulted in the establishment of an R&D network located in different parts of the world to continuously work on improving the products and identifying new possibilities. This has also resulted in the increased R&D spending and introduction of vehicles that meet the toughest global safety and environmental standards.]*

I. Introduction

The liberalisation of outward FDI (OFDI) in India in 2004 led to a sudden growth in the OFDI from India. The OFDI stock of India increased from $9.7 billion in 2005 to $27 billion in 2006; an increase of 178%. The key objectives of OFDI policy of India have been the promotion of exports and the establishment of home-grown MNCs (Joseph 2019). However, a closer examination of Indian OFDI shows that technology catch-up is also a key consideration of investors, especially those in the manufacturing sector. Automotive is a leading sector of origin of OFDI from India. Data on innovation-oriented greenfield-OFDI (G-OFDI) shows that automotive is the topmost sector within the manufacturing sector, accounting for nearly half (42 per cent) of the total innovation-oriented G-OFDI from India by the manufacturing sector during the period between January 2003 and December 2018[1]. A review of foreign takeovers by leading Indian automotive firms also

[*] Dr. Reji K. Joseph. Associate Professor at the Institute. Paper prepared under the ISID's ICSSR Research Program on 'Industrial, Trade and Investment Policies: Pathways to India's Industrialisation'.

[1] This refers to the FDI Markets data of Financial Times. Investments on 'design, development &

shows that acquisition of technology is a major objective. This paper makes a case study of two leading Indian automotive firms – Mahindra and Mahindra Ltd. (MM) and Tata Motors Ltd. (TM) to identify the factors that led these firms to engage in cross-border investments for the acquisition of technology and the impact of such investments.

II. An Overview of Indian Automotive Industry

General Motors (GM) was the first automotive company to establish in India in 1928. The British rule in India at that time did not permit the operation of indigenous manufacturers. However, the World War – II threw open an opportunity for indigenous players and two firms were established during the war period - Hindustan Motors Ltd. (HM) in 1942 and Premier Automotive Ltd. (PA) in 1944, both producing cars.

After independence (in 1947), the industrial licencing policy in India allowed only four more automotive manufacturers to establish – Standard Motor Products of India Ltd. (SMP), Ashok Leyland Ltd. (AL), MM and Tata Engineering and Locomotive Company (TELCO). While SMP focused on cars other companies focused on heavy vehicles and farm equipment. Restrictions imposed on the mere assembly of imported completely-knocked-down (CKD) vehicles led to the withdrawal of foreign companies operating in India.

Restrictions on the entry of new players harmed competition, making the incumbent players very complacent in upgrading the technology. Cars sold in India until the 1980s relied on the vintage technology of 1950s with minor modifications (Sagar and Chandra 2004). The fate of Indian automotive industry began to change with the establishment of Maruti Suzuki (MZ), formerly known as Maruti Udyog Ltd., a Joint Venture (JV) of Government of India and Suzuki Motors Ltd., Japan, in 1981 and launch of the small car 'Maruti 800' in 1983, which captured the imagination of people of India. Within a decade, MZ acquired a market share of 62% in the passenger vehicles category (Miglani 2019). This woke up erstwhile firms from slumber and they began to upgrade their technologies through foreign collaboration. HM entered into a collaboration with Isuzu of Japan and Vauxhall of the United Kingdom (UK) and PA with Nissan of Japan (Sagar and Chandra 2004).

Major reforms were introduced in the automotive sector in the 1990s. The new Industrial Policy of 1991 abolished the industrial license system and permitted automatic approval of FDI up to 51% in the automotive industry, except in motor cars. The new automobile Policy of 1993 extended these reform measures to motors cars also. The National Auto Policy of 2002 permitted 100% FDI in automatic route in the automotive sector. Change in the FDI policy led to the entry of a number of foreign companies into India. From the mid-1990s onwards, at least 12 foreign automotive companies were established in India either independently or in collaboration with Indian companies.

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testing' and 'research & development' are considered as innovation-oriented investments.

Apart from the reforms in the industrial licensing and FDI, new environmental regulations and changing consumer preferences significantly impacted the business environment in the automotive sector in the new millennium. India introduced emission norms corresponding to that of European Emission Standards under the badge Bharat Stage (BS) in 2000. Implementation of BS-II in major cities in the next year, called for improving fuel injection, introducing multi-valve engines, catalytic converters and fixed exhaust gas recirculation (EGR). BS-III required upgradation to variable EGR. BS-VI, which was implemented from April 2020, bypassing BS-V, required major improvements calling for significant investments in design and product R&D. The NOx emissions had to be brought down by 25% for petrol vehicles and 68% diesel vehicles. The PM emissions, a major component of outdoor pollution, had to be brought down by 80% for diesel vehicles (Salhotra 2016). Fixation of Diesel Particulate Filter (DPF) under the bonnet of small cars required major design and engineering works so as to not increase the length of the bonnet to keep the length of the vehicle to less than 4 meters[2].

The contemporary features in the global auto industry have become mainstream in India now. Awareness of consumers gained through TV shows, magazines specialising in automotive reviews, automotive expos, etc. have raised expectations of consumers in terms of fuel efficiency, safety, aesthetics and entertainment. In the mid-1990s, the cars introduced in India, even by the MNCs, were outdated (Sagar and Chandra 2004). Now, consumer preference is also shifting from low cost to higher-priced models, but those providing value for money. According to Philip Spender, former Managing Director of Ford India, "Indian consumers are very demanding. They aspire to have the best, but they won't spend excessive amounts of money (Hilsenrath 2000). Being unable to find a foothold in the Indian market, some of the foreign companies – Ford and GM, have wound up their operations in India in the recent past.

The gross turnover of the Indian automotive industry was $67.7 billion in 2016-17, according to the Society of Indian Automobile Manufacturers (SIAM)[3]. In the domestic market, two-wheelers is the leading segment, in terms of the number of vehicles sold during the last three financial years ending in 2019-20, with a market share of 81 per cent followed by commercial vehicles (CVs) with 13 per cent (Table 1). The domestic market accounts for lion's share of sales for most vehicle categories except quadricycles in the case of which more than four-fifths of the vehicles produced is exported.

The share of exports in the sales turnover (in terms of value of exports and sales) has been increasing in the Indian automotive industry (Figure 1). Fourteen per cent of sales turnover came from exports in 2018-19. Although the R&D intensity has slightly increased during the last two decades, it remains less than 2 per cent. However, the R&D intensity

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[2] A lower excise duty is applicable on vehicles with length less than 4 meters.

[3] 'Gross Turnover of the Automobile Manufacturers in India' (In USD Million), http://www.siamindia.com/statistics.aspx?mpgid=8&pgidtrail=10 (accessed on 1 September 2020).

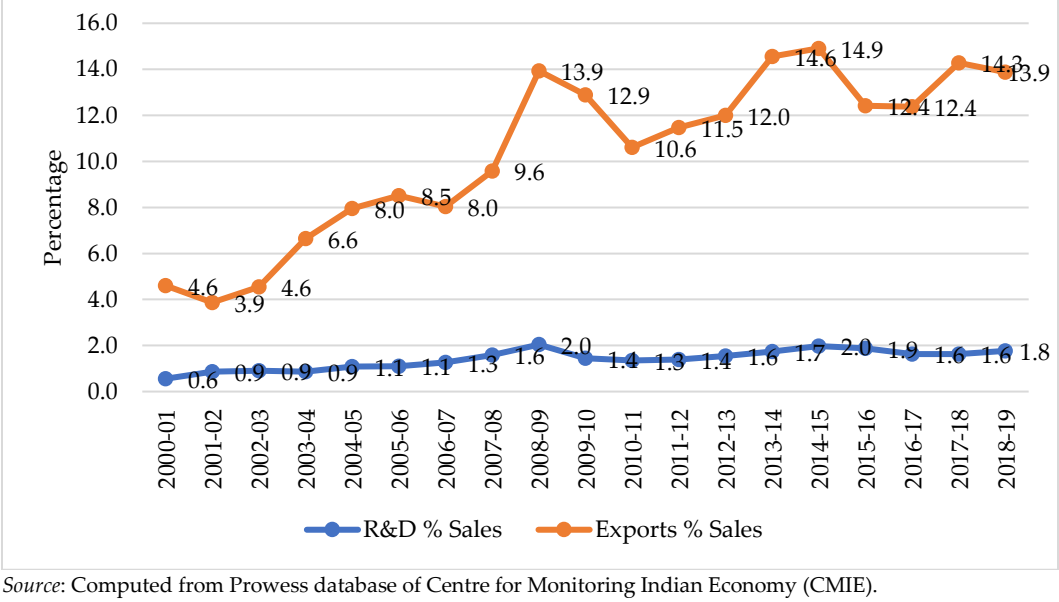
of leading three firms combined – MZ, TM and MM was 3.2 per cent in 2018-19, which is comparable with some of the leading global automotive firms; the R&D intensity of Toyota Motors was 3.5 per cent in 2018-19 (European Commission 2019).

Table 1: Performance of Indian Automotive Industry during 2017-18 to 2019-20 (number of vehicles)

Vehicle Category	*Production*	*Domestic Sales*	*Exports*	*Domestic Sales % Production*	*Exports % Production*
Passenger Vehicles	11482751	9439545	2101869	82.2	18.3
Commercial Vehicles	2759875	2581915	257511	93.6	9.3
Three Wheelers	3424872	1973272	1450854	57.6	42.4
Two Wheelers	68690909	58797580	9616220	85.6	14.0
Quadricycles	13196	1569	11190	11.9	84.8
Grand Total	86371603	72793881	13437644	84.3	15.6

Source: Compiled and computed from the statistics provided by SIAM at http://www.siamindia.com

Figure 1: Export and R&D Intensities of Indian Automotive Industry as Percentage of Sales



Source: Computed from Prowess database of Centre for Monitoring Indian Economy (CMIE).

III. Case Studies

III.1 Mahindra and Mahindra

The MM, founded in 1945 as a steel trading company, entered the automotive business in 1947 by partnering with Willys to assemble and market its Jeep in India. In the course of

time, the company has diversified it's business into other areas including tractors, armoured vehicles, aeroplanes, seed, agricultural implements and IT services. However, automotive business (motor vehicles, trailers and other transport vehicles) constitutes 90% of the company's total turnover (Mahindra and Mahindra 2018a).

MM's automotive business has been focused on rural areas. It's passenger utility vehicles (PUVs) - International, Commander, Armada and Bolero, transformed travel and transport of goods in rural areas. Although the company has introduced a number of vehicles more suitable for the urban market, the rural market still accounts for a significant share in it's product portfolio with Bolero retaining the position of the highest selling vehicle of the company[4]. Launch of the sports utility vehicle (SUV) - Scorpio in 2002 marks the beginning of a new era in the history of MM, characterised by an emphasis on R&D and acquisition of technology.

Growth of MM's Automotive R&D

The MM entered a new era of the automotive business, supported by more intensive R&D, in 1993 with the joining of Mr. Pawan Goenka, who was managing GM's engine design and development at Detroit as General Manager of R&D. The R&D facility of MM was very small in 1993. It's R&D facility located at Nasik, Maharashtra, had about 50 personnel whose main activity was the conversion of left-handed vehicles into right-handed ones and translate points coming from drawings of old Willys jeep or drawings coming from elsewhere[5]. Revamping of MM's R&D started with the establishment of divisions for computer-aided design and engineering at the Nasik facility.

The first vehicle that came out from the new R&D facility was a Pick-Up van in 1997, followed by Bolero in 2000, which replaced Armada. MM had obtained the license from Willys in 1947 to assemble and market its Jeep models,[6] which had petrol engines. Later, MM developed clone models in which diesel engine from its tractor division was fitted into Jeep's chassis. The CJ500D was the first such clone model, which had a 2.3 litre International Harvester B275 diesel engine from its tractor range. MM vehicles – Armada, Commander, MM540, Thar, and Bolero are all based on the chassis of Jeep. Bolero was the first vehicle that was developed in-house, with an investment of INR 300 million (Madhavan 2014); the body of this vehicle does not resemble that of other Jeep models.

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4 Dr. Pawan Goenka & Mahindra - A Story of 25 Years, https://www.youtube.com/watch?v=DRzmNqxu7NQ (accessed on 26 August 2020).

5 Information gathered from (i) Inside India's Best Known Companies - Mahindra and Mahindra - Part 1, https://www.youtube.com/watch?v=pfcC6K5P9d8 (accessed on 12 December 2019), and (ii) supra note 4.

6 The CJ3B, CJ3A, and Willys MB was initially assembled in India. They were marketed under Willys brand, https://www.cartoq.com/10-cool-accessories-to-pick-for-your-new-car/ (accessed on 10 March 2020).

The first breakthrough in the automotive business of MM came in 2002 with the launch of Scorpio. It was built on MM's own chassis. In the second half of the 1990s, when foreign companies like Hyundai, Ford, Honda, Opel and Daewoo had entered the Indian market, it was do or die situation for MM, which led to the development of Scorpio.

Development of Scorpio involved considerable reliance on foreign consultants and technology. An integrated design and manufacturing centre was established by the company at its plant in Kandivali, Mumbai, for the development of Scorpio. Although the initial styling was done at the centre, it did not have the capability to produce the clay model or designing the body. This was overcome by availing the services of foreign consultants. To overcome the limitation of lack of expertise in paint or body shop, it collaborated with a Korean company which had some expertise in body shops, but never developed one fully[7]. It also made use of the paint shop that was established as part of Ford-Mahindra JV in 1994. With an effort of five years with a cost of Rs. 550 crore, Scorpio was launched in 2002. Revenue and profits of the company increased sharply after the introduction of Scorpio; the revenue of the automotive division of MM increased from INR 18270 million in 2001-02 to INR 25110 million in 2002-03 and profit before tax increased by 43 per cent to reach INR 1470 million in 2002-03 (Thakkar 2012).

The lessons learnt from the development of Scorpio led to the formation of the next phase of the R&D strategy of the company. Two main lessons learnt were: (i) the firm has the capability to produce new vehicles, and (ii) it needs to build necessary capabilities in house, rather than relying on foreign consultants. Next phase of R&D development of MM began in 2005, with the initiatives to establish Mahindra Research Valley (MRV), an integrated R&D centre covering automotive, farm products, power train engineering and advanced technologies, near Chennai, which came into operation in 2012. It is 500000 square feet building, housing 32 laboratories which physically make parts and perform mock-up testing, and design offices that validate and test designs. It has 2600 engineers working on various projects and has applied for 319 patents (Mahindra and Mahindra 2019)[8]. MM's R&D facilities in Nashik and Kandivali were shifted to MRV. MRV has become the core centre of MM's automotive R&D.

Three major products (two passenger vehicles and one tractor) have come out of the second phase of the R&D strategy – XUV 500, New Scorpio, and Arjun Novo (Tractor). The New Scorpio, launched in 2014, using the traditional method of the body on a platform chassis. MM introduced a monocoque body, which is an integrated body structure having less weight and providing better control and mileage, in XUV 500. Launched in 2011, XUV 500 was developed at a cost of INR 6500 million, taking four years (Indian Express 2011). However, comparison with vehicles of global automotive companies shows that MM's

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7 MM's decision to engage with a less established firm was mainly on consideration of economic costs.

8 The Road to Innovation, Mahindra and Mahindra, https://www.mahindra.com/innovation/autojourney/the-road-to-innovation (accessed on 27 October 2019).

vehicles have more defects. For example, in the JD Power's Initial Quality Survey 2013, Scorpio reported 117 issues in the SUV category while Toyota's Fortuner reported only 53 problems. This survey captures the problems per 100 vehicles reported in 90 days after selling the vehicle (Madhavan 2014). This led to the realisation that India lacks a strong base in automotive technology, resulting in overhauling of the R&D strategy. The new strategy - phase three of R&D, is focused on the acquisition of automotive design and engineering expertise available in foreign countries.

OFDI for the Acquisition of Technology

Acquisition of foreign firms constituted an important aspect of the new strategy. In some cases, the firm has engaged in greenfield investment to set up R&D facilities in foreign countries. It has established a technology centre - Mahindra Automotive North America (MANA) in Detroit, the hub of the global auto industry, in 2013. The MANA is expected to enhance the design engineering capability of MM. This centre has done the design, engineering, testing and validation of Marazzo, a multi-purpose vehicle (MPV) of MM launched in 2018 (Mahindra and Mahindra 2018b). Marazzo combines American engineering and Indian product planning; the product planning was done at MRV[9]. The MANA also launched Roxor in 2018, an off-road vehicle in the powersports segment in the United States (US), based on it's Thar model in India. It was conceived, designed and engineered by MANA (Mahindra and Mahindra 2018c). However, the commercial launch of this vehicle has been stalled due to an intellectual property (IP) dispute with Fiat Chrysler Automotive (Livemint 2020).

Tech Mahindra, the IT division of MM, established Makers Lab in Texas in collaboration with the University of Texas. Makers Labs are technology incubation centres especially in artificial intelligence (AI), blockchain, cybersecurity and AI-infused internet of things (IoT) solutions (Businesswire 2018). Automotive engineering is an important part of the business of Tech Mahindra. Tech Mahindra also has Makers Lab in Germany. New technologies have disrupted the conventional automotive engineering activities and it is estimated that 40% of the architecture of a car now consists of electronic software. And 90 per cent of the R&D spent is on electronic systems[10]. Therefore, Tech Mahindra's entry into MM's automotive R&D is highly significant.

MM has been able to use the strengths of its foreign R&D centres to launch new vehicles in India. Acquisition of South Korean Ssangyong in 2011 was the first major acquisition by the firm. Ssangyong is primarily an SUV automotive company. MMs product line is also in this segment. MM's XUV 300, launched in India in February 2019, is based on X100 platform of Ssangyong, which is used in its Tivoli model. MM has fully

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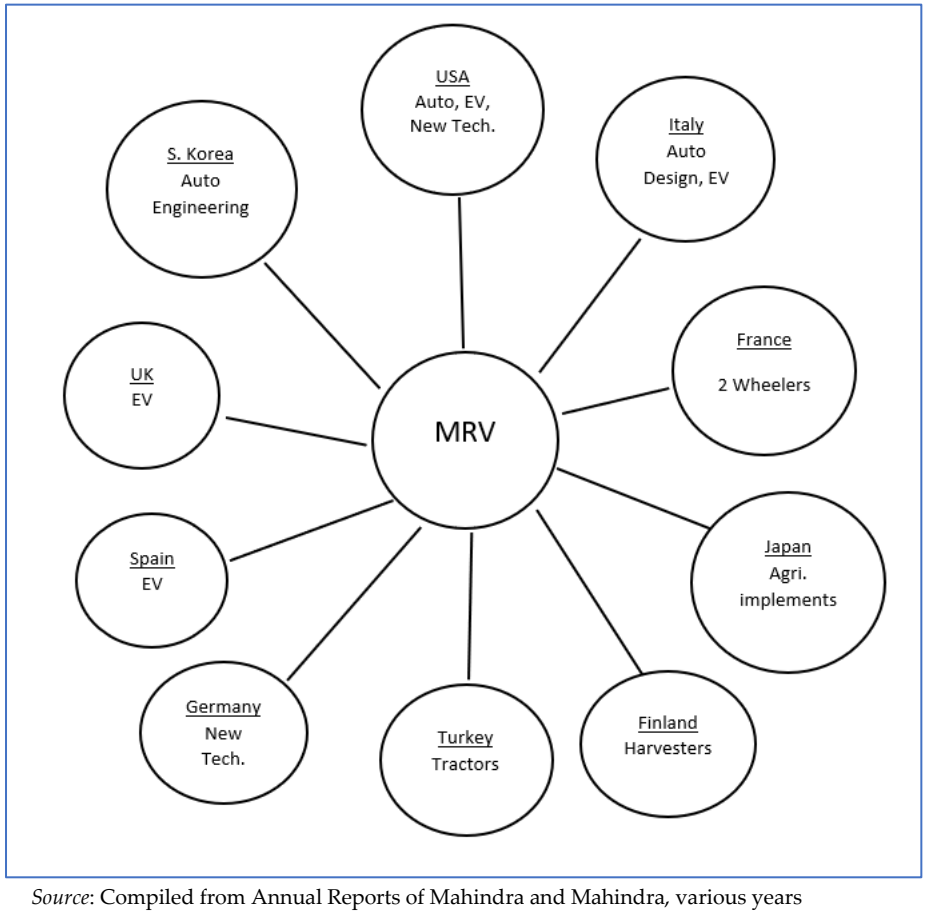
9 In Conversation with Dr. Pawan Goenka, MD, MM, https://www.youtube.com/watch?v=YF-fGzc9jis, 15 March 2018 (accessed on 29 October 2019).

10 Increasing Complexity of Software in Automotive Industry - Tata Elxsi - MATLAB – Simulink, https://www.youtube.com/watch?v=xdQDPVYA9zs (accessed on 6 September 2020).

leveraged its global network at its disposal for the development of this model. The design and some engineering were done by Pininfarina, it's Italian subsidiary. Some design engineering and platform was done by Ssangyong. MANA did the engineering. MRV acted as the nerve centre for engineering and product development. According to Pawan Goenka, XUV300 brings together best of four worlds, "some Italianness, some Koreanness, Some Americanness and a lot of Indianness"[11]. XUV300 was tested for its aerodynamics at Pininfarina's wind tunnel test facility in Turn, Italy. In January 2020, this vehicle achieved five-star rating of Global NCAP, an international safety accreditation body. XUV 300 is exported to a few countries like South Africa (Parikh 2019) and is likely to be exported to other countries including those in Europe. Development of XUV300 reveals the hub and spokes model in the R&D strategy of MM, wherein MRV acts as the hub and its R&D labs in various parts of the globe act as spokes. Following figure (Figure 2) provides a diagrammatic representation of the automotive R&D network of MM.

Figure 2: The Hub and Spokes R&D Model of Mahindra and Mahindra



Source: Compiled from Annual Reports of Mahindra and Mahindra, various years

[11] Supra note 4.

MM has established a network of R&D centres in foreign countries focusing on various aspects of automotive technologies such as electric vehicles (EVs), automotive engineering, new technologies, technologies for two-wheelers and farm equipment. MM is reported to be launching an all-electric version of XUV300 soon (Singh 2018). It had acquired Reva Electric Car Co., the manufacturer of India's first electric car - Reva, in 2010. After the acquisition MM launched e20, which is a modified version of Reva with four doors. However, the low volume has been a concern for the company[12]. MM is reported to have stopped the production of e20, possibly in preparation for electric XUV300 (Outlook 2019). MM's R&D facility in foreign countries will help in developing technologies for EVs. It's Italian subsidiary Pininfarina had launched in March 2019 the Battista, a luxury electric car which touched a speed that is more than that of Formula 1 race car (Business Today 2019). Apart from Italy, MM has R&D facility for electric vehicles in Spain, UK and USA. The recently formed Mahindra-Ford JV in India (in 2019) will also have a focus on the development of EVs.

However, the establishment of this network has not helped MM in enhancing market profile in all segments of the industry, as it is seen in its commuter two-wheeler business. Anand Mahindra, Chairman of MM, had admitted that entry into the commuter two-wheeler business was a mistake (Business Standard 2019). The company entered into this business through the acquisition of Kinetic Motors in 2008.

In the case of vehicles for farming purposes, the establishment of foreign R&D centres has also had the objective of assisting its internationalisation efforts. For example, the establishment of Mitsubishi Mahindra Agricultural Machinery Co. Ltd., a JV in collaboration with Mitsubishi Agricultural Machinery Co. Ltd., in Japan in 2015, had the objective of enhancing its product development capability with an eye on North American market. In the segment of vehicles for farm applications, MM has a global presence. It is the global leader in the tractor business.

MM seems to be adopting two different strategies for (i) PVs and CVs and (ii) vehicles for farming purposes. In the former category, India is being the hub of R&D and export activities. Design, engineering and R&D inputs from its foreign subsidiaries are integrated at MRV and production takes place in India. Some of these products are exported from India. This is probably because the export destinations are developing countries where the conditions are quite similar to that of India. Whereas in the latter category, the approach of MM is diversified and has a global approach.

Impact on R&D and Exports

During the last two decades, the R&D intensity (R&D as percentage of sales) of MM has increased, from 1.8 per cent in 2001-02 to 6.7 per cent in 2018-19 (Figure 3). There has been a consistent increase in the R&D expenditure after the operationalisation of MRV in 2012.

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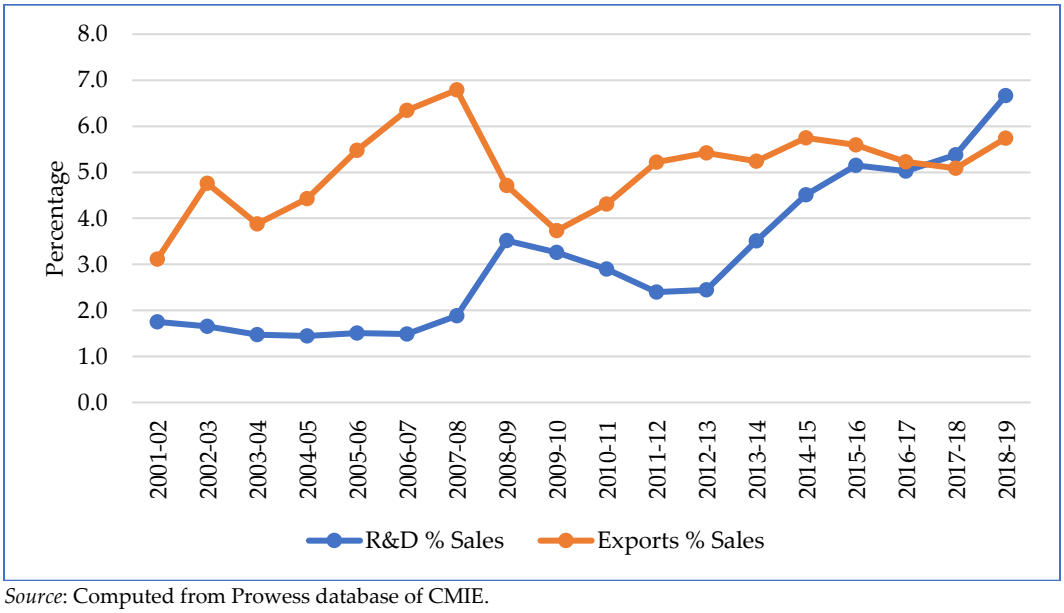
[12] Supra note 9.

Currently, the R&D intensity of MM is comparable to that of global leaders in automotive R&D. Volkswagen, which was the largest R&D investor globally in the automotive industry in 2018-19, had an R&D intensity of 5.8 per cent (European Commission 2019). Whereas the export intensity of MM has stagnated in the range of 5-6 per cent since 2011-12.

The reorganisation of the R&D system of MM, however, has not resulted in enhancing the market position of the firm in terms of domestic sales and exports. In the case of PUVs, in which MM is strongly placed, its share in domestic sales has declined from 56 per cent in 2011-12 to 29 per cent in 2016-17[13]. This could be due to the lag in the fruition of R&D investment and the advances made by competitors. The market share of Maruti Suzuki in the domestic sales of PUVs has increased from less than 2 per cent to 26 per cent during the same period[14]. The successful Ertiga model of Maruti Suzuki, first PUV of the company, was launched in 2012.

Figure 3: R&D and Export Intensities of MM as Percentage of Sales



Source: Computed from Prowess database of CMIE.

In exports as well, an immediate impact of a reinvigorated R&D system is not visible. In the PUVs category, the share of MM in total vehicles exported from India, has declined from 81 per cent in 2011-12 to 7 per cent in 2016-17.[15] The global financial crisis since 2008 has adversely affected exports from India. Changes in the technical regulations of some of the African countries like Algeria and higher taxes imposed on imported vehicles in countries like Sri Lanka are also adversely impacting exports of Indian

13 Compiled from the Annual Reports of SIAM, various years.

14 Ibid.

15 ibid.

automotive firms, including MM (Business Line 2018). Developing country markets, especially those in Africa, still remain the key export destination of MM.

Attempts of MM to enter the US markets in the category of pick-up and off-road vehicles have not been successful so far. After successful of entry into the US in tractor business, MM made an attempt to sell utility vehicles and trucks in the country, offering lower prices and better fuel efficiency. It had entered into a distribution arrangement with US-based Global Vehicles. As the engine of Scorpio based pick-up, the first product that was planned, could not meet the norms of US Environmental Protection Agency, the entire plan was dropped in 2011 (Mishra 2012). As already mentioned in the paper, Roxor could not be commercially launched in the US due to a dispute on IP.

III.2 Tata Motors

The Tata Group was established in Mumbai in 1868 by Jamsetji Tata and it is owned now by Tata Sons. Tata Locomotive and Engineering Company (TLEC), the predecessor of TM, was established in 1945. When the company was established, the plan was that it would establish initially in the business of locomotives and boilers and then enter into engineering equipment such as road rollers, tractors, earthmovers, diesel engines, etc. Later, the company shifted its focus to automotive as it realised that government being the sole customer, exclusive focus on locomotives and boilers would make the company very vulnerable (Lala 1992). When the focus of the company was shifted to trucks and general engineering, its name was changed to Tata Engineering and Locomotive Co. (TELCO) in 1960.

TM's entry into the automotive sector was facilitated by technology collaboration with Daimler-Benz in 1954, for a period of 15 years, for the manufacture of trucks and buses. It was envisaged that initially chassis would be manufactured at TATA's Jamshedpur plant and by the end of collaboration, engines would be manufactured[16]. The first truck of Tata-Daimler Benz was launched in 1954. In 1969, when the collaboration ended, TM launched trucks in the Tata brand name. The extent of indigenisation was such that the trucks launched by Tata, did not resemble that of Daimler-Benz trucks. Today, TM is the most important player in the CVs segment. In 2016-17, TM accounted for more than half (55 per cent) of the CVs exported from India. And in the sale of goods carrying medium and heavy CV (CMHVs) in India, it had a market share of 51 per cent in the same year[17].

Entry into Passenger Vehicles Business

The entry of TM into light commercial vehicles (LCVs) paved the way for its entry into PVs segment. The liberalisation of licenses by the Government of India in 1981 enabled Tata to launch new models (Salwan 2011). A highly successful, indigenously designed LCV – Tata

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16 Information gathered from Tyabji (2005) and Commissioner of Income Tax Vs. Tata Locomotive and Engineering Co., 15 February 1967, https://indiankanoon.org/doc/1652663/ (accessed on 29 June 2020).

17 Supra note 13.

407, was launched in 1986. This was followed by the launch of a pick-up van (TataMobile) in 1988, on Tata 207 platform. Development of TataMobile helped TM to gain some first-hand experience into the development of a PV. TM had already made an effort to get into the passenger car segment with the collaboration of Honda for the production of Accord in India. Honda had even transferred to certain drawings to TM. However, the Government of India did not grant permission due to considerations on foreign exchange and the plan was shelved. Preparation for the manufacture of Accord had helped the development of TataMobile (Subbu 2017).

Sierra, an SUV, was the first PV of TM launched in 1991 on TataMobile platform. Next year the estate model was launched on the same platform. Later, a few other PUVs were launched based on this platform - Sumo in 1994 and Safar in 1998. TM's entry into PVs was compelled by the cyclical shrinkage that TM was facing in the CV segment (Bruche 2010). As the restrictions on the import of technology were liberalised, TM could import technology for fuel injected petrol engine from AVL Austria in 1992, which the company used to provide petrol option for TataMobile platform based vehicles. Sumo was a highly successful model which acquired a market share of 31% during 1996-97 (Mahapatra and Biswal 2007).

However, the realisation that the PV market in India would be focused on small cars in the near future led to the launch of Tata Indica in 1998. According to Ratan Tata, the Chairman of Tata Sons during 1991-2012, Indica was designed to have the external dimensions of Maruti 800 and interior space of HM's Ambassador. It had a powerful engine and excellent fuel efficiency. Within seven days of the launch of the car, 115000 fully paid car bookings were received (Garage 2017). Development of this car involved about 700 engineers and a cost of $400 million, which is about one-fifth of the cost of development of a new car in advanced countries (Sagar and Chandra 2004). A series of vehicles were launched in the Indica platform – Indigo, Indigo XL and Marina. Major technology and know-how of the car such as exterior and interior design, powertrain and engine, production line, etc. were bought from foreign countries (Bowonder 2004, Salwan 2011). Despite the success of Indica and its many versions in India, it was not able to replicate the same in exports. Exports were less than 5% of the total sale of the model and were confined mostly to Malta and South Africa (Bruche 2010).

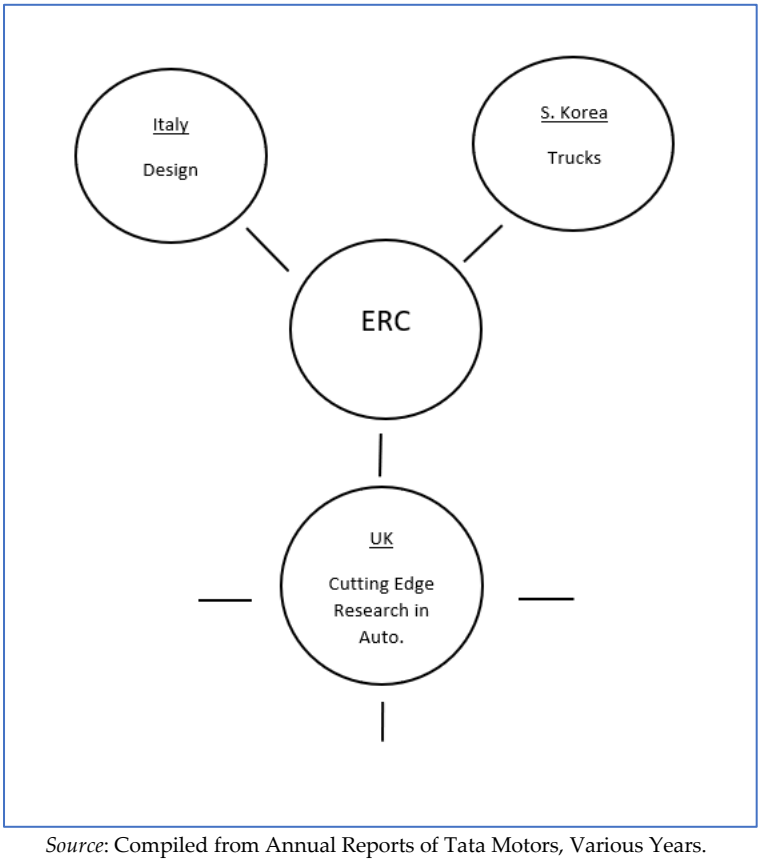
OFDI for the acquisition of technology and entering into the luxury segment

Being the world's fourth-largest producer of trucks and second-largest producer of buses, TM had over the years developed an aspiration to become a major global automotive player. It also had the compulsion to introduce contemporary features in CVs so that it would have first-mover advantage when foreign players introduce those features in the

Indian market[18]. It also wanted to upgrade technologies used for PUVs and enter into luxury segment of PVs so as to have a complete PV product range.

TM has entered into three major OFDI ventures for the purposes of establishing a network of R&D centres across the globe with the Engineering Research Centre (ERC), Pune, remaining the core of the network. Established in 1966, the ERC had played an important role in adapting external technologies and developing suitable indigenous technologies for TM (Bruche 2010).

Figure 4: The R&D Network of Tata Motors



Source: Compiled from Annual Reports of Tata Motors, Various Years.

Acquisition of Daewoo Commercial Vehicle Company (DCVC) of South Korea (in 2004), which had more than 90 models of trucks in the range of 210-400hp engine capability, helped TM to launch heavier trucks in India. The Novus trucks, launched in 2005, are heavy-duty trucks which are used in mines and construction sites. The advantage of this truck is that it has a non-computerised engine and therefore it can be easily serviced anywhere (Mani 2013). The Prima truck, launched in 2009, is a world-class premium truck.

[18] On The Line With Tata Motors CVBU Head, Ravi Pisharody, https://www.youtube.com/watch?v=fySDq95IaKM (accessed on 2 September 2020).

TM later added telematics technology to this model to cater to the requirements of the logistics sector. This technology not just assists in vehicle maintenance and tracking, but in tracking the inventory while it is in the movement[19]. Launch of Prima models before the entry of foreign firms in truck business seems to have benefitted the company; Volvo entered India in partnership with Eicher in 2010 and Daimler AG through its subsidiary Daimler India Commercial Vehicles Pvt. Ltd. in 2011.

Tata Motors European Technical Centre Plc. (TMETC) was established in 2005 as a UK based centre of excellence in automotive design and engineering. The TMETC would perform R&D primarily for TM and for selected other partners. It was expected to strengthen TM's skill sets and provide European standards of delivery to its PVs (Tata Motors 2018a).

Acquisition of Italian based design and engineering company – Trilix Srl in 2010 had the objective of uplifting the styling and design capabilities TM to match global standards. Trilix is a company specialised in offering design and engineering design in the automotive sector.

TMETC is one of the major R&D centres of TM. While it does R&D for TM, it also has formed a network of its own and is providing R&D services to other automotive firms. It has joined the National Automotive Innovation Campus (NAIC) project located in the campus of the University of Warwick, together with Jaguar and Land Rover (JLR). NAIC is being designed to perform cutting edge research in the automotive industry. TM contributed 30% of the total investment for the establishment of NAIC.

TMETC played an important role in the design and development of some of the new vehicle models of TM. The Nano car, launched in 2008, was a breakthrough product, but it could not make much impact in the market. Development of Nano was a disruptive innovation. All components of nano were designed from scratch. The entire engine was redesigned thrice, the floor plan was redesigned 10 times, wiper system 11 times. Locally sourced components constitute 97% of the vehicle (Bruche 2010). This innovation made an Indian group, the Tata group, to figure in the Boston Consultancy Group's list of Most Innovative Companies in the World in 2008 that too at the sixth position just after Apple, Google, Toyota, GM and Microsoft (BCG 2008). Tata Group continued to figure in the list, although not consecutively, till 2015. Thereafter, until the list in 2019, no Indian company has figured in the list. Although nano was not a commercially successful model, TM is in the process of launching a future city car based on Nano, the concept of which was displayed in Geneva Motor Show in 2010-11.

TMETC is leading the efforts of TM in introducing connected and autonomous vehicle technologies in its vehicles. It has successfully completed the trials of these technologies in the new-generation SUV, Tata Hexa. TM along with its subsidiary, TMETC,

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19 *Ibid*.

has developed a fully autonomous car as part of the UK Auto drive project (Tata Motors 2019).

The network of R&D centres and design studios of TM has many firsts to its credit. The ERC has an end to end powertrain development facility which was recently upgraded with India's first multi-storey soak room facility for the development of BS-VI compliant powertrains; first anechoic chamber in Asia, first facility in India for vehicle crash test. All the R&D centres of TM combined, employs more than 5000 engineers, designers, scientists and technicians[20]. All these centres together focus on the three- horizon innovation strategy of TM. The first horizon involves the product lines that the company is already working on. The second one involves the known technologies which the company is not familiar with but are needed for future products. And, the third horizon is the 'blue sky' research. Future technology of TM would focus on four areas - smart autonomous & connected vehicle, clean vehicle, capable vehicle and desirable vehicle (Tata Motors 2018a).

The SUV – Harrier, launched in 2019 is using Optimal Modular Efficient Global Advanced (OMEGA) platform, derived from JLR's D8 platform and developed in collaboration with JLR (Tata Motors 2018b). JLR's platform has been adapted to suit Indian conditions by TM engineers. The executive committee team in charge of the development of Harrier used to meet periodically in one of the three design studios of TM located in Pune (India), Turin (Italy) and Coventry (UK) discussing only design. The advantage of OMEGA architecture is that it can be used for hybrids, electric and even for developing a seven-seater vehicle (Chaudhary 2019).

PVs of TM has been based on body-on-frame platforms, until the launch of Harrier in 2019. The X1 platform is used for PVs - Indica, Indigo. Bolt, Zest, Tigor and Nexon. This approach helped TATA in optimising cost, but it restricted design innovations to meet better weight to power ratios. Tata Motors got into a design freeze during the period between 2000 and 2010, which led in a fall in its market share (Rao 2019). Nevertheless, the Nexon (launched in 2018) has demonstrated the design capability that TM has acquired. It has won multiple awards - "Best Design and Styling Award 2018" and "Best Value for Money Car of the Year 2018" of Autocar and "Subcompact SUV of the year 2018" and "Design of the year 2018" of NDTV Car & bike (Tata Motors 2018a). Nexon was the first Indian origin car to win five star in the rating of Global NCAP.

TM has the benefit of taking advantage of TATA group companies specialising in areas relevant for automotive. Tata Elxsi, a group company focused on global design and technology services, has partnered with TM to develop connected car vehicle platform. Both the firms together have the connected vehicle platform that is used in recently launched Nexon EV (Jisha 2020).[21]

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[20] Innovations at Tata Motors: Innovation drives the next generation of experience and performance https://www.tatamotors.com/innovation/ (accessed on 2 September 2020).

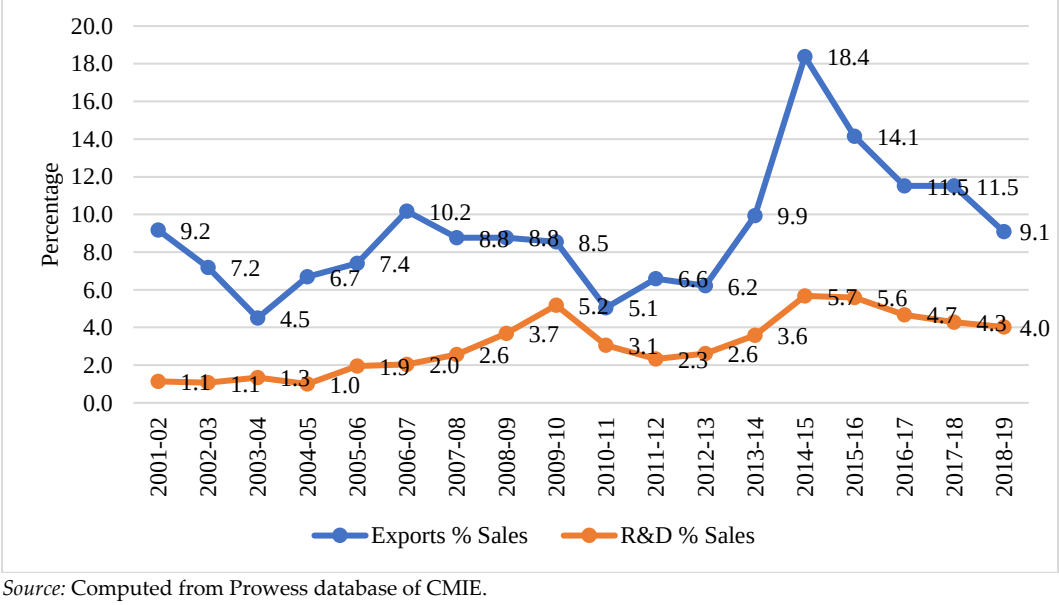
[21] TATA ELXSI IoT software powers tata motors connected vehicle platform,

Apart from its own R&D system spreading across India, the UK and Italy, the TM also has tie-ups with various Universities based in India and abroad. In India, as part of its efforts in this area, the Company has signed a Memorandum of Understanding with IIT Bombay (IITB) and College of Engineering Pune (COEP) to undertake collaborative research on live projects and to create a technological partnership (AR Standalone 2015-16).

Impact on R&D and Exports

The R&D intensity of TM has increased over a period of two decades from 1 per cent to 4 per cent (Figure 5). The R&D spending of TM is more than double that of MM. In 2018-19, TM had spent $937 million on R&D while MM spent $441 million[22]. Export intensity, which had peaked in 2014-15, began to face a decline thereafter.

Figure 5: R&D and Export Intensities of TM as percentage of Sales



Source: Computed from Prowess database of CMIE.

In the case of PVs, the share of TM has declined both in the domestic and international market. The share of passenger cars declined in the domestic market from 13 to 6 per cent between 2011-12 and 2016-17 and in the export market from 1.5 per cent to less than 0.5 per cent during the same period. In the case of PUVs, TM's share declined from 13 per cent to 2 per cent in the domestic market and from 14 per cent to less than 1 per cent in the export market during the same period. However, in the case of medium and heavy CVs (MHCVs), TM's share in exports has been increasing although the share in the domestic market declined. In exports, the share of passenger carrying MHCVs increased

https://www.motownindia.com/Bureau/Technology/326/Tata-Elxsi-IoT-software-powers-Tata-Motors-Connected-Vehicle-Platform-Jisha-P (accessed on 2 September 2020).

[22] Data provided by Prowess, CMIE.

from 37 per cent to 48 per cent and goods carrying segment increased from 57 per cent to 65 per cent during the period between 2011-12 and 2016-17.

IV. Concluding Remarks

The two Indian automotive firm's entry into foreign countries for the acquisition of technology and know-how was necessitated primarily by the changing preferences and expectations of the Indian consumers. Being global players, the foreign automotive firms operating in India were in a position to fulfil the aspirations of the consumers faster as compared to Indian firms. MNCs operating in India such as MZ[23], Hyundai, Honda, etc. are in a position to take advantage of the R&D of their parent firms whereas the two Indian firms have to acquire it their own. The OFDI strategy of the two firms had the focus of upgrading their technology capabilities to match that of MNCs and keep pace with fast-evolving new technologies in the automotive sector. An immediate outcome of this strategy is visible in the increased R&D intensity of the two firms, which has become similar to that of global leaders in the automotive industry. Both the firms were able to launch new products, complying with global standards, in the recent past heavily relying on the technology acquired from foreign countries. These firms have to their credit the manufacturing of vehicles in India that meet the toughest global safety standards. The recent models (New Swift, Brezza and Ertiga) of MZ, the market leader in PVs, have not been able to secure the safety standards that the latest models of these two firms could secure. It is expected that the impact of the new strategy will also be visible in terms of the increased market share of these firms in the near future.

This case study brings out the significance of OFDI for technology catch-up which often hasn't gained the attention of policymakers in India and developing countries in general. The Draft National Auto Policy 2018 of India points out that the Indian automotive firms spend less than 1% of revenue on R&D as compared to 5-10% of their global counterparts and proposes various measures to incentivise R&D in the sector. One of the measures proposed is encouraging inward FDI while there is no acknowledgement of the significance of OFDI. Similarly, the Draft Industrial Policy 2019 of India acknowledges the low spending on R&D (only 0.7 per cent of GDP) as a major issue of the industry sector in India to be addressed. And it also calls for the encouragement of inward FDI as a means for attracting more investment in R&D while there is no recognition of the possible role the OFDI could play in this.

The G-FDI data of Financial Times shows that the share of innovation-oriented investment in India's G-OFDI has increased from 4 per cent during the last decade to 7 per

[23] Suzuki Motor Corporation (SMC) of Japan has acquired a majority stake (56.2 per cent) in the company and it has now become a subsidiary of SMC. For details please see https://www.marutisuzuki.com/corporate/investors/details-of-the-business (accessed on 4 September 2020).

cent in the current decade[24]. Whereas in inward G-FDI, the share of innovation-oriented investment has declined from 11 per cent to 8 per cent. Although, this database of Financial Times has been compiled based on the announcements made by investors on their intentions and therefore there is no assurance that they have been materialised, it brings out the changing perception on using cross-border investment as a means for enhancing technology capabilities. Inward FDI, which is generally viewed as an important channel for the transfer of technology, carries the risk of decisions of domestic enterprises being controlled by foreign firms that may not be desirable in many circumstances.

[24] (i) Last decade refers to January 2003 to December 2010 and current decade refers to January 2011 to December 2018; in the case of inward FDI, the data is up to October 2018. (ii) Investments in all sectors, not just manufacturing, is covered here.

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Institute for Studies in Industrial Development
4, Institutional Area, Vasant Kunj Phase II, New Delhi - 110 070
Phone: +91 11 2676 4600 / 2689 1111; Fax: +91 11 2612 2448
E-mail: info@isid.org.in; Website: http://isid.org.in