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FDI in R&D in India: An Introspection

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Abstract. Of late, India has emerged as an attractive destination of foreign direct investment (FDI). Along with it, multinationals have been investing significantly in research and development in India. In this context, this paper makes an attempt to analyze salient features of FDI in R&D and makes an assessment of the gains from R&D initiatives of MNCs in India. To be specific, the paper attempts to demystify the FDI flows in R&D with a view to understand whether these types of flows would help in raising the innovation potential of India. We find that there has been a rise FDI in R&D in India. However, the rise has not been commensurate only with rise in Core R&D activities. Rather, more than 50% of the inflows in R&D by MNCs have come for non-core R&D activities. This will not help in promoting innovation culture in India and make India a global manufacturing hub.

Keywords. FDI, R&D, Core R&D, Manufacture, Non-core R&D.
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1. Introduction

Of late, India and China have emerged as the fastest growing economies of the world. Both of these countries have also emerged as attractive destination of foreign direct investment (FDI). Simultaneously, multinationals (MNCs) have been investing significantly in research and development (R&D) activities in these countries. Till early 2000s, it was not perceived that developing countries could emerge as attractive locations for R&D activities of MNCs. However, plethora of evidence in recent years indicated on the contrary. For instance, a survey conducted by UNCTAD (2005) has indicated that India was the third most attractive destination for prospective R&D locations after China and USA (see Mrinalini et al, 2013). Subsequent studies seem to indicate that India continues to be an attractive destination for FDI in R&D in recent years (Mrinalini & Sandhya, 2008; Mrinalini, Nath & Sandhya, 2013; 2014; and Basant & Mani, 2012). The recent media report indicates that India is the No. 1 choice location for MNCs to establish product engineering and R&D centres outside their home countries and the growth of these centres is India is outpacing the average global growth. According to the study, India accounted for US $ 12.3 billion or 40% of the total of US $ 31 billion of globalized engineering and R&D in 2015. The revenues of these centre has grown by 8.3% in 2015 as against the growth of

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7.6% in the preceding year. The past two years have also witnessed a spate of new centres being set up and the older ones are being expanded.

Surely, the positive trend in respect of FDI in R&D is a good omen. No doubt, this would help in realizing potentials of Make in India slogan (see Government of India, 2015). In this context, this paper makes an attempt to analyze salient features of FDI in R&D and makes an assessment of the gains from R&D initiatives of MNCs in India. To be specific, the paper attempts to demystify the FDI flows in R&D with a view to understand whether this type of flows would help in raising the innovation potential of India.

The structure of the paper is as follows. Section 2 provides a profile of FDI flows in R&D in India along with the sectoral and regional distribution. Section 3 analyzes the components of R&D activities that are pursued by MNCs in India with a view to understand whether R&D diffusion from these activities would help in realizing the Make in India slogan. Finally section 4 provides concluding remarks.

2. Profile of FDI in R&D

Major policy changes coupled with rapid economic growth in the 1990s have made India an important destination of foreign direct investments (FDI). These investments have been made in all the major sectors with greater emphasis on some newly growing or modern ones. FDIs are not only meant for establishing or expanding production capacities and marketing infrastructure but also for making innovation and diffusion of new product and technology. The existence of talent pool enables low cost innovation which is important for global competitiveness. Further, in view of the vast Indian consumer market it is necessary to make the imported products/ technologies suitable for local conditions. Thus investment in research and development (R&D) activities has become quite attractive for the foreign investors in India. Such attractiveness however varies across sectors of activities and regions.

The data on FDI in India at project level are available at fDi markets. Of course, there are other sources of data. For example, RBI data on FDI available in its website is not presented with adequate sectoral disaggregation. Moreover, its estimates of FDI as well as R&D expenditure are highly under-estimated as compared to those of the fDi markets. UNCTAD data on FDI are compiled from the fDi markets. The FDI markets provide break-up of the capital investment data of FDI into two categories namely, actual investment and estimated investment for different projects. The actual or fixed Investment is the investment expenditures that the business sector has in reality undertaken during a given time period inclusive of both planned investment and any unplanned inventory changes. By contrast, estimated or committed investment measures the investment which would be roughly calculated or judged based on the value to future streams of investment. There is a possibility of under estimation of actual FDI data due to filtering of projects. Moreover, estimated investments may not be actually realized. The relevant data are shown in Tables 1. As this table indicates, inflows of FDI in R&D as share of total FDI inflows were on the higher side during the period 2003-2006. Thereafter, it declined in subsequent years barring year 2010 when it inched towards double digit mark. A consistent double digit share of FDI in R&D would have signified a good omen.

Table 1. *FDI inflows and inflows of FDI in R&D in India*

Year	FDI Inflows (US $ Million)	FDI in R&D (US $ Million)	Share of FDI in R&D in FDI Inflows (%)
2003	19685	2575	13.1
2004	34253	3394	9.9
2005	27234	3064	11.3
2006	133620	19750	14.8
2007	50767	3577	7.0
2008	74708	3937	5.3
2009	50302	4454	8.9
2010	46630	4368	9.4
2011	39382	2152	5.5
2014	23000*	n.a.	

Source: fDi Markets

Notes: *Rough estimate; n.a.: Not available; R&D includes Design, Development & Testing (DDT), Education and Training (E&T) and Core R&D

The sectoral distributions of FDI inflows and FDi in R&D for manufacturing and non-manufacturing sectors are shown in Table 2 and Table 3 respectively. The distinction is made since the current economic survey (2015-2016) argues that manufacturing sectors have to play to dominant role for the *Make in India* slogan to be successful (see Government of India, 2015). As Table 2 indicates, sectors attracting higher FDI inflows need not be one where higher FDI in R&D flows. For instance, the sector that has received maximum of FDI is Metal sharing nearly 20 percent of total FDI inflows during 2003-2011. However, a little of the investment is intended to R&D. By contrast, sectors like semiconductors, automotive OEM, aerospace, electronic components scores high in respect of share in total R&D in selective period (viz. 2003-06 or 2007-11), even though the shares of same in respect of total FDI flows are low. By and large, there are wide variations in respect of share in total R&D between the two periods barring sectors like biotechnology and pharmaceutical among the higher recipient of FDI in R&D.

The R&D intensity, the ratio of R&D spending out of FDI received by a sector, indicates the sector's attractiveness to foreign investors for the purpose of making innovations. Biotechnology is the most important sector with 88% intensity, followed by Medical device (71%), and Pharmaceuticals (51%). The sectors such as aerospace, minerals, electronic components, and semiconductors also display higher R&D intensity.

Overall, around 65% of FDI inflows have flown into manufacturing sector during 2003-2011. On the other hand, about 57% of FDI in R&D is drawn towards manufacturing sector. R&D intensity of FDI in manufacturing stands around 15%.

Table 2. *Distribution of FDI Inflows and R&D across Manufacturing Sectors*

Manufacturing Sector	Sectoral share of FDI Inflows (%)		Sectoral share of FDI in R&D in Total FDI in R&D (%)		FDI in R&D / FDI (%)	
	2003-06	2007-11	2003-06	2007-11	2003-06	2007-11
Aerospace	3.4	3.1	20.8	5	83	11.4
Automotive Components	1.8	3.1	1.9	4.6	14.5	10.7
Automotive OEM	7.7	8.5	2.2	12.5	3.8	10.4
Beverages	0.4	0.4	0	0	0	0.3
Biotechnology	0.7	0.3	4.7	3.9	89.8	85.4
Building & Construction etc	2	1.4	0	0	0	0
Business Machines & Equipment	0.5	0.2	0.6	0.1	17.4	6.1
Ceramics & Glass	0.2	1.6	0	0	0	0
Chemicals	0.9	1.9	0.3	2.5	3.8	9.2
Coal, Oil and Natural Gas	6	8.2	0.9	0	2	0
Consumer Electronics	0.4	0.9	0.4	1	12.5	8.4
Consumer Products	0.7	1	0.2	0.5	3.4	3.8
Electronic Components	1.7	2.9	1.8	11.8	14.5	29.2
Engines & Turbines	1.6	4.1	0.3	0.7	2.2	1.2
Food & Tobacco	1.2	1.3	0.3	0.7	3.7	3.8
Industrial Machinery Equipment	1.1	3	1.8	3.5	21.8	8.2
Medical Devices	0.1	0.6	0.2	6.5	46	73.3
Metals	15.7	23.9	0.4	0.2	0.4	0.1
Minerals	0.2	0.2	0.2	1	16	33.9
Non-Automotive Transport OEM	0.3	0.9	0.1	0	4.4	0
Paper, Printing & Packaging	0.1	0.4	0	0	0	0
Pharmaceuticals	1	0.9	5.5	4.1	71.3	31.9
Plastics	0.2	0.3	0.1	0.3	7.5	7
Rubber	0.1	1.4	0	0	0	0
Semiconductors	11.2	0.4	11.3	4.1	13.5	80.3
Wood Products	0.2	0	0	0	0	0
Textiles	0.8	0.6	0.2	0.4	3.2	4.6
Sub Total	60.2	71.5	54.2	63.4		

The data in Table 3 indicates that real estate, software and IT services, communication, transportation, warehouse and storage are the non-manufacturing sectors where most of the FDI have flown during this period. Unlike the manufacturing sectors, two of them (viz. software and IT services, communication) also score high in respect of share of FDI in R&D. During the later period, business services also registered higher share in respect of FDI in R&D. However if one looks at the R&D intensity of FDI, a marginally different trend emerges. The sectors with high R&D intensity are software and IT services, business services, communication, and space and defence. Overall, R&D intensity in FDI in non-manufacturing sectors has fallen in the later period. Note that, it is lower than that of manufacturing sector.

Table 3. *Share Of FDI Inflows/ R&D across Non-Manufacturing Sectors*

Non-manufacturing Sectors	Sectoral share of FDI Inflows (%)		Sectoral share of FDI in R&D in Total FDI in R&D (%)		FDI in R&D / FDI (%)	
	2003-06	2007-11	2003-06	2007-11	2003-06	2007-11
Alternative/Renewable energy	0.8	1.3	0	0.9	0	5.2
Business Services	1.4	1.2	1.5	4.8	13.8	27.9
Communications	4	5.2	6	10.7	20.4	14.1
Financial Services	1.4	2.6	0	0.1	0	0.3
Healthcare	0.2	0.5	0.1	0.3	5.6	4.6
Hotels & Tourism	2.5	1.7	0.1	0	0.7	0
Leisure & Entertainment	1.2	0.4	0.4	0.3	3.9	5.2
Space & Defence	0	0.1	0.2	0.4	66.6	28.4
Real Estate	11.1	5.4	0	0	0	0
Transportation	5.3	3.5	0	0.1	0	0.3
Warehousing & Storage	4.2	3.4	0	0	0	0.1
Software & IT services	7.7	3.2	37.5	19	65.6	42.3
Sub Total	39.8	28.5	45.8	36.6		
Average Share					14.7	10.7

Among the Indian states, the preferred destinations of FDI are Karnataka, Tamil Nadu, Orissa, Maharashtra, Andhra Pradesh, Gujarat, and Haryana (Table 4). Karnataka is becoming the single most important R&D hub in the country whose share in total foreign R&D investment increased from 26% during 2003-06 to 42% during 2007-11. Besides Karnataka, Andhra Pradesh, Maharashtra, Tamil Nadu and Haryana are preferred by the foreign investors for conducting R&D activities. If we go by the measure of R&D intensity, Haryana, and Karnataka show consistent high score. By contrast, states like Uttar Pradesh, Mahashtra, Andra Pradesh, and Assam display good score in earlier period.

Table 4. *Distribution of FDI And R&D across States during 2003-11*

Destination State	State's share of FDI Inflows (%)		State's share of FDI in R&D in Total FDI in R&D (%)		FDI in R&D / FDI (%)	
	2003-06	2007-11	2003-06	2007-11	2003-06	2007-11
Andhra Pradesh	15	5.6	9.2	11.3	8.3	14.3
Assam	0.1	0	0	0.1	0	42.5
Chandigarh	0.3	0.1	0.1	0.1	4.3	7.3
Delhi	3.4	2.3	1	1.5	3.7	4.7
Goa	0.2	0.4	0.2	0.3	13.8	5.7
Gujarat	3.1	4.9	0.3	1.9	1.2	2.8
Haryana	4.2	3.8	10.7	6	34.4	11.1
Jharkhand	0.1	0.8	0.1	0.2	5.1	1.8
Karnataka	15	12.2	25.6	42	22.8	24.4
Kerala	1.9	2.1	0.4	0.7	2.7	2.4
Maharashtra	10.2	9.9	15.3	10.8	20.1	7.7
Orissa	6.2	14.6	0.1	6	0.2	2.9
Punjab	0.5	0.9	0	0.2	0	1.3
Tamil Nadu	9.6	15	5.2	7.8	7.3	3.7
Uttar Pradesh	1.8	1.4	5	0.9	36.9	4.5
West Bengal	3	3.5	1.6	1.2	7	2.5
Others/Unspecified	25.4	22.5	25.2	9		
Grand Total	100	100	100	100		

Source: fDi Markets

Table 5 shows the top three destination states for FDI in R&D activities in each of the important sectors of activities. The sectors with R&D share exceeding one percent are considered important for this purpose. Karnataka ranks number one in many of the sectors in either period. Maharashtra ranks at the top of the R&D destination states sectors like pharmaceuticals, biotechnology, industrial machinery, equipment & tools, and chemicals in some of the period.

For the Software & IT services sector, there is stiff competition among Maharashtra, Haryana and Andhra Pradesh for the second and third place for attracting R&D investment. In the case of Semiconductors Karnataka is far ahead of other competing destination and further consolidated its position during 2007-11. There is stiff competition among states of Karnataka, Haryana, Tamil Nadu, Andhra Pradesh and Maharashtra for attracting R&D investment by foreign companies whereas in the case of electronic components Karnataka far exceeded other competing states for attracting R&D. Maharashtra, Andhra Pradesh and Karnataka are the preferred destination for research investment in pharmaceuticals and biotechnology.

Table 5. *Sectoral Distribution of FDI in R&D by top 3 states*

Sectors	Year	State-1	State-2	State-3
Software & IT Services	2003-06	Karnataka (25.6)	Haryana (24.7)	Andhra Pradesh (13.8)
	2007-11	Karnataka (27.2)	Maharashtra (17.3)	Andhra Pradesh (15.4)
Aerospace	2003-06	Karnataka (13.1)		
	2007-11	Karnataka (56.7)	Tamil Nadu (13.2)	Maharashtra (2.7)
Semiconductors	2003-06	Karnataka (25.7)	Uttar Pradesh (22.7)	Maharashtra (17.4)
	2007-11	Andhra Pradesh (40.3)	Karnataka (23.7)	Maharashtra (9.0)
Communications	2003-06	Karnataka (45.0)	Andhra Pradesh (21.8)	Maharashtra (9.3)
	2007-11	Karnataka (53.5)	Maharashtra (6.3)	Tamil Nadu (4.5)
Automotive OEM	2003-06	Karnataka (68.1)		
	2007-11	Karnataka (31.9)	Haryana (18.7)	Tamil Nadu (12.3)
Electronic Components	2003-06	Karnataka (79.7)	Maharashtra (8.8)	Tamil Nadu (3.8)
	2007-11	Karnataka (92.0)	Haryana (3.6)	Maharashtra (2.0)
Pharmaceuticals	2003-06	Maharashtra (63.0)	Haryana (15.9)	Karnataka (7.0)
	2007-11	Andhra Pradesh (25.3)	Karnataka (17.2)	Maharashtra (9.0)
Biotechnology	2003-06	Maharashtra (77.1)	Andhra Pradesh (10.0)	Karnataka (3.8)
	2007-11	Andhra Pradesh (60.6)	Karnataka (21.7)	Maharashtra (6.5)
Automotive Components	2003-06	Tamil Nadu (47.0)	Karnataka (29.1)	Andhra Pradesh (9.0)
	2007-11	Karnataka (51.4)	Maharashtra (16.6)	Tamil Nadu (12.8)
Business Services	2003-06	Karnataka (53.9)	Maharashtra (15.8)	Andhra Pradesh (11.7)
	2007-11	Andhra Pradesh (17.6)	Maharashtra (14.6)	West Bengal (11.2)
Medical Devices	2003-11	Karnataka (86.6)	Gujarat (8.0)	Kerala (3.5)
	2003-06	Kerala (71.0)	Maharashtra (29.0)	
	2007-11	Karnataka (91.1)	Gujarat (8.4)	Maharashtra (0.5)
Industrial, Machinery, Equipments	2003-06	Maharashtra (34.8)	Haryana (15.51)	Karnataka (15.1)
	2007-11	Maharashtra (27.0)	Tamil Nadu (23.76)	Karnataka (10.6)
Chemicals	2003-06	Goa (33.6)	Maharashtra (20.92)	Karnataka (19.2)
	2007-11	Maharashtra (50.4)	Andhra Pradesh (21.5)	Haryana (7.2)

Source: fDi Markets

Notes: Parenthesis shows percentage share of the state in total R&D of the sector

3. Characteristics of India's FDI in R&D

At the outset, increased flow of FDI in R&D seems to be a good omen. However, overall inflows of FDI in R&D hide the nature of these flows. It must be mentioned that not all flows help in enhancing the quality of R&D investment and thereby promote innovation and diffusion of new product and technology. The fDi markets database reports FDI in R&D under three heads namely Design, Development & Testing (DDT), Education and Training (E&T) and Core R&D. As the name suggests, DDT component of R&D primarily makes foreign products suitable to Indian conditions. On the other hand, E&T component of R&D aims to help in the diffusion of innovated or imported product in this country. The most important component of R&D namely Core R&D is the one which intends to make real innovations in the country and may really help in realizing the *Make in India* slogan successful.

In India, all these three components are subject to tax benefits. However, in other countries, many of the non-core R&D activities are not subject to tax benefits so as to encourage Core R&D activities and generate tax revenues from non Core R&D activities. For instance, there is long list of activities in Australia that do not benefit from tax exemptions. Some of these, for example, are as follows: (a) market research, market testing or market development, or sales promotion (including consumer surveys); (b) management studies or efficiency surveys; (c) maintaining national standards; (d) calibrating secondary standards; (e) activities associated with complying with statutory requirements or standards. Thus, it may be likely that MNCs would consider India as a fertile ground for carrying out many of these activities pertaining to R&D and simultaneously get tax benefits. In this context, let us examine what components of R&D activities are emphasized by FDI in India.

The relevant statistics are collated in Table 6 for manufacturing sector. As this table shows, the average share of Core R&D activities has fallen from 51% in the

earlier period to 31% in the later period. This has come at the rise of DDT activities, which also comprises many purely non- core R&D activities such as sales promotion etc. The good news is that MNCs mainly invests consistently in Core R&D activities in some sections like biotechnology, chemicals, consumer electronics, medical devices, food and tobacco, engines and turbines and pharmaceuticals. However, sectors like electronic components, textiles, plastics, aerospace, automotive components, automotive OEM and minerals mainly attract non-Core R&D activities. Note that a significant variation between DDT activities and core R&D activities is displayed in a few sectors such as metals.

With regard to types of R&D activities in non-manufacturing sector, the relevant statistics are shown in Table 7. As this table shows, there is absence of consistent inflows of Core R&D in most of the non-manufacturing sectors barring business services. However, there has been a rise in core R&R activities in the later period in many of the sectors such as alternative renewable energy, healthcare, space and defence except communication and software & IT department which witnessed higher flows in the earlier period.. Note that sectors like hotel and tourism, transportation, leisure and entertainment, warehouse & storage has received only non-Core R&D activities.

Table 6. *Composition of R&D invVarious Manufacturing Sectors*

Sector	DDT in Total R&D (%)		E&T in Total R&D (%)		Core R&D in Total R&D (%)	
	2003-06	2007-11	2003-06	2007-11	2003-06	2007-11
Aerospace	99.6	86.7	0	13.2	0.4	0.1
Automotive Components	73.2	89.8	0	0	26.8	10.2
Automotive OEM	68.1	87.5	0	0.9	31.9	11.6
Beverages		100		0		0
Biotechnology	3.1	1.8	0	0.9	96.9	97.3
Business Machines & Equipment	88.9	84.2	0	0	11.1	15.8
Chemicals	38.4	40.8	0	2.7	61.6	56.4
Coal, Oil and Natural Gas	0		0		100	
Consumer Electronics	69.2	6.7	0	0	30.8	93.3
Consumer Products	0	82	37.5	1.1	62.5	16.9
Electronic Components	75.2	93.6	0	0.9	24.8	5.5
Engines & Turbines	0	64.4	0	4.9	100	30.7
Food & Tobacco	39.3	0	0	4.9	60.7	95.1
Industrial Machinery, Equipment	47.2	74.6	1.6	8.9	51.2	16.5
Medical Devices	29	10.2	0	0.5	71	89.3
Metals	1.7	100	26.1	0	72.3	0
Minerals	87.2	96.4	12.8	3.6	0	0
Non-Automotive Transport OEM	0		0		100	
Pharmaceuticals	2.6	9.9	0	0	97.4	90.1
Plastics	74.3	100	0	0	25.7	0
Semiconductors	57.3	95.9	0.4	0	42.3	4.1
Textiles	82.3	100	17.7	0	0	0
Average Share	44.6	66.2	4.6	2.1	50.8	31.6

Source: fDi Markets

Notes: Total R&D includes Design, Development & Testing (DDT), Education and Training (E&T) and Core R&D

In sum, the average share of Core R&D activities in the non-manufacturing sectors is about 20% between 2003 and 2011. The most flows have become in the form of DDT activities. The absence of strict standards, environment and health related norms compared to developed countries provides a business friendly environment for the MNCs to indulge in these activities in India. To some extent, this is evident in the case of manufacturing sectors since the share of DDT related R&D activities in the same stands at about 55% during the period.

Table 7. *Composition R&D in Non-Manufacturing sectors*

Sector	DDT in Total R&D (%)		E&T in Total R&D (%)		Core R&D in Total R&D (%)	
	2003-06	2007-11	2003-06	2007-11	2003-06	2007-11
Alternative/Renewable energy		14.5		0		85.5
Business Services	56.7	24.2	23.8	50.2	19.5	25.6
Communications	33.2	98.7	0	0	66.8	1.3
Financial Services		68.1		31.9		0
Healthcare	100	3.2	0	19.8	0	77
Hotels & Tourism	100		0		0	
Leisure & Entertainment	4.3	100	95.7	0	0	0
Software & IT services	63	92.1	0.7	3.3	36.3	4.6
Space & Defense	100	41.7	0	0	0	58.3
Transportation		100		0		0
Warehousing & Storage		0		100		0
Average Share	65.3	54.3	17.2	20.5	17.5	25.2

Source: fDi Markets

Notes: Total R&D includes Design, Development & Testing (DDT), Education and Training (E&T) and Core R&D

4. Concluding Remarks

The Prime Minister has made the revival of Indian manufacturing a top priority, reflected in his Make in India campaign and slogan. The objective is as laudable as the challenges it faces are daunting because Indian manufacturing has been stagnant at low levels, especially when compared with the East Asian successes. It is expected that FDI would play an important in realizing this dream. In this context, we can expect that the surge in R&D activities by MNCs in India would help in building the innovation culture in India. However, an in depth analysis of components of R&D activities pursued by MNCs in India does not provide a very positive picture.

It is true that there has been a rise FDI in R&D in India. However, the rise has not been commensurate only with rise in Core R&D activities. Rather, more than 50% of the inflows in R&D by MNCs have come for non-core R&D activities namely design, development & testing, education and training. It could be that tax exemption, and weak heath and environmental norms have driven MNCs to pursue these activities in India. Alternatively, it may be possible that MNCs are wary to pursue core R&D activities in India due to weak IPR laws. On the positive side, manufacturing sector has attracted more core R&D activities than the non-manufacturing sector. However, one needs to introspect how to create enabling environment for increasing core R&D activities by MNCs in India. Only then, we can expect diffusion from R&D activities of MNCs would help domestic economy to promote innovation culture and make India a global manufacturing hub.

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