

# Foreign direct investment in R&D in India<sup>†</sup>

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*This article presents an overview of the investments made by the multinational companies (MNCs) for research and development (R&D) in India during 2003–2009. It focuses on some salient features of foreign direct investment (FDI) in R&D in India and makes a preliminary assessment of the gains from the R&D initiatives of MNCs in India. It presents the flow of FDI for R&D in the context of total FDI inflow and gives details of the sector and cluster preferences for the investments. It is observed that FDI inflow for R&D is insignificant in comparison to the total FDI flowing into the country. The patent behaviour indicates that the R&D activities by MNCs in India do not reflect much importance of their Indian set-up, or their interest in high-end R&D initiatives. Sector-based classification of investment showed that major part of the FDI in R&D was flowing to software and IT sector, auto industry being a poor second, closely followed by pharma and biotechnology sector. The rest of the sectors had insignificant FDI in R&D.*

**Keywords:** Foreign direct investment, research and development, multinational companies, sector and cluster preference.

TILL early 2000, it was not perceived that developing economies could emerge as attractive locations for research and development (R&D) activities of multinational companies (MNCs). The scenario gradually changed and by mid-2000 it was realized that India and China are emerging as the two most attractive destinations for the R&D set-up of MNCs. The world leaders in high-tech areas are targeting these two countries for setting up their dedicated R&D centres. India as a location for R&D set-up started with Texas Instruments in 1985 and since then there has been a gradual growth in the number of MNCs setting up their R&D centres. It was in 2005 that the United Nations Conference on Trade and Development (UNCTAD) focused on this new trend and in a survey conducted by UNCTAD on prospective R&D locations, India emerged as the third most sought-after location, after China and USA. Around the same time Economist Intelligence Survey, 2004 also presented a comparative scenario based on its survey on the reasons for choosing a particular location, where India topped the list in terms of access to highly skilled labour force, R&D activities and new opportunities in outsourcing. The

MNCs would set up their R&D centres where the host country's industries are technologically competitive and also to have access to the knowledge resource from centres of excellence in the host country<sup>1-4</sup>. Cantwell<sup>5</sup> distinguishes the production activities of the MNCs: 'MNCs engage in both research intensive production which is linked to the local R&D facilities, the other is assembly type of production where R&D is not the major requirement.' When both investing country and the host country have highly evolved and technologically competitive markets, the host country with innovative domestic industries attracts inward investment by the MNCs and in such a situation they also set up their R&D facility in the host country, to support their research-intensive production and to further gain from the local science and technology (S&T) support and infrastructure<sup>5</sup>. According to Terpstra<sup>6</sup>, 'For a country to become an R&D location it must have sufficient scientific and technical personnel. On the basis of size and availability, India is a good candidate.' It is generally believed that foreign direct investment (FDI) follows the growth trajectory of the host country. It targets the sectors that have high growth<sup>7</sup>. The attraction of MNCs towards emerging economies has drawn the attention of researchers very recently, in the context of the interaction of MNCs with the host country institutions and its impact on the host country<sup>8-18</sup>.

With this background, the present article focuses on some salient features of FDI in R&D in India and makes a preliminary assessment of the gains from the R&D initiatives of MNCs in India. The article is based on a study on the impact of FDI in R&D on Indian R&D and production system during 2003–2009, and is organized as

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**Table 1.** Overview of FDI in India during 2003–2009

	2003	2004	2005	2006	2007	2008	2009	Total*
No. of investments	348	486	437	627	512	686	344	3467
No. of countries	32	33	38	39	38	51	37	
Total FDI (in billion USD)**	19.79 (5.65)	36.73 (10.48)	29.74 (8.49)	89.14 (25.43)	56.85 (16.22)	80.54 (22.98)	37.68 (10.75)	350.47 (100)

Source: CSIR–NISTADS–TIFAC study 2011 (compiled, collated and constructed from FIPB/SIA on-line, Financial Times database, FDI Intelligence, IBID Database, Business News).

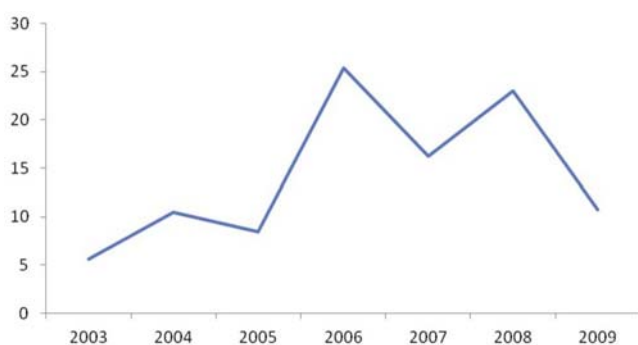
\*During 2003–2009, 2492 number of firms have made a total of 3467 number of Foreign Direct Investments in India.

\*\*Figures in brackets are percentages.

**Table 2.** Country-wise share in FDI (in billion USD)

Country	2003	2004	2005	2006	2007	2008	2009	Total	Percentage
USA	3.34	5.37	6.10	22.38	13.30	13.97	6.80	71.26	20.3
UK	1.57	2.45	6.38	7.20	11.66	13.97	4.38	47.61	13.6
UAE	0.11	0.15	2.66	3.57	2.68	6.52	1.72	17.41	4.97
South Korea	0.48	4.10	1.12	1.36	4.21	1.66	3.40	16.33	4.66
Switzerland	0.14	0.43	0.11	3.56	0.23	1.01	0.47	5.95	1.7
Singapore	1.83	1.36	0.80	3.54	0.67	1.44	1.78	11.42	3.26
Russia	0.03	0.14	1.06	0.67	0.72	2.34	0.23	5.19	1.66
The Netherlands	0.79	1.18	2.00	4.92	1.91	1.19	0.70	12.69	3.63
Malaysia	0.001	0.91	0.39	0.93	0.62	2.33	0.65	5.83	2.11
Japan	0.38	1.78	0.95	3.85	6.57	6.72	1.93	22.18	6.33
Italy	0.04	0.13	0.25	1.20	0.94	1.52	1.52	5.60	1.6
Germany	1.00	0.96	1.76	10.03	3.31	7.75	1.56	26.37	7.52
France	0.63	0.40	0.87	3.07	1.46	3.48	1.99	11.90	3.4
China	0.12	0.12	0.43	0.27	1.00	5.66	1.13	8.73	2.49
Canada	0.41	1.11	0.41	0.23	0.20	1.21	1.35	4.92	1.4
Austria	–	0.10	0.05	4.74	1.55	0.33	0.26	7.03	2.01
Others	8.92	16.04	4.40	17.62	5.82	9.44	7.81	70.05	20.0
Total	19.79	36.73	29.74	89.14	56.85	80.54	37.68	350.47	100

Source: CSIR–NISTADS–TIFAC study 2011.

**Figure 1.** Flow of investment during 2003–2009 (%).

follows. We first present the pattern and sources of FDI flow in India. This provides the backdrop for FDI in R&D in the context of total FDI inflow discussed in the next section. We then give details of the distributions of the R&D centres of MNCs in terms of sectors and clusters and map out their spread in India. The next section captures the intersectoral and intercluster features of the inflow of FDI for R&D in India during 2003–2009. Then we assess the gains from FDI in R&D in India. Gains

have been seen from two perspectives: generation of employment and generation of knowledge. For the former we have used total employment generation, while a more appropriate parameter would have been data on scientists, technologists and engineers employed by the MNCs in their R&D centres. Data with such break-ups, however, could not be generated. We have used patent counts for the patents filed from India by R&D centres of these MNCs in India.

### Pattern and source of FDI inflow in India

We examine the inflow of FDI in R&D in India in the context of total FDI inflow in the country. Table 1 gives an overview of the flow of FDI during 2003–2009.

Figure 1 shows that the flow of FDI peaked in the year 2006 and then sharply declined in the global recession year 2009. Total FDI during this period was USD 350.47 billion. A total of 3467 (counting the number of investments during the reference period) MNCs from 51 countries brought FDI to India. A total of 2432 firms brought FDI to India during 2003–2009.

**Table 3.** Sectoral pattern of FDI

Sector	Percentage share of FDI
Aerospace	3.26
Auto industry	8.7
Pharma and biotechnology	1.4
Real estate and construction	11.33
Machinery and equipment	1.86
Services	5.16
Chemicals	1.54
Metals and minerals	27.01
Software and IT	13.79
Electronic components	1.99
Engines and turbines	2.4
Tourism and entertainment	3.1
Transportation	6.62
Warehousing and storage	5.1
Others	6.73

Source: CSIR–NISTADS–TIFAC study 2011.

There are small countries such as Bangladesh and Sri Lanka which bring FDI to India. The USA and the UK are the major FDI source countries sharing 20.3% and 13.6% respectively, of the total FDI. It is to be noted that other developed countries such as Japan, Germany and The Netherlands continued to be important sources of FDI, whereas South Korea is emerging as one of the important new sources. Table 2 shows that USA is the major source of FDI in India, not only in terms of volume but also in terms of setting the trend of investment. The number of source countries for FDI reached 39 in the year 2006 (Table 1). The row 'Others' in Table 2 includes 23 countries having less than 1% of the total FDI. Together these 23 countries share 20% of the total FDI; a little less than the share of USA alone.

Having seen country-wise sources of FDI inflow to India, we present here the distribution of this inflow amongst various sectors. The metals and minerals industry seems to attract maximum investment (27.1%) followed by software and IT sector (13.79%), and then real estate and construction sector (11.33%). These three sectors together attracted about 42% of the total FDI. Table 3 presents sector-wise share of FDI for 14 sectors that had more than 1% share of FDI during 2003–2009.

### FDI in R&D

Given this background of increasing flow of FDI in India and the sectoral attraction of FDI, the part of FDI going for R&D activities in India is examined. Table 4 presents an overview of FDI in R&D during 2003–2009.

Table 4 shows that the investment coming in for R&D is similar with the FDI inflow, like the fall in investment in 2009 due to recession. It is interesting to note that the share of R&D in total FDI inflow was only 8.25.

Table 5 gives information on the number of firms in various investment ranges. Almost 86% of the invest-

ments is less than 50 million USD and generally, small investments do not reflect high-end R&D.

### Country-wise pattern

The total number of FDI for R&D received was 964 from 706 firms. Total amount of FDI for R&D was US\$ 29.22 billion. The year 2006 was the peak year of investment for R&D activities. Table 6 gives country-wise number of investments from major source countries. USA which was a major source of FDI is also the major source of FDI in R&D. Of the total 897 investments made, USA was the source of 591 investments; UK being a distant second with 51 investments.

The scenario is the same with regard to the volume of investment from the source countries. As shown in Table 7, the share of USA was as high as 82.47% in 2005 with an overall share of 52.82% of the total FDI in R&D. Germany follows USA with a share of 7.88%, and UK, which has the second largest number of investment, shares 3.96% of the total FDI in R&D.

### Sectoral distribution

Table 8 shows the sectoral distribution of FDI in R&D. As expected, the software and IT sector attracted most of the FDI in R&D; this was followed by the aerospace sector. Two more significant sectors are the auto industry and pharma and biotechnology industry. Other sectors where there was considerable flow of FDI are real estate and construction industry. The metal and mineral industry did not have any significant investment in R&D. The flow of FDI in R&D has followed the pattern of FDI inflow.

Table 9 compares the share of a sector in total FDI and also the share of the sector in total FDI in R&D. The aerospace sector which has 3.26% share of total FDI shares 12.52% of total FDI in R&D. The software and IT sector which has 13.79% share in FDI has a share of 50.36% in total FDI for R&D. High FDI-inflow sectors like metals and minerals (27.01%), and real estate and construction (11.33%) do not have any R&D investment. It is to be noted that overall share of FDI for R&D in total FDI inflow during 2003–2009 is only 8.25%.

FDI in R&D is insignificant compared to the total FDI flowing into the country from 2003 to 2009. This is reflected in the nature and extent of flow of FDI in Indian production and R&D activities. The reference year is the year of high growth in the real estate and construction sector and also the metals and minerals sector. Both these sectors attracted highest flow of FDI. These sectors were followed by the software and IT sector, which again is the fastest growing industrial activity in India. FDI in R&D, however, is restricted only to the software sector with pharma and biotechnology and auto industry being a

**Table 4.** An overview of FDI in R&D

Year	No. of investments	No. of source countries	Investment (billion USD)	Share in total FDI (%)	Sector
2003	103	13	2.18	11.02	19
2004	182	15	3.19	8.68	17
2005	140	13	2.66	9.68	13
2006	192	23	10.63	11.93	22
2007	131	16	3.37	5.93	17
2008	114	23	3.61	4.48	23
2009	75	13	3.56	9.45	22
Not specified	27	16	0.02		13
	964 (total)		29.22 (total)	8.25 (average)	

Source: CSIR-NISTADS-TIFAC study 2011.

**Table 5.** Number of firms in various investment ranges

Investment range (million USD)	No. of firms	Percentage of firms in various investment ranges
0 to < 1	60	8.49
1 to 10	186	26.34
10 to < 20	177	25.07
20 to < 30	117	16.57
30 to < 40	52	7.36
40 to < 50	17	2.40
50 to < 100	37	5.24
100 < 500	53	7.50
500 and above	7	0.99
Total	706	99.96

distant second and third. Though India is attracting investments for R&D to a greater extent since 2000, it is insignificant in comparison to the flow of total FDI. As shown in Table 5, almost 86% of investments is less than 50 million USD.

### Inter-sectoral and inter-cluster features

The flow of FDI is channelled in certain select clusters such as Bangalore, Hyderabad, Chennai, Mumbai/Pune and Delhi/NCR, which account for around 88% of inflow. Tables 10 and 11 present the cluster-wise and sector-wise break-up of FDI in R&D inflow as well as the magnitude of the inflow. During the six years from 2003 to 2009, out of a total number of 706 MNCs investing in R&D in India, 560 are in IT and software, pharmaceuticals and automobile sectors, of which 495 are in the above-mentioned five clusters. These three sectors share around 69% of the total FDI in R&D and 63% of this is in the above-mentioned five clusters. As far as the job creation potential is concerned, three sectors account for more than 82% of the jobs, with the IT sector alone accounting for around 74% followed by automotive and pharma/biotechnology sectors at around 5.29% and 3.31% respectively. Job creation has mainly been in the select clusters. The clusters have provided for more than 74% jobs of which more than 66% is in IT, 5.28% in the automotive

and 2.89% in pharma/biotechnology sectors. It clearly indicates that the sector that attracts maximum investment in R&D is IT and software, which is human resource-intensive. Bangalore has emerged as the cluster which has attracted maximum investment and again in the IT and software sector.

### Assessing the gains

#### *Job created through FDI in R&D in India*

Table 12 presents the jobs created by various sectoral activities due to the investment in R&D. This again shows that IT and software sector creates more job opportunities in comparison to other sectors. The software and IT service sector has 50.30% share of the total FDI in R&D and it has more than 74% share of the total jobs created. Again, as seen from the last column of Table 12, the services sector, software and IT sector and transportation sector generated more employment per million USD with the average being 6.35 jobs per million USD. Electronic components, and machine and equipment are other sectors that generate more than average employment per million USD investment.

#### *Patenting activities*

Patenting activities would broadly indicate the type of R&D activities undertaken by the MNCs in India. Table 13 shows the pattern of patenting activities of the MNCs. Out of 706 companies investing in India, only 74 companies have been granted patents. Again, the software and IT sector has the major share (54 companies). These 74 companies together have 214,686 global patents granted. And only 1166 of those patents granted are from India. The software and IT sector shares 749 of the 1166 patents from India. The table also shows that 63 out of 74 firms have less than 5% share of Indian patents vis-à-vis their global patents. The Indian R&D initiatives of the

**Table 6.** Country-wise number of investments

Country	2003	2004	2005	2006	2007	2008	2009	Total
USA	75	124	99	120	77	57	39	591
UK	5	13	8	10	4	5	6	51
Germany	2	8	6	7	6	9	11	49
France	2	6	5	4	8	5	1	31
Japan	2	4	1	9	5	3	3	27
Switzerland	2	9	2	3	2	1	2	21
Others	12	17	14	32	17	26	9	127
Total	100	181	135	185	119	106	71	897*

Source: CSIR–NISTADS–TIFAC study 2011. \*The total country-wise investments shown here is 897, whereas the number of investments in Table 4 is 964. This difference is due to non-specification of the source country though investments were made. Table 6 gives only those investments where the country name has been specified.

**Table 7.** Share of a country in total FDI for R&D in a year (%)

Country	2003	2004	2005	2006	2007	2008	2009	Total
USA	64.10	64.75	82.47	45.65	61.37	49.15	27.90	52.82
UK	5.43	5.13	2.92	1.72	10.87	3.87	3.04	3.96
Germany	2.92	3.82	2.12	10.96	2.39	7.67	15.55	7.88
France	0.78	1.57	5.20	0.91	8.05	2.23	1.92	2.49
Japan	1.22	3.92	0.18	1.89	4.27	3.89	1.57	2.37
Switzerland	4.52	9.44	1.69	0.60	1.39	8.05	4.27	3.43
Others	21.03	11.36	5.43	38.27	11.67	25.14	45.75	27.05
Total	100	100	100	100	100	100	100	100

Source: CSIR–NISTADS–TIFAC study 2011.

**Table 8.** Sectoral pattern of FDI in R&D (billion USD)

Sector	2003	2004	2005	2006	2007	2008	2009	Total
Aerospace	0.02			3.25	0.02	0.23	0.1	3.62
Auto industry	0.08	0.12		0.47	0.66	0.59	0.76	2.68
Pharma and biotechnology	0.04	0.12	0.45	1.11	0.31	0.43	0.35	2.81
Machinery and equipment	0.11	0.15	0.13	0.18	0.2	0.1		0.87
Chemicals	0.03		0.01	0.02	0.22	0.02	0.06	0.36
Electronic components	0.33		0.05	0.03	0.03	0.15	0.15	0.74
Engines and turbines	0.02			0.02	0.02	0.01	0.03	0.10
Services	0.009	0.37	0.02	0.009	0.09	0.03	0.23	0.76
Metals and minerals	0.03	0.08		0.13	0.02	0.01	0.07	0.34
Software and IT	1.43	2.21	2.12	4.96	1.7	1.74	0.4	14.56
Others	0.09	0.13	0.04	0.15	0.03	0.2	1.39	2.03
Total	2.19	3.18	2.86	10.33	3.3	3.51	3.54	28.91

Source: CSIR–NISTADS–TIFAC study 2011.

**Table 9.** Relative sectoral share of FDI and FDI in R&D: a comparison

Sector	Sectoral share of total FDI in R&D	Sectoral share of FDI in total FDI
Aerospace	12.52	3.26
Auto industry	9.27	8.7
Pharma and biotechnology	9.72	1.4
Real estate and construction	0.00	11.33
Machinery and equipment	3.01	1.86
Chemicals	1.25	1.54
Electronic components	2.56	1.99
Engines and turbines	0.35	2.4
Services	2.62	5.16
Tourism and entertainment	0.14	3.1
Metals and minerals	0.18	27.01
Software and IT	50.36	13.79
Transportation	0.00	6.62
Warehousing and storage	0.00	5.1
Others	7.02	6.73
Total	100	

Source: CSIR–NISTADS–TIFAC study 2011.

**Table 10.** Sector and cluster-wise break-up of FDI in R&D inflow

No. of MNCs investing in R&D	706
No. of MNCs in IT, pharma and automotive	560
Total no. of MNCs in select clusters and sectors (IT, pharma and automotive)	495
Share of IT and software, pharmaceutical and automobile sectors together in total FDI in R&D	69.47%
Share of Bangalore, Mumbai/Pune, Delhi/NCR, Hyderabad and Chennai together in the total FDI in R&D	88%

Source: CSIR–NISTADS–TIFAC study 2011.

**Table 11.** Magnitude of inflow of FDI in R&D in the select sectors and clusters

Sector	Percentage of MNCs		Percentage of FDI in R&D		Percentage of jobs created	
	In sectors	Sectors in clusters*	In sectors	Sectors in clusters*	In sectors	Sectors in clusters*
Software/IT	63.46	55.94	50.30	44.50	74.17	66.52
Pharmaceuticals/biotechnology	12.18	10.62	9.23	8.75	3.31	2.89
Automotive	3.68	3.54	9.85	9.82	5.29	5.28
Percentage of the total	79.32	70.11	69.38	63.07	82.77	74.69

Source: CSIR–NISTADS–TIFAC study 2011. \*The clusters are Bangalore, Mumbai, Pune, Delhi, NCR, Hyderabad and Chennai.

**Table 12.** Job created through FDI in R&D

Sector	Jobs created	Percentage share of total jobs created	Investment (million USD)	Percentage share of investment	Jobs created per million USD
Aerospace	6,601	2.6	3756.18	12.85	1.7
Auto industry	13,106	5.29	2878.45	9.88	4.55
Chemicals	2,196	0.88	439.4	1.50	4.99
Electronic components	5,610	2.26	674.36	2.31	8.31
Engines and turbines	422	0.17	109.21	0.37	3.86
Machinery and equipment	5,300	2.14	617.53	2.11	8.58
Metals and minerals	2,201	0.88	352.2	1.20	3.89
Pharma and biotechnology	8,208	3.31	2699.6	9.24	2.97
Services	8,325	3.36	648.6	2.22	12.83
Software and IT	183,500	74.17	14702	50.30	12.48
Space and Defence	73	0.02	23.3	0.08	3.13
Tourism and entertainment	504	0.2	80.8	0.28	6.23
Transportation	243	0.09	23.3	0.08	10.42
Others	10,921	4.41	2223.68	7.61	4.91
Total	247,403	99.78	29,228.61	100.00	6.35 (avg)

Source: CSIR–NISTADS–TIFAC study 2011.

**Table 13.** Patenting behaviour of firms bringing FDI in R&D during 2003–2009

Sector	No. of R&D FDI firms	Patent granted for MNCs with R&D centres in India	Global patents granted for the same set of firms	Percentage share of patents of the R&D FDI firms operating in India in comparison to their global patents				
				< 1	1 < 5	5 < 10	10 < 50	> 50
Software and IT	54	749	129,385	22	21	4	3	4
Pharma and biotechnology	4	19	3,413	3	1			
Automotive	3	5	12,460	3				
Machinery and equipment	5	47	12,583	4	1			
Electronic components	1	1	338	1				
Metals and minerals	1	5	1,992	1				
Chemicals	3	4	6,285	3				
Others	3	336	48,230	2	1			
Total	74	1,166	214,686	39	24	4	3	4

Source: CSIR–NISTADS–TIFAC study 2011 (Delphion database).

MNCs till now do not have much importance given the scale of their global activities.

## Conclusions

FDI in R&D is insignificant compared to the total FDI flowing into the country from 2003 to 2009. It is generally believed that FDI follows the growth trajectory of the host country. This is reflected in the nature and extent of flow of FDI in Indian production and R&D activities. The IT and software sector has attracted maximum investment for R&D activities, which is one of the fastest growing industrial activities in India.

There are a large number of small investments, i.e. almost 86% of investments is below 50 million USD, which reflects that the MNCs are not investing to take up high-end R&D. This is corroborated by the patent information, which indicates that the R&D activities undertaken by MNCs in India, in comparison to their global R&D activities, do not reflect much importance of their Indian set-up, or their interest in high-end R&D initiatives. Sector-based classification of investment showed that major part of FDI in R&D was flowing to the software and IT sector, with the auto industry being a poor second, closely followed by pharma and biotechnology sector. The rest of the sectors had insignificant FDI in R&D.

The share of FDI in R&D in total FDI in India is only 8.25%. The software and IT sector has a share of 13.79% of FDI and shares 50.36% of the total FDI in R&D.

A cluster-wise classification shows that about 88% of such investments were made in five clusters, namely Bangalore, Hyderabad, Chennai, Delhi/NCR and Mumbai/Pune. Of these, Bangalore is the main centre of FDI in R&D in India.

The total jobs created during the period of 2003–2009 are 247,403 on an investment of 29.22 billion USD. The software and IT sector has a share of 74.17% of the total employment created. Among other sectors, the auto industry has a share of 5.29% and pharma and biotechnology has a share of 3.31%. The software and IT sector has a share of 50.30% of the total FDI in R&D, followed by the auto industry (9.88%) and pharma and biotechnology sector (9.24%). Employment created per million USD invested shows that the software and IT sector is the highest employment generator at 12.83; whereas the pharma and biotechnology (2.97) and auto industry (4.55) are more capital-dependent investments.

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