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## **R&D Internationalization: With Special Reference to Indian Information Technology Sector<sup>1</sup>**

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### **Abstract:**

By taking the case of Indian (IT) sector, the paper, gives an overview of top global IT firms up to 2004 that have their R&D operations in India. Linkages with the Indian production and R&D systems are analyzed based on 60 global IT firms, up to 2007, that have their R&D activities in India. US firms are making maximum R&D investment in Indian IT sector. Most of the global IT firms are establishing linkages with the leading academic and technical institutions of India besides the leading Indian firms to have access to the scientific and technical resources. Almost 72 percent of the global IT firms that have their R&D operations in India are having linkages with the Indian production and R&D system. Compared to other sectors, it is the IT sector which has attracted maximum FDI in R&D. The analysis is based on

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er seeks to delineate the orientation of these linkages as knowledge seeking, joint product development or combination of both.

## 1. Introduction

Internationalization of R&D as a phenomenon is not new. To a limited extent, firms were having their R&D activities outside their home country as a part of their business expansion strategy. Firms, though spread out their production and marketing activities, globally, held R&D as an activity which was not meant to cross borders. R&D was a centralized activity and even when spread to other regions, it was more to provide technical help to their production units. The other important dimension of this is that the firms opted to have their R&D activities in developed countries, to have the knowledge advantage. The R&D activities were basically located in the developed countries, especially USA, Europe Japan etc. This is to say that firms from developed countries had their R&D centres within their own domain. In this new phase, firms from developed countries are moving out of this domain to source knowledge resources from the emerging economies. The recent observable change is the increase in the process of R&D internationalization seeking emerging, economies, which are being seen as new centres of competence (Hamilton and Insead 2006). The other interesting aspect is that there is a continuous growth in foreign R&D i.e more and more R&D sites are emerging in other regions in comparison to the home country. This is a shift from the earlier phase, where R&D was central to the home country, though the production and marketing was spread to other regions.

the new pattern in R&D internationalization, where the MNCs are seeking the shores of emerging economies for their R&D activities. In the new phase of internationalization of R&D, MNCs from industrialized economies are competing to have access to the knowledge resources available in the emerging economies. This is paving way for the emergence of a new pattern in internationalization of R&D. Now MNCs are creating Global R&D networks where both the industrialized and the emerging economies are contributing to the global knowledge system. By taking the case of Indian IT sector, the paper, gives an overview of top global IT firms up to 2004 that have their R&D operations in India. The data is based on secondary sources. Linkages with the Indian production and R&D systems are analyzed based on 60 global IT firms, up to 2007, that have their R&D activities in India. The paper seeks to delineate the orientation of these linkages as knowledge seeking, joint product development or combination of both.

The paper is organised as follows: In the first section the focus is on the process of R&D internationalisation adopted by the global firms as a part of their business strategy. The second section traces a new pattern of R&D internationalisation where the issues arising out from the recent changes in the FDI in R&D are discussed. India and China are emerging as the most sought after destinations for the location of R&D set-up. More and more R&D centres in emerging economies by the global firms is a contrast to earlier pattern. In the third section, scenario of global IT firms' R&D operations in India is discussed. The linkages of these IT R&D centres with Indian R&D institutes, universities and firms are discussed in the perspective of their choice for such a linkage in the fourth section which looks at the developments in the IT sector in India during 1998-2003 through select indicators. The ensuing section presents a typology of probable linkages with the host country institutions and their outcome. The fifth section summarises the discussion.

## 2. Internationalization of R&D



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Internationalization of R&D has emerged as an important mode to access global pool of knowledge. Types and ways of establishing linkages with the resource centers in the host countries varies from contract research to setting up dedicated R&D centers. Firms have always been in the lookout for newer knowledge to enhance their competitive strength. According to BIAC, The trends in managing research and development are towards closer collaboration between talented researchers in different public and private institutions and between companies, their suppliers and their customers. Practices in internationalization of R&D reflect this need and possibility to establish useful connections with partners, customers, public institutes and other bodies, whose knowledge will contribute to producing and supporting the required products and services (BIAC, 2005). This helps MNCs in strengthening their in-house capabilities through the channels of collaborative networks with global academic and R&D institutions.

Global firms seek other regions, to establish their R&D activities, basically to expand their market potential and this depends to a great extent upon host country's S&T infrastructure, human resource and the policy framework. R&D as a part of business strategy needs continuous access to knowledge resources to cope up with the fast changing business demands. With emerging newer markets, access to localized knowledge resources and human capital becomes inevitable to cope up with the changing global innovation trends. Kuemmerle perceives foreign R&D to be an activity for either resource exploitation or augmentation (Kuemmerle, 1997). Kuemmerle's later study of MNCs points towards MNCs having foreign R&D in other locations for augmenting their home knowledge base with the knowledge resources of the host countries (Kuemmerle, 1999). Serapio and Dalton have evolved several theoretical frameworks based on the motivation of FDI in R&D according to which the recent changes in the FDI in R&D decisions are influenced more by supply side factors in influencing firms' decisions to invest in R&D particularly in drugs, biotechnology and the electronics



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)). Their previous works have pointed at the demand side factors more (Dalton & Serapio, 1993; Dalton & Serapio, 1995). They have observed the transition from demand driven factors to supply driven factors in firms in these sectors. We have seen the manifestation of the same phenomena in Indian Pharmaceutical industry where most of the subsidiaries of foreign multinationals worked for the localization and formulations research involving adaptive research and there seems to be a shift in their R&D now towards the supply side factors. Industry level study by Hegde and Hicks also points out that the US MNCs R&D activities in foreign shores depends on the host country's markets, technological capabilities and the S&E capability (Hegde, D and Hicks, D, 2008). It is very clear that the firms are decentralizing their R&D activities to other regions, in addition to their home country to have access to the knowledge base, S&T resources and the market. Ernst has observed this shift as a transformation from global production network to global innovation network+ (Ernst, D., 2006) Firms are outsourcing and offshoring some of their R&D activities to firms and R&D setups in other countries to, to enhance their R&D and technological capabilities.

Internationalization of R&D and innovation, in the present context is encompassing various strategic activities of the firms. Various channels for R&D internationalization are universities, public research institutes, public and private firms. Universities and public research institutes as part of the innovation system enhance the location advantage for the firms. Firms are disaggregating their innovation activities. They are into a global network mode by offshoring, outsourcing and subcontracting various activities, including the R&D activity to network partners in different regions.

There are many reasons behind global firms offshoring and outsourcing their R&D activities elsewhere. It is not a new phenomenon but has taken on greater momentum with R&D Globalization. A new scenario is emerging where the firms can lookout for their collaborative partners from any part of the world as per their requirement. Firms enhance their capabilities by having tie-ups with academic and research institutions globally. Companies supplement their in-house

partnerships and contracts with academic, R&D institutions and other firms. They can now have their collaborative partners from any part of the world. R&D as a global activity sustains and strengthens competitiveness among these globally competing firms by creating global innovation networks. New innovation patterns are emerging with global networks. Chip designing is one such R&D activity which illustrates the vertical specialization in different regions resulting in Global design networks (Ernst, D., 2005). This is nothing but seeking knowledge from different regions through various channels. These global networks provide access to certain specialized knowledge system available in various locations. Cost may be one of the factors for setting up R&D centres in other regions but other factors like specialized knowledge with highly skilled manpower and well established R&D institutions and universities do contribute to such corporate decisions.

## **2.1 Shifts towards Emerging Economies**

Internationalization of R&D has entered a new phase, with MNCs overseas investment increasing in the Asian region. China and India are emerging as the most preferred destinations for MNCs for setting up their dedicated R&D centers. The reasons mainly attributed to this present shift are the following:

1. Resource scarcity in developed countries
2. Escalating demand on S&T structure.
3. Prohibitive costs of highly skilled manpower
4. To have continuous access to knowledge resources

The domestic S&T resources have become inadequate to face the pressure of competition and consequent pressure on the process of innovation in the ever increasing phase of globalization. The developing countries, therefore, became the destination. As stated by Hakanson and Nobel, Supply conditions in the market for engineers and technical

countries be so favorable that they induce companies to set up local research establishments to tap into the local scientific infrastructure, be it in terms of labor market for scientists and engineers, privileged access to local universities and research institutions etc. (Hakanson and Nobel, 1993). MNCs setting-up their R&D centers in Asian countries, especially in India and China, reinforce this perception (UNCTAD, 2005(a)). US firms overseas R&D activities have increased from 3% in 1994 to 10% by 2002 (UNCTAD, 2005(b)). As observed by UNCTAD, the expansion of R&D into selected developing countries is a reaction to increased competition, which forces firms to innovate more at lower cost. TNCs are especially attracted to host countries that have the appealing combination of low wages and large pools of skilled workers (UNCTAD, 2005(c)).

Historically, developed countries were considered to be having the strength of highly skilled scientists and engineers and now this is paving way to the new trend wherein the developing countries are attracting the MNCs with their technically skilled manpower. Manpower shortage on one side and manpower under utilization on the other has also been one of the main factors for the shift to developing countries. A large part of the skilled manpower is under utilized in many developing countries, and therefore, is easily accessible to foreign R&D centres who can offer comparatively attractive compensation, better career options, and exposure to frontier of R&D. (Dirk, M.B., 2004; Reddy, P and Sigurdson, J., 1994; UNCTAD, 2005 (b) )

The comparative advantage of emerging economies especially, India and China, from supply side can be understood from the responses of 500 senior executives in a global survey conducted by Economic Intelligence unit of the Economist (Economic Intelligence Survey. The finding is reproduced in the Table 1 according to which India tops the preference when it comes to access to highly skilled labour force, R&D activities and new opportunities in outsourcing.

MNCs are locating their R&D centres in different regions as a part of their business strategy and in the process are establishing linkages with the host countries R&D and production system to supplement their capabilities. Many of MNCs



country's R&D institutions and universities, and we have termed them as %knowledge seekers+. There are several linkages with the production system which we have termed as %joint production seeker+ and the remaining have a combination of both. The linkages between the foreign R&D centres and the host country institutions can be presented in the form of areas of intersection with local R&D system and universities on one side and production system on the other (Fig.1) ( Mrinalini and Sandhya, 2008) .

### 3. Foreign R&D centres in Indian IT sector

In India, the foreign R&D centers are growing in number and are concentrated in four major clusters . Bangalore, Chennai, Pune and Delhi NCR and most of these centres are being set up by the global IT companies (figure 2.).

In India, the maximum R&D investments as well as the maximum number of R&D centres are being set up by the firms from United States. Of the total R&D investment by firms from USA, 65% is towards the software development and 15% is in hardware production. This implies that almost 80% their R&D investment is in the IT sector.

Oracle, IBM, SAP, etc, global IT giants have already their R&D foothold in India and have plans to expand their existing facilities and infrastructure. A lot of them are carrying out a significant proportion of their global R&D activity in India. Some of these companies have one of their largest R&D centers in India outside the US in India. Seeing the success of these centers, an increasing number of companies have realized India's potential as a resource base and are keen to set up their own centers here. Many IT giants, by setting up their R&D centers in India, are making India a R&D hub for global IT companies.



According to DQ-IDC survey, 2007, multinational firms in the R&D business pay the highest salaries in the Indian IT industry (De, R, 2007). According to the survey, Cadence Design Systems (India) Pvt. Ltd, Sun Microsystems India Pvt. Ltd, and Honeywell Technology Solutions Lab Pvt. Ltd, pay very high salaries which include their R&D personnel and their primary activity is R&D in India.

In Indian IT sector, MNCs operation has been quite significant and hence this has been chosen as a case to highlight the factors that have drawn these MNCs to Indian shores and also the pattern of their linkages with the Indian R&D and production system.

#### **4. Developments in the IT sector in India during 1998-2003 through select indicators**

MNCs operations in Indian IT sector are delineated in terms of their choice of locations in India, R&D expenditure, manpower employed and their linkages with the R&D and production system as follows:

##### **4.1 Trends in the setting up of Foreign R&D centres in the IT sector**

A look at the trends in the setting up of foreign R&D centres in the pre and post globalization period reveals that 1996-2000 was the period when the maximum number of global firms established their R&D centres in India (table 2.). Prior to 1995, global firms did not use the mode of offshoring their R&D activities to Asian countries such as China and India. It is

A new trend in R&D internationalization has begun since 1995, where global firms are targeting the emerging economies in Asia, such as, India and China for their dedicated R&D activities. Coming to the IT firms, maximum number of IT firms established their R&D centres in India during the same period 1996-2000. The year wise break up of R&D centre in all the sectors and centre in the IT sector is represented in figure 3.

The table 2. also presents the number of IT firms which established their R&D centres in India as a percentage of the total no. of companies which established their R&D centres in India during three consecutive intervals of time period. While a total of around 52 % R&D centres owe their origin up to 1995, 34 % centres got established during 1996 to 2000 and another 13 % in the next four years.

## **4.2 R&D investments in the IT sector from overseas by the MNC,s during 1998-2003**

India has emerged as an important destination for R&D investments from overseas can be seen from table.3. United States tops the list of R&D Investments in the India during 1998-2003, followed by Korea, Germany, China, and UK besides several others. Of the total investments in R&D in India, the proportion of IT is substantial in terms of quantum (figure 4.). The table 3 shows the investments in the IT sector during 1998-2003 as a percentage of the total R&D investment by the various countries in India during that period. USA stands out as country whose total R&D investment in India has been very high in comparison to other countries (figure 5.). Almost 68 percent of its total R&D investment has been in IT sector. Out of a total of 100 firms which brought FDI in R&D, 36 belong to IT.

## **4.3 Manpower employed in the IT sector by various countries**



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R&D employment by US firms is the highest. It has employed maximum people in its IT firms compared to other countries during 1998-2003 (figure 6.). Within the IT sector, the percentage contribution of various countries shows that more than 3/4<sup>th</sup> of the total manpower employed by the foreign R&D centres in the IT sector in India is by the US global IT firms (figure 7). Around 76 % of the total manpower employed by the US companies in the Indian R&D sector is in the IT sector.

#### **4.4 Global IT firms and their linkages in India**

In this section, a few representative cases of the foreign R&D investment in India, their nature of alliances with the domestic R&D and production system is presented. The table 4 presents the list of Top 20 Global IT companies which were having their R&D centers in India with their R&D investments during 1998-2003 (figure 8.). It is seen that all the top 20 global IT companies are not only operating in India but have also established their R&D centers here. In doing so they have even forged their links with the Indian production system, MNC, s and other institutions as can be seen from the table 4. Firms R&D investment pattern and also their employment pattern along with their linkages with Indian R&D and production system are also depicted in the table.

The behavior of foreign R&D centres towards establishing linkages in the Indian IT sector is examined by looking at some of the alliances between the foreign R&D centres and their domestic partners (table 5.). This pattern is indicative based on some of the cases of the linkages between Global IT R&D centres and Indian production and R&D system

to the type of linkages. There are certain new product development centres, training partnerships, centres of excellence and also joint research facilities are some of the forms of linkages that we observe in Indian scenario.

This is based on around 60 global IT firms that have their R&D centres in India up to 2007. Out of these 43 R&D centres have linkages with the Indian production and R&D systems, which is around 72%.

The table 6 classifies the global IT firms in three different categories on the basis of their Industry linkages and the graphical representation of the same is presented in figure 9.-

- 1. Knowledge – seekers:** These are the firms which approach India in the search of centres of excellence and technically sound people. They don't mind even if the pay-scale of such people is high. In most of the cases they enter into collaborations with the technically renowned universities of ours such as IITs (Indian Institute of Technology), IIMs (Indian Institute of Management), and IISc (Indian Institute of Science) etc.
- 2. Joint-production seekers:** These firms concentrate on establishing the linkages with the Indian firms involved in the production of similar products and services. Their purpose is for joint product development, production and marketing.
- 3. A Combination of these two Categories:** In this category the firms go in for linkages with the intent of seeking knowledge and work with the Indian firms for joint product development, production and marketing.

The Table 6 clearly indicates that majority of the global IT R&D firms are in the category of a combination of both-knowledge seekers and joint production seekers. It is very important to note that there are some global IT firms who seek

university system for their R&D activities. This is a change from the earlier pattern where the global firms would go to other developed countries in search of knowledge resources.

## 5. DISCUSSION AND CONCLUSION

Since mid nineties, most of the global firms are actively investing in R&D set-ups in emerging economies. Low cost of operation because of cheap labour was considered to be the main factor for such a change. Though to begin with, this may have been one of the major factors but now the global firms are seeking the host country's S&T infrastructure for enhancing their capabilities. They have linkages with host country's R&D and university systems for their R&D activities in new and emerging areas.

India seems to have emerged as one of the most sought after location for establishing their R&D set-up by the global firms, the reason being, highly skilled human resource and also well established R&D institutions. Compared to other sectors, it is the IT sector which has attracted maximum FDI in R&D. Most of the global IT firms established their R&D centers in India during 1996-2000 and are planning to further expand their existing facilities and infrastructure. Many of them are carrying out a significant proportion of their R&D work in India, as a part of their business strategy. US firms are making maximum R&D investment in Indian IT sector. In the process, India has become a centre for global R&D activities. Almost 72 percent of the global IT firms that have their R&D operations in India are having linkages with the Indian production and R&D system. Most of the IT firms are establishing linkages with the leading academic institutions of India besides the leading Indian firms in Bangalore to access the skilled manpower.

Firms like HP, Oracle, Intel which can be very well placed in the category of knowledge seekers seeing their linkages with the technical institutions such as Indian Institute of Technology, Indian Institute of Science etc. The



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is emerging where the firms from developed countries are setting up their R&D activities in emerging economies to have access to their S&T resources. Major IT firms have set up their dedicated R&D centres such as Cadence Design Systems (India) Pvt. Ltd, Sun Microsystems India Pvt. Ltd, and Honeywell Technology Solutions Lab Pvt. Ltd, etc. These are not only pursuing R&D activity in India but also recruit the highly skilled manpower apparent from the very high salary structures. This again reconfirms the new emerging global R&D trends.

Thus a transformation is discernible in the Indian IT sector which has attracted lot of FDI in R&D. The factors which seem to govern foreign firms' decisions to invest in R&D in the IT sector are driven by supply side factors. Although the investigation of the depth and spread of the internationalization phenomena are still on by the authors yet the preliminary investigation have thrown interesting insights.

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**Table 1. Destination of FDI: Choice of the 500 executives**

	China	Euro area	Japan	Russia	USA	UK	India	New entrants	EU	Brazil
New consumer markets	49	9	2	5	7	2	9	15		4
<b>Low-cost Labour</b>	50	2	0	3	1	0	<b>29</b>	12		3
New partnership possibilities	20	22	5	5	14	4	12	14		3
New corporate markets	23	22	3	5	17	3	7	15		4
<b>Access highly skilled labour force</b>	6	22	7	3	14	6	<b>30</b>	10		2
<b>New opportunities in outsourcing</b>	16	9	1	3	7	2	<b>46</b>	12		4
Acquisition opportunities	15	20	2	5	13	5	8	22		9
<b>Research and Development activities</b>	11	20	5	4	22	7	<b>24</b>	6		3
Greater efficiency in supply chain	17	26	6	2	22	5	10	9		3

Source : Economic Intelligence Unit , 2004

**Table 2. Year-wise break-up of the IT firms.**

S.No.	No. of Firms	Year-Wise Distribution		
		Prior to 1995	1996-2000	2001-2004
1.	Total no. of companies which established their R&D centres in India	19	46	30
2.	No. of IT firms which established their R&D centres in India	10	16	9
	Percentage of IT firms' R&D centres to that of the total no. of R&D centres	52.63%	34.79%	13.33%

Source: TIFAC 2005

**Table 3: Investment in the IT sector in India country-wise.**

S.No.	Country	Total R&D Investment in India during 1998-2003 (million US \$)	Investment in the IT sector during 1998-2003 (million US \$)	Percentage of investment in the IT sector to that of the total R&D investment	Total No. of companies which established their R&D centres during 1998-2003	No. of IT Companies out of the total
1.	USA	761.32	515.19	67.67%	53	24
2.	UK	22.5	12.51	55.09%	7	3
3.	Switzerland	.70	0	-	2	0
4.	Sweden	1.08	.25	23.07%	2	1
5.	South Africa	.62	0	-	1	0
6.	Norway	NA	0	-	1	0
7.	Netherlands	17.20	4.69	27.27%	3	1
8.	Mauritius	10.74	0	-	2	0
9.	Korea	73	46.93	64.28%	3	1
10.	Japan	8.80	4.69	53.92%	7	1
11.	Germany	72.10	21.58	29.94%	7	1
12.	France	93.82	18.77	95.92%	5	1
13.	Denmark	.03	.03	100%	1	1
14.	China	56.48	56.31	99.7%	2	1
15.	Canada	10.63	0	-	3	0
16.	Australia	2.08	2.08	100%	1	1
	TOTAL	1045.24	638.07	65.35%	100	36

Source: TIFAC 2005

**Table 4: Top 20 global IT companies in India during 1998-2003**

S.No.	Name of the Company	Country of origin	R&D investment in India(1998-2003) million US \$	Manpower in R&D sector in India(1998-2003)	Domestic Partners during 1998-2003
1.	<b>Oracle</b>	USA	112.63	2700	HP
2.	<b>IBM</b>	USA	93.86	200	Phoenix Global Solutions, Indian research laboratory
3.	<b>Huawei Technologies</b>	China	56.31	500	-
4.	<b>Texas Instruments</b>	USA	52.14	500	Cranes software India Limited
5.	<b>Cisco</b>	USA	46.93	500	Infosys, Wipro, HCL
6.	<b>LG</b>	Korea	46.93	500	-
7.	<b>Intel</b>	USA	38.48	1000	Academicia and Government
8.	<b>Bell Labs</b>	USA	31.28	750	Lucent Technologies
9.	<b>Cognizant</b>	USA	25.02	600	IIT Madras, IIT Kanpur, IBM, Gartner Group, Forrester Research Meta Group
10.	<b>SAP</b>	Germany	21.58	700	-
11.	<b>ST Micro Electronics</b>	France	18.77	800	-
12.	<b>Aztec</b>	USA	17.43	418	Microsoft, Cadence, IBM, Novell
13.	<b>Aerotek Software</b>	USA	12.51	300	-
14.	<b>Adobe</b>	USA	12.51	300	-
15.	<b>Motorola</b>	USA	12.20	290	Bharti Enterprise, Cisco Systems
16.	<b>Mentor Graphics</b>	USA	9.38	250	-
17.	<b>Synopsis</b>	USA	9.38	250	View Logic Systems Inc
18.	<b>Microsoft</b>	USA	8.34	200	-
19.	<b>Intergraph</b>	USA	8.34	200	-
20.	<b>Iflex</b>	UK	8.34	200	-



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of R & D Investment pattern and linkages of different IT global firms in India\*

S.No	Name of the Firm	Firms' Global R&D investment	R&D investment in India	Linkages & Future Plans
1)	ABB Labs	700m US \$ (in year 2000)	10.9m US\$ (in 2003-04)	ABB labs has linkage with Indian Institute of Technology , Delhi, for technology development and knowledge sharing. Linkage with educational institution,a lab is setup for joint work in Bangalore
2)	Adobe India	613.2 m US \$(2007)	12.51mUS\$ (till 2003)	Working out collaboration with Indian Institute of technology and Banares university
3)	BELL labs research centre	4.7 b US\$ (in 2006)	200 million US\$(every year for the coming few years)	Bell Labs is also planning to enter into an agreement with leading academic institutions such as IITs to incubate ideas and promote R&D activities in the country.
4)	CISCO systems India private limited	4,580m US\$ (2007)	750 million US\$ (by 2008 end)	CISCO in collaboration with National Institute for Information Technology (NIIT) and Indian Institute of Hardware Technology (IIHT) to generate highly skilled labor for Cisco's global requirements. Collaborations with local Indian firms such as HCL, Wipro, TCS, Satyam, Zensar. 1)Cisco to invest over US \$1 Billion in India over next three years (in this 750 million US\$ are allocated to R&D sector) 2) CISCO to spend 200 million US\$ in India on a development centre.
5)	Dell India R&D centre	436.73m US\$ (in year 2004-05)	150 million US\$ (till 2007)	Dell plans to invest USD30m during the next five years in India. The company plans to add 300 to 600 engineers by the end of 2007 in its R&D centre in India. Dell plans to add 5,000 employees in total to its Indian operations
6)	EMC India Software development and support center	Over 1 billion US\$ (by 2010)	250 million US\$ (till 2007)	Company plans to double its investment to 500 million US\$ by 2010. EMC has an academy program in which it has an academic partnership with leading academic institutions in India aimed at building a resource pool of skilled professionals in the country. This program is expected to graduate 10,000 professionals by 2010. Wipro Limited and EMC Corporation announce a global strategic alliance.

				EMC and International Institute of Information Technology (IIIT ) Bangalore sign an education agreement. EMC and NIIT agree partnership to develop trained and certified information storage professionals. The company has alliances with 26 educational Institutes across India.
7)	Ericsson India private limited	28,842m US \$(2007)	100 million US\$ (every year)	Collaborations with Sony, Wipro, TCS for R&D consultancy service and telecom solutions. Joint venture with Tata Liebert.
8)	i2 Technologies	66.56m US\$ (in year 2004-05)	10 million US\$ (from 2003)	Partnership with Wipro, TCS, HCL, Accenture, IBM, Patni computers.
9)	Microsoft India development centre	8.03 Billion US\$ (2007)	0.83mUS\$ (till 2003)	1) Vodafone and Microsoft to offer SMS search for customers in India. 2) Wipro and Microsoft expand their strategic alliance to accelerate benefits to business. 3) Microsoft and TiE enter into a global strategic partnership. 4) It has decided to open offices in six cities in India, namely Ahmadabad, Indore, Nagpur, Chandigarh, Cochin, and Coimbatore under its geo expansion plan.
10)	Motorola India private limited	135.60 m US\$ (in year 2005)	17 million US\$ every year for the coming next few years.(already invested 85 million US\$ in R&D till 2007)	1) Undertakes Research in collaboration with IIT Kharagpur. 2)Linkages with Bharti Enterprise and CISCO systems(Indian office) 3) Motorola plans to hire nearly 500 people at its India R&D centre every year.
11)	Novell Software development private limited	194.83 m US\$ (in year 2004-05)	100 million US\$ (by the end of 2011)	Novell to invest 100m US\$ in India in the next three years. Novell is having a joint venture partnership with the Indian Company Onward Network Technologies. Novell plans to integrate Onward Novell Software (I) Ltd. with its research and development (R&D) centre in Bangalore and focus on selling Linux products in India.
12)	Oracle India development centre	2,205m US\$ (2007)	2 billion US\$ (from 2001 till 2007)	1) Oracle university in India offers oracle certified courses across oracle technology and applications. 2) Collaboration with IIIT Hyderabad. 3) Oracle partner network includes iflex, Wipro, TCS, Infosys, Satyam and Sonata.



				4) Oracle announced that it plans to invest USD125 million in India's I-flex Solutions, marking an increase in its ownership stake in the software company.
13)	Red Hat software services (India) private limited	71,038 m US\$	20 million US\$ (by 2008-09)	Collaborations with HCL info systems limited , Wipro InfoTech , Zensar technologies limited , Satyam computer services limited , iBLIT technologies limited Plans to increase its headcount to 200 by 2008.
14)	SAP Labs India	2835mUS\$ (2007)	500 million US\$ till 2007.	Collaborations with Hewlett Packard limited, Intel technology India private limited, IBM India limited, Microsoft corporation India private limited, Sun Microsystems India private limited. SAP to invest USD1 bn in India for its activities including R&D by 2011.
15)	SAS research and development	0.5 billion US\$ (2007)	20 million US\$ (in Pune center)	1) Collaborations with Blue star , Cognizant , HCL info systems , Wipro , Satyam , TCS , CBIA , ibill technologies ,HSBC 2) Various university linkages such as with IIT Bombay, IIIT Bangalore, AIIMS.
16)	Sharp India	1462mUS\$ (in year 2004-05)	5m US\$ (till 2003)	Partnership with Larsen & Turbo Limited and Bharat Forge Limited.
17)	Siemens Information Systems	6.70 b US\$ (2007)	1.2m US\$	SAP AG, i2 Technologies, IBM,SDRC,university linkages(Research & innovation award)
18)	STMicroelectronics Private Limited	1,802 million US\$ (in year 2007)	25 million US\$ (in year 2007)	ST enumerated plans to invest USD30 million in local operations by 2009. ST has inked a deal to set up joint research and innovation labs at two leading Indian technology Institutes, BITS Pilani and IIT Delhi.
19)	Texas instruments India private limited	2,155m US\$ (2007)	52m US\$ (from 1998-2003)	<b>Partners:</b> Cranes software India limited, Texas instruments has set up its Digital Signal Processing (DSP) laboratory at IISc Bangalore. TI is planning to ramp up its operations in India through expansion of its sales offices and partner network.
20)	Unisys Technology Development Center	231.7m US\$ (in year 2006)	180m US\$ (planned to invest by 2009)	Unisys India sign MOU with new Horizon college of engineering to address the talent gap in the Indian IT industry. The Company plans to invest a research center in Hyderabad. Plans to invest about 180m US\$ by the end of 2010 and increase its work force to around 4500 by the end of 2008.

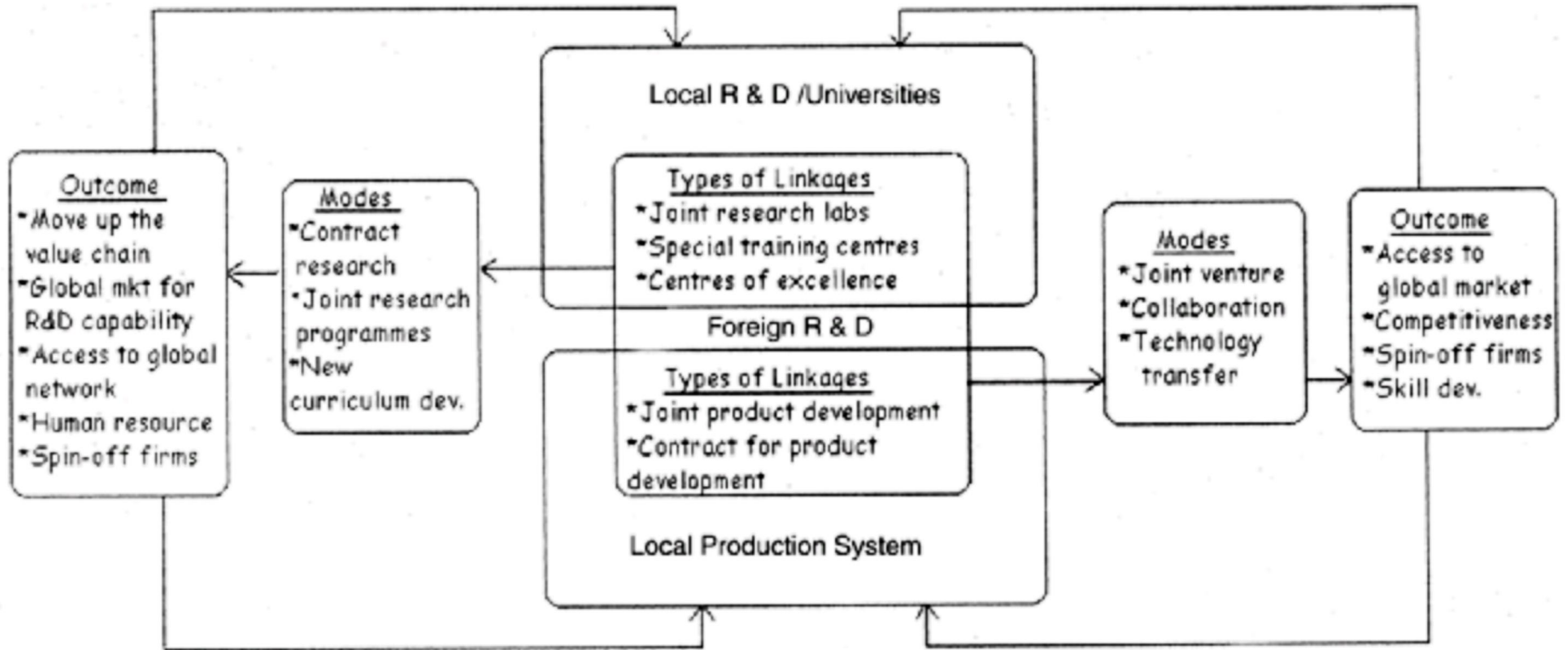
Source: Business news, Company news, company annual reports, marketline database

ut global IT firms R&D investment patterns in India and also globally along with an overview of their future plans in India. Here, the focus is on the pattern of linkages that these firms have established in India. As the data for some years was not available it cannot be compared

**Table6: Classification of R&D Centres based on Linkages upto 2007**

<b>Category</b>	<b>No. of Global IT firms having their linkages</b>	<b>Percentage of the total no. of firms</b>
<b>Knowledge-Seekers</b>	6	13%
<b>Joint Production Seekers</b>	15	36%
<b>A Combination of these two</b>	22	51%
<b>TOTAL</b>	<b>43</b>	100

between Foreign R&D Centres and the host country's R&D and Production System and the probable outcomes



## Hub-wise and Year-wise distribution of the foreign R&D centres in India

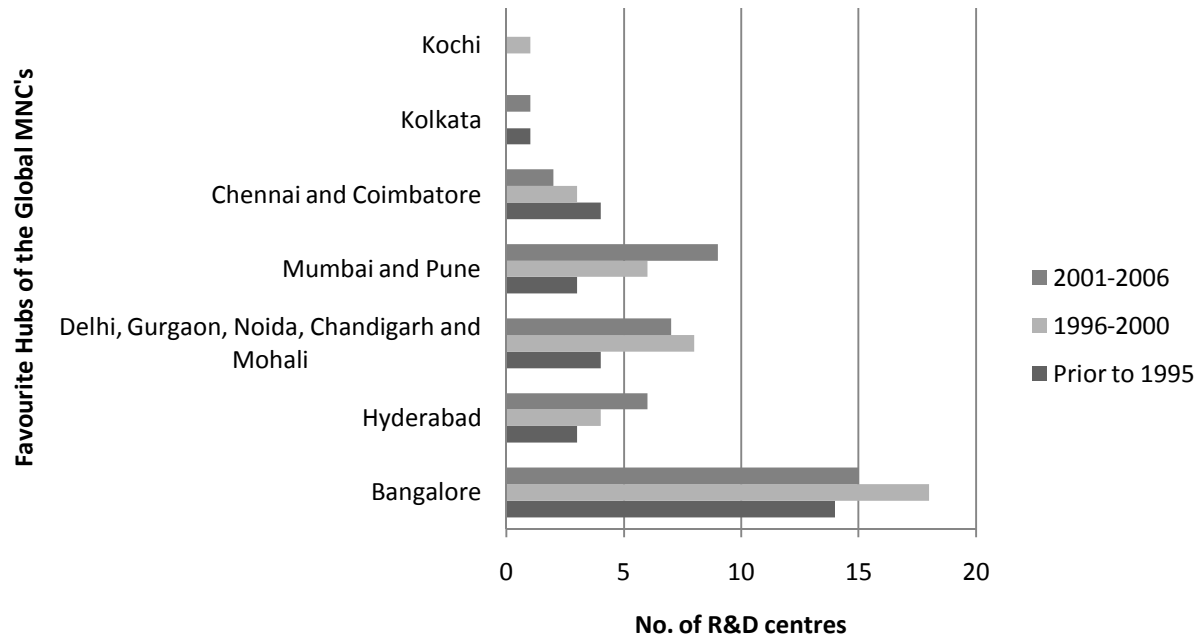
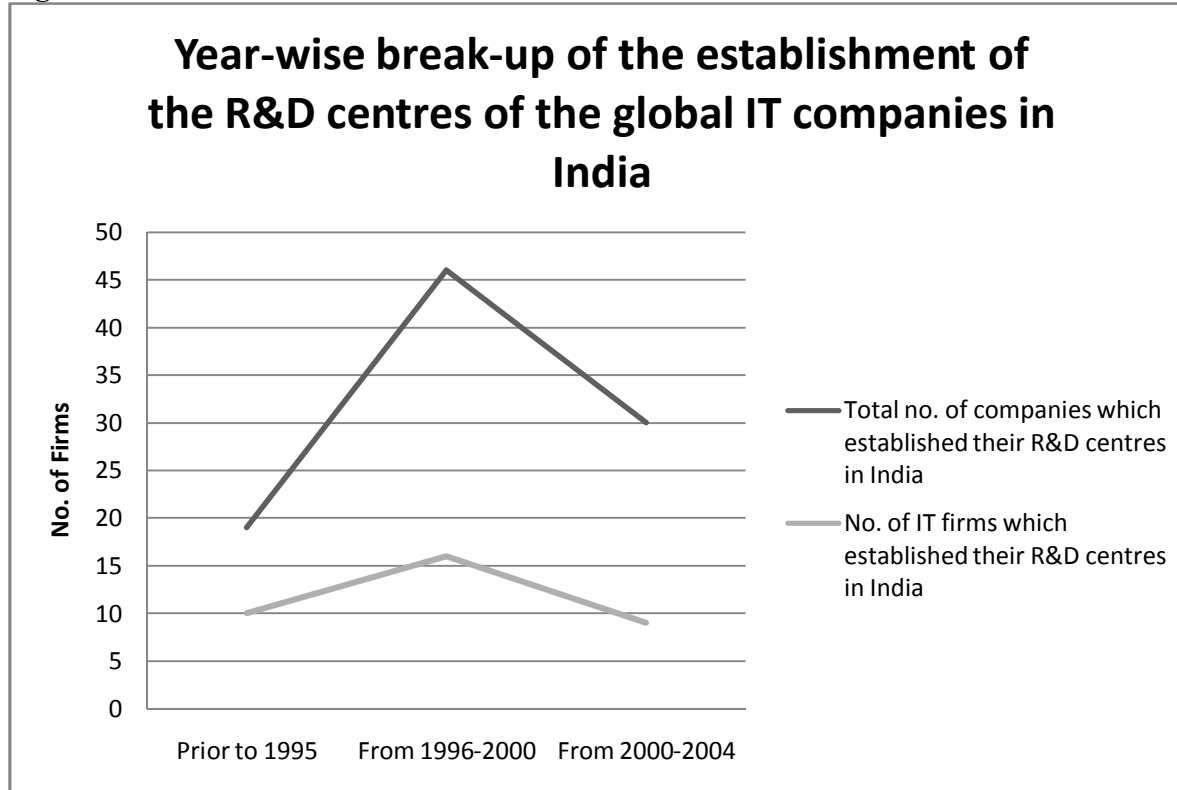
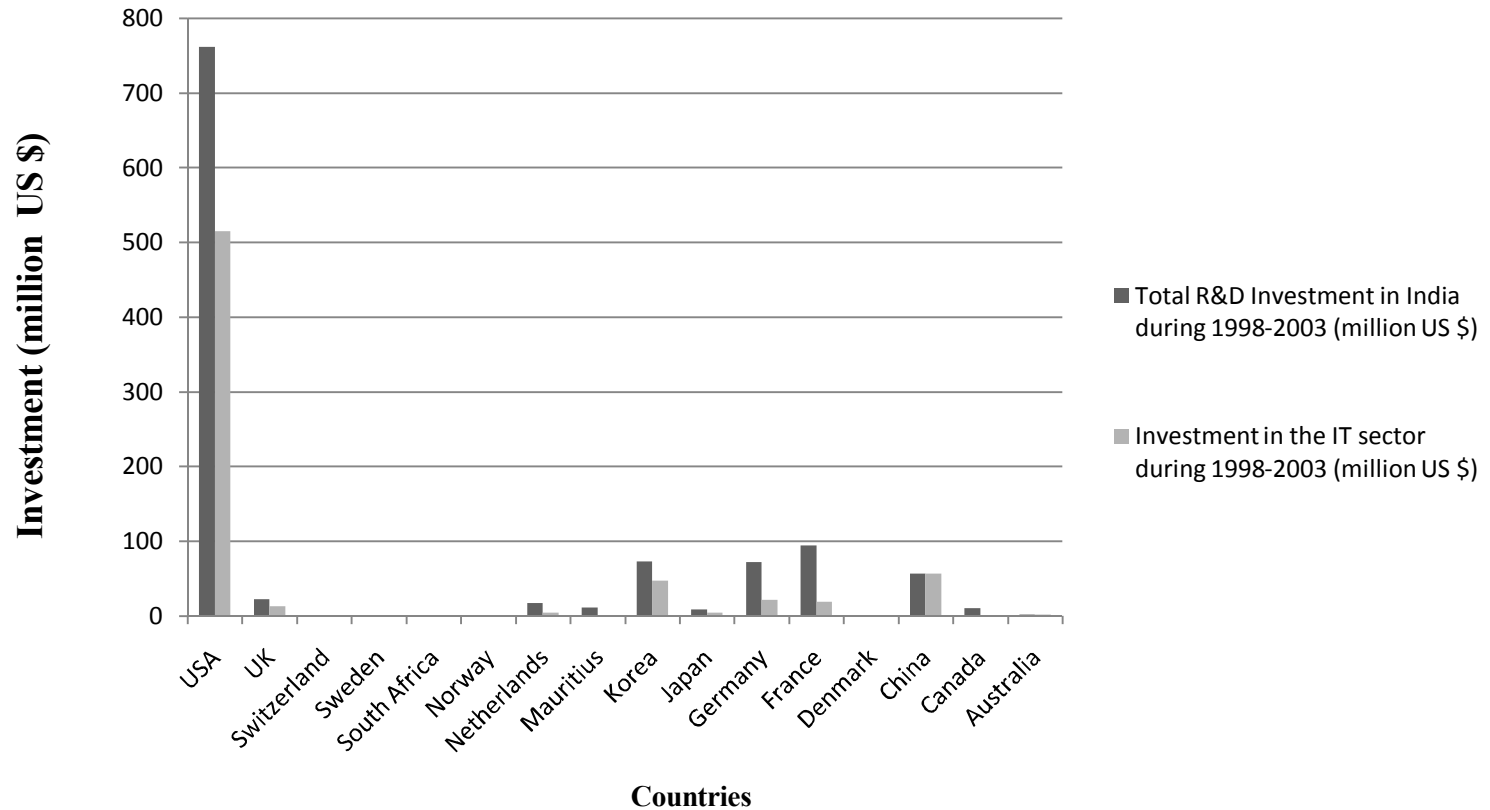


Figure 3:



### Investment in the IT sector in India as compared to the total R&D investment during 1998-2003



**Figure 5:**

**Percentage distribution of total R&D investment in IT sector by  
various countries in India during 1998-2003**

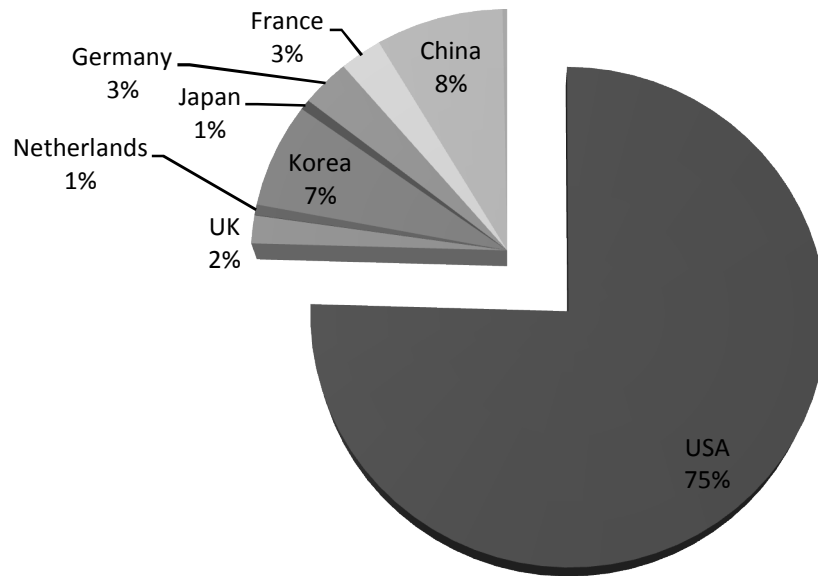
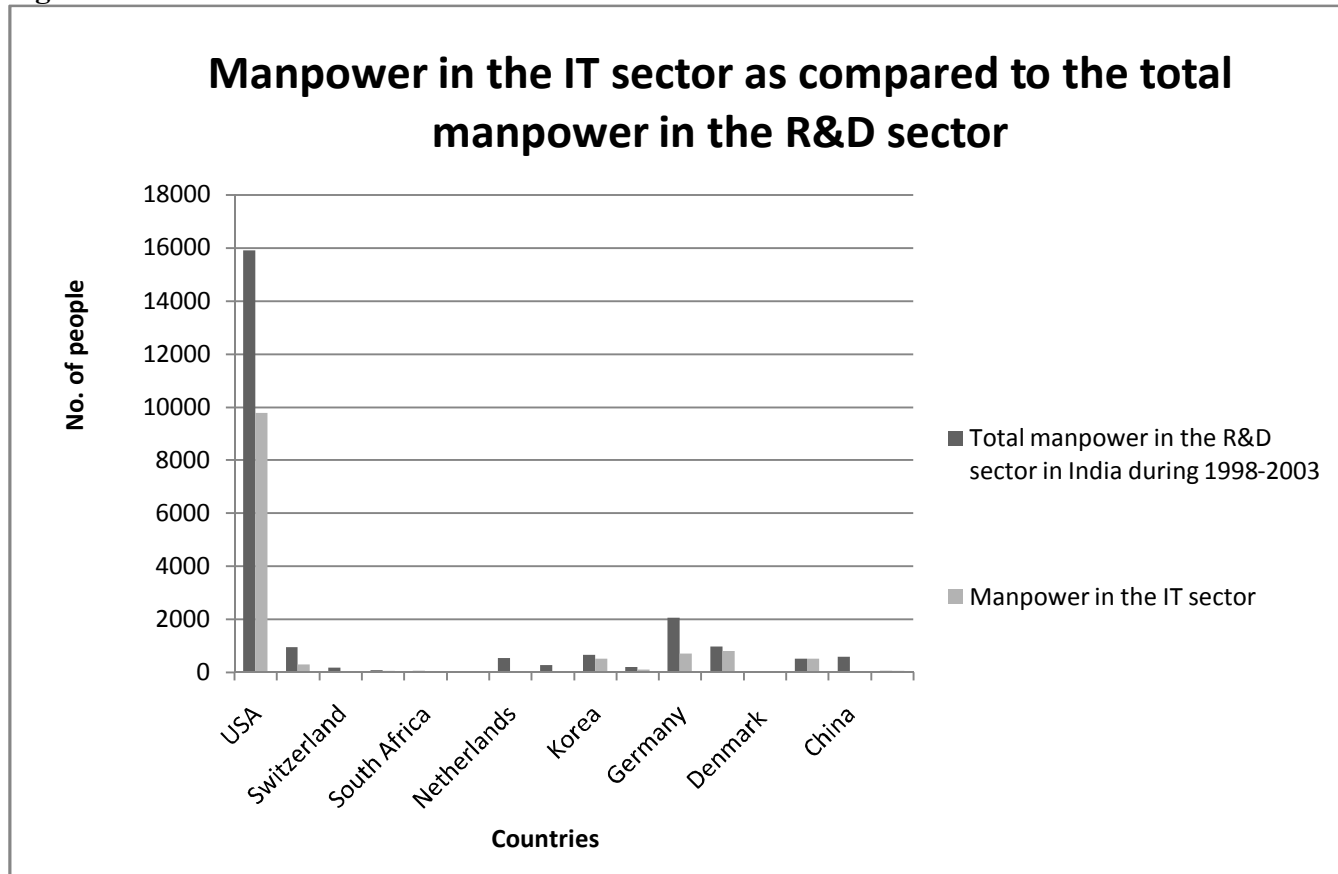




Figure 6:



### Percentage of manpower employed by various countries in Indian IT sector during 1998-2003

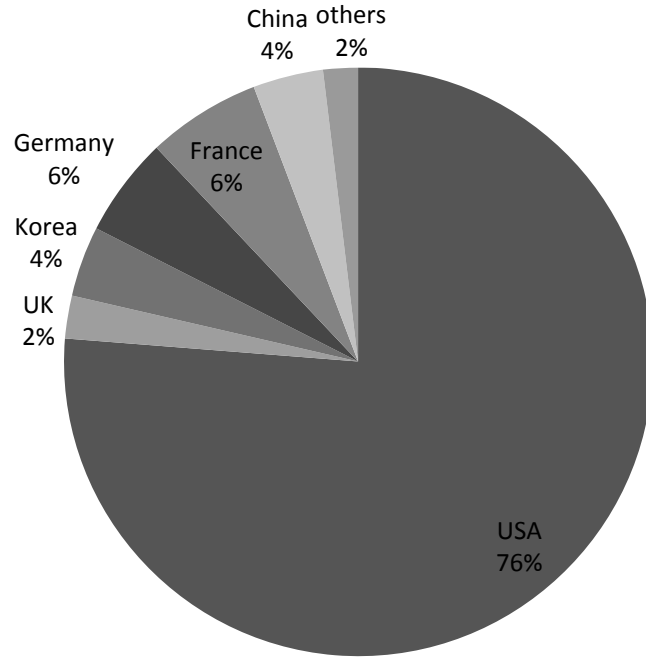


Figure 8



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### Top 20 Global IT companies during 1998-2003 according to their R&D Investment

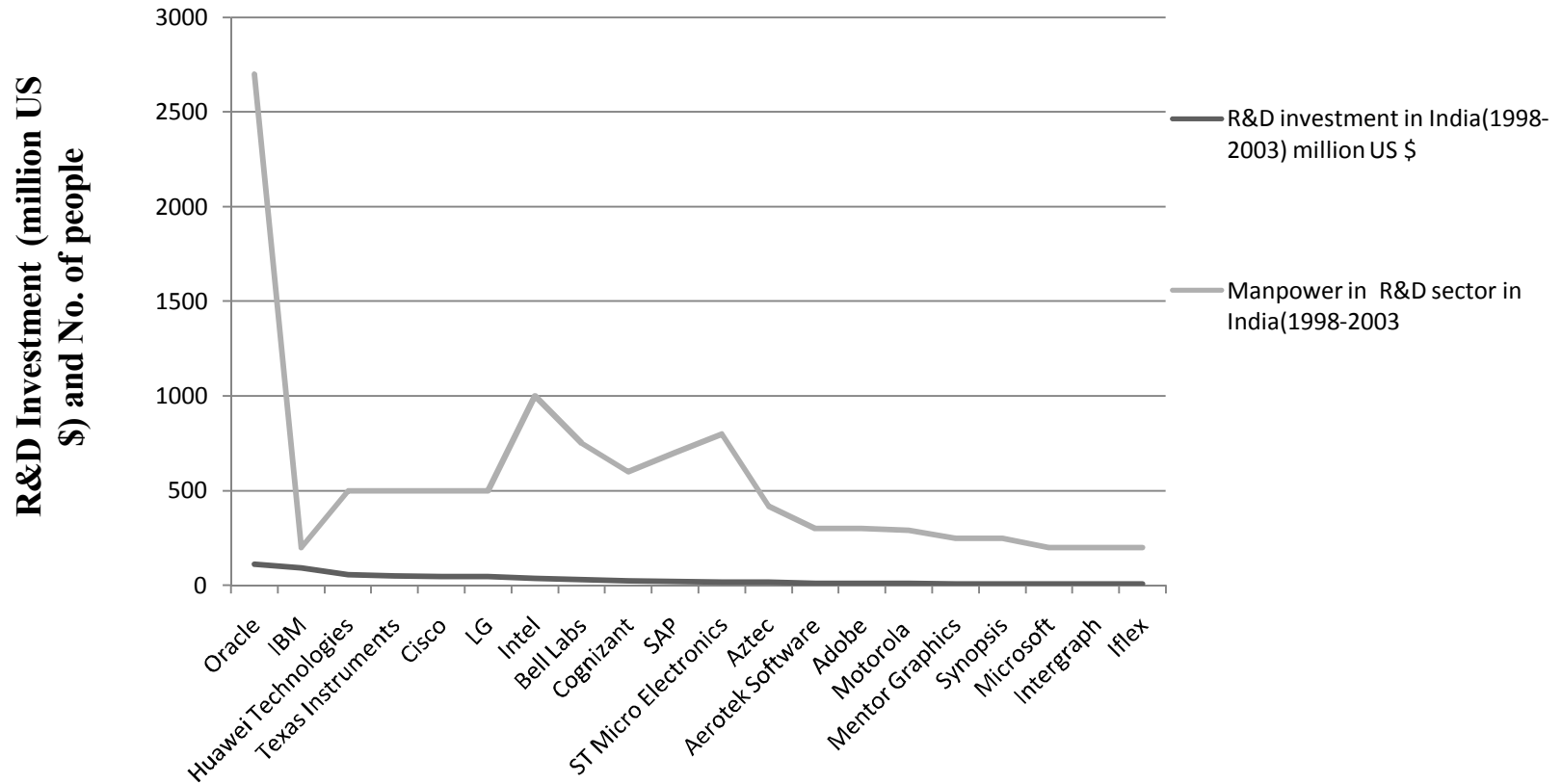


Figure 9

### Categorization of the Global IT companies on the basis of their Linkages

