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IT Clusters in India

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Abstract

One of the facilitating factors that enabled the rise of IT industry in India is the evolution of IT clusters. A study of these clusters can provide interesting insights. The rise of the Banglaore IT cluster was due, among other things, to some of the policies the Indian government took three decades or earlier. It would be difficult to talk of "benign neglect" of the government towards this sector. Different factors worked in the case of Hyderabad. A comparison between the IT clusters in India has much to tell the new emerging IT clusters in India as well as those outside of it.

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IT Clusters in India

- G. Balatchandirane

Foreign interest in the Indian economy has been on the rise since it was opened up in the early 1990s. While the large domestic market was an attraction, what really fuelled the rising foreign interest was the growth performance of the Indian economy. Last fiscal India grew at 8.1%, which was just below the Chinese growth rate. In the first half of the current fiscal India has grown at an even higher rate of around 9%. India's rise in the field of Information Technology[1] made the world take increasing note of her; the rise of offshore outsourcing (offshoring) and the subsequent perceived "loss" of jobs in the US heightened the awareness of, and interest in, India.[2] China is increasingly seen as the manufacturing hub of the world and India, it is held, would rapidly modernize through the service industry which is on a dynamic growth path. While the IT industry's overall share is small, the rapid growth rate it has been registering seemed to give credence to this outlook.

A large number of writings have discussed the economic growth potential of India of late. One such that had a huge impact in both the academic and popular discourse was what came to be called as the BRICs report.[3] The term BRICs refers to the four economies of Brazil, Russia, India and China. The report held that the collective economic weight of the BRICs countries which was about 15 percent of the combined G6 economies (namely the US, Japan, UK, Germany, France and Italy) in 2003 would reach 50 percent of that value by the year 2025.

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[1] Terms like 'IT Superpower' to describe India are misplaced. While the growth rates in the Indian IT industry have been impressive, the Indian IT industry's total sales were about US$ 36 billion this fiscal, as against the global figure of approximately US$ 1500 billion. In other words, India's share of the world market is just a little over two percent.

[2] Much has been written about the offshoring issue. For a balanced and extensive study see Aspray, William, Frank Mayadas, Moshe Y.Vardi, eds., 2006.

[3] Wilson, Dominic and Roopa Purushothaman, 2003.

In less than another two decades they would overtake the G6 economies in US dollar terms. Of all the four BRICs countries, India had the most consistent growth potential and its growth rate would continually be above five percent till 2050. If things went right, the economy of India would be larger than that of Japan by 2032 to become the third largest economy in the world behind only China and the US. By the year 2050, it could raise its US dollar income per capita to 35 times the level in 2003.[4] There has been no major criticism of the BRICs report so far. If anything, World Bank has predicted that India is likely to become the third largest economy in the world even earlier, by around 2025.[5]

One of the major contributors to this could be services, and the IT sector could be playing the stellar role inside this. The IT sector has been able to register high growth rates consistently in the recent past and the predictions portend an even rosier scenario. The Indian software industry has grown at a phenomenal compound annual rate of over 50 percent in the 1990s, the highest for any county during this period. Most Fortune 500 companies outsource some of their software-related work from India. Currently India is rated as the premier offshore destination for IT services on par with Ireland and the competitors like China and Russia are way behind. Some of the best performing and most admired industries in India are IT-related industries. Significant and rising shares of Indian exports are accounted for by IT-related services. The compensation packages in this industry are the highest in India having grown annually at rates between 15 and 20 percent in the last decade, clearly reflecting the very high productivity rises in this sector.

For 2004-05, the IT-ITES (IT enabled services) production in India was US $ 28.2 billion.[6] There was a 28 percent growth in year 2005-06 notching a figure of US $ 36 billion. Service exports (IT-ITES), account for about two thirds of this

[4] While these predictions might be impressive, it has to be remembered that on a per capita basis, India would be much behind the advanced nations.

[5] For instance see the statement of Graeme Wheeler, Managing Director of the World Bank at http://www.export.gov.il/Eng/_Articles/Article.asp?ArticleID=4468&CategoryID=612 Accessed on 11th December 2006. Also see Economist 2006.

[6] Unless otherwise stated, the figures relating to Indian IT industry have been taken from NASSCOM 2006 and NASSCOM 2005.

figure, and are estimated to have grown by 32 percent in the current fiscal. Since 1999-2000, the Indian IT-ITES industry has gown at a Cumulative Annual Growth Rate (CAGR) of over 28 percent. Over the same period, the industry's contribution to the national GDP has risen from 1.2 percent to around 4.8 percent in the current fiscal. By FY 2009-10 the exports of the IT-ITES sector alone are expected to exceed US $ 60 billion.[7]

The total direct employment in the Indian IT-ITES sector is estimated to have grown from 284,000 to a projected 1.287,000 in the FY 2005-06. In addition to the 1.3 million strong workforce employed directly in the industry, Indian IT-ITES is estimated to have helped create an additional 3 million job opportunities through indirect and induced employment. Currently, software services are India's largest export. The US absorbs about two thirds of all of India's IT and ITES exports. Japan accounted for three percent; South Korea's share was just 0.2 percent and China's was a measly 0.1 percent.

Reasons for Growth

A number of factors seem to have propelled India towards the position of a dynamic IT player in the world. These would include, a large and educated labor force, widespread fluency in the English language, comparatively low labor costs, high quality of the work force (in terms of minimal complaints against the services and products provided), absence of barriers to setting up back offices in India, reasonable availability of infrastructure in the IT clusters like Bangalore, Hyderabad, Chennai, National Capital Region, Pune etc. To this one has to add the fortuitous circumstances like the boom in IT in the world which took place and coalesced with the start of the reforms in the Indian economy in the 1990s when a number of regulations which stymied the economy were removed.

Clusters

[7] The impact of the IT sector on the Indian economy can be potentially very large. A wide range of works have covered this some detail. See for instance, Thatchenkery, Tojo, Roger R. Stough, Govindasamy Balatchandirane and Rupa Ranganathan, 2005.

Industrial clustering[8] takes place as it brings a number of benefits: rapid interchange of information and knowledge (about best practices, about market opportunities), locational economies (it is cheaper to provide infrastructure to a cluster of software firms than to the same number of firms that are scattered), and a raised marketplace profile. Government has supported these efforts by bringing infrastructure to the clusters and through incentives. IT clusters like Bangalore may not have any way other than following the clustering approach to leapfrog in the global competition in the IT industry. In what follows we try to see the details of one of the better known clusters, Bangalore and contrast it with Hyderabad in some detail.[9]

Bangalore

Bangalore has had a number of features, some historical, and some recent, which were advantageous to the rapid development of the IT industry. It should be remembered that the positive attributes provided only the potential. Among the historical advantages of Bangalore are the educational institutions, the presence of a number of public sector undertakings, the accommodating local population, the conducive climate, the entrepreneurial nature of Kannadigas, the metropolitan character of the city etc. The more recent factors that played a positive role in the IT sector boom in Bangalore would be the policy initiatives of the government (both central and local), availability of a large number of skilled professionals, the Y2K problem, and role of the Indian Diaspora etc. The ICT cluster in Bangalore has over 1500 IT firms out of about 3500 IT firms in India. In fiscal 2005-06, the state of Karnataka accounted for 37.6 percent of the total software exports from India and the city of Bangalore alone accounted for about 97 percent of it. Thus around one third of all of India's software exports are from the city of Bangalore.

In terms of all the IT clusters in India, Bangalore occupies the number one

[8] There is a vast literature on industrial clusters. For instance, see Schmitz, Hubert and Khalid Nadvi 1999. and Kuchiki, Akifumi and Masatsugu Tsuji eds., 2005. We confine ourselves to the more recen studies that relate to IT clusters. See among others, Quah, Danny 2001, Okada, Aya 2005, Basant, Rakesh, 2006, Eischen, Kyle 2000a and 2000b, ramachandran, Kavil and Sougata Ray, 2005 and Saxenian, AnnaLee, 2001.

[9] For this I draw partly on Balatchandirane G 2004a and 2004b.

position in terms of exports of software, followed by the National Capital Region (comprising of Delhi, Noida & Gurgaon), Chennai, Hyderabad, Pune and Mumbai. Bangalore is the largest employer of software professionals in India. The city employs about 160,000 people in the technology sector. IT accounts for 100,000 of these jobs with the rest in business process outsourcing and call centers. The United Nations Human Development Report has ranked Bangalore as the fourth as a global hub of technological innovation

After the success of India's first offshore chip-design center setup in 1985 by Texas Instruments at Bangalore, new companies like Intel, Cisco, IBM, SAP, HP, Philips, Sun Microsystems, Oracle, Peoplesoft, Honeywell, AOL, Accenture, Google, Yahoo etc opened their offices Indian companies like Infosys, Wipro, Iflex have a strong presence in Bangalore.

Educational Institutions and training centers:

Karnataka state, of which Bangalore is the capital, has historically had a positive attitude towards education and learning, with a number of the princely rulers encouraging the spread of education. In 1807 the creation of a military base in Bangalore led to the emergence of the city as an educational center. The first English medium school was begun in 1842. The first engineering college was set up in 1917. The Indian Institute of Science (IISC), which is a world-class research institute today, was set up in 1911 by the Tata family. There are other world-class institutions like the Indian Institute of Information Technology (IIIT), Indian Institute of Management (IIM) etc in Bangalore.

Bangalore had high literacy rates even in the 1950s. The literacy rate in Bangalore in 1951 was 43 percent compared to the national figure which was less than 17 percent and it was 86 percent in 2001 while the national figure was just 55 percent. The very large number of engineering colleges in the state has meant a steady supply of large numbers of highly educated, skilled persons for the IT industry.

While the educational institutions provide the intake for engineers and

managers for the IT companies in Bangalore, their in-firm training is considered extremely important as software creation demands an awareness and knowledge of latest development in the field. Most of the major companies have invested heavily in training. The Infosys Company has a facility for training 10, 000 engineers a years in Bangalore, possibly the largest in the world. The IT firms in Bangalore make large investments in training, professional development programmes, techniques and methods, process and people management initiatives. In the year 2001, training accounted for about 5% of revenues for the firms. In addition firms like Infosys spent around 5% of their revenue on R & D.

IIM Bangalore runs courses which it believes are the need of the hour. There is a specialized program in Masters in Business Administration designed especially for the IT professional. Naturally the IT majors have a stake in such a program as this would ensure a supply of very skilled and qualified professionals who can enter their labor force. The interesting aspect is that while the IIM Bangalore does interact with industry, accepts large donations from the industry, it still retains it autonomy. The private industry cannot control or decide on the kind of course that will be run or how it will be run. IIM Bangalore decides completely on it own about its course, which is a highly sought-after program.

Research Institutions:

A number of research institutions were established in Bangalore as the central government had, soon after Independence, decided to nurture strategically sensitive industries away from the borders and the coastline, so that they do not make easy target in times of war. Likewise, a large number of military related research and production outfits like the Indian Space Research Organization (ISRO) were started at Bangalore. This in turn led to the rise of a large number of universities and other educational institutions related to engineering and scientific training. Public sector units like Hindustan Machine Tools (HMT), Bharat Electricals Limited (BEL), Bharat Heavy Electricals Limited (BHEL), Hindustan Aeronauticals Limited (HAL), and Indian Telecom Industries (ITI) were some of

these. Electronics firms were also set up as they offered inputs to the research institutions as well as the industries. Software in the initial phases was more hardware centric, and hardware firms tended to set up shop in the vicinity of software firms in Bangalore.

Some of the scientists and engineers working in these places were working at the cutting edge technologies of their fields. These institutions have been in existence in Bangalore for quite some time, so there is a culture of high level science and technology research in Bangalore as compared to other cities of India. Thus Bangalore had the personality of the science and technology capital of India. This resulted in Bangalore having a history of being a research and development (R&D) hub; the government had poured considerable amount of resources towards developing its scientific talent and infrastructure. The density of PhDs per square kilometer is the highest in Bangalore compared to any other city in India. Bangalore was thus provided with a suitable environment for the take off of the IT industry in the mid 1980s.

Some of the pertinent points to emerge from a study done by NASSCOM and Hewitt Associates[10] listed below go to show the importance attached to training by the IT companies. This applies to companies all over India.

1. Nearly all companies (95%) have a formal development and learning needs analysis program.
2. Review of development and learning need is typically carried out on a quarterly basis.
3. The most commonly used mechanisms to support continuous learning and development for employees are organizational libraries, assessment of skills/knowledge/abilities and job postings/internal transfer systems.
4. The median number of training hours per employee per year is 40. The distribution of training hours across behavioral and technical training programs varies with level of employees. Senior employees get more behavioral training;

[10] See NASSCOM 2004

up to 60% of the training is either on managerial or interpersonal skill enhancement.

5. 98% of the companies have a formal training feedback mechanism.

Government policies (central and local):

Some have talked about the benevolent neglect of this industry by the government; and that unlike other sectors of industry the IT industry flourished, as this sector was not interfered with. This kind of argument could be appealing as the government and the bureaucracy were well known for meddlesome interferences and regulations that stymied much of Indian industry before the liberalization process started in 1991. While it is true that the government was not overly regulating this industry, it is possible to talk of the government's role as being more than benign negligence.

The government had foreseen the potential of software exports as early as in 1972 when a Software Export Scheme was launched offering concessions to software exporters. In the mid-1970s the government passed a law insisting on the local ownership for software firms. Some foreign companies like ICL accepted, reducing its equity to 40 percent. IBM refused and chose to leave. This only encouraged Indian firms to struggle to fill up the void and meet the demand. UNIX, a non-IBM software was mastered and Indian firms created software using UNIX. Even in the early 1970s, computer ad software education and training were emphasized and institutions that focused on training were allowed to import hardware at much lower import duties.

In the early 1980s, there was a tight foreign exchange situation and industries which needed foreign exchange to import technologies and machinery had to petition the government of India for the release of foreign exchange. There were stringent rules and most of the time it was difficult to get the requisite amount of foreign exchange. On the 1st January 1981, the Software Export Policy press note was issued. Under this policy, it was possible for a company to get a particular amount of dollars released if it would export twice that amount of dollars

worth of products in the next five years. The company had to just show it had orders for the requisite sum of dollars worth of goods. The first Software Export Processing Zone was inaugurated in Bangalore around 1981. This availability of foreign exchange enabled a number of software companies to import computers and other required components. This policy acted as a boost for the fledging software industry.

After the eighties and during the time when Mr. Rajiv Gandhi was the Prime Minister there was the political slogan of preparing the country for the twenty first century and the major impact was on giving lot of incentives and liberalization with regard to import of computers. The central government came up with a tax holiday, waiving tax for 10 years for IT startups in the early 1990s. What this meant was that anything bought in the international market by the IT companies for their business attracted no duty on the imported product. The IT startups in India found that they were exposed to almost the same price as other IT companies say in California. The price of an input in the developed foreign market and that in India was the same. So this put Indian companies on par with the foreign competitors as far as machinery input cost, which was considerable in those days, was concerned.

In addition, the corporate income taxes was made zero for ten years. Suppose one set up a company in 1992, from 2003 onwards he had to start paying regular taxes. Later on the industry lobby asked for more tax breaks so the government went on extending the tax holiday. Right now it is till 2010, from which time onwards the Indian IT companies will have to pay 30 percent corporate taxes. Needless to add, this enabled a large number of Indian IT companies to survive the initial years against the bigger players both at home and abroad. A large number of specific government policies that were to facilitate the growth of this sector can be identified.[11]

The state government acted in a promotional manner. It offered many

[11] Basant, Rakesh 2006 gives details.

incentives besides tax holidays and others. It offered preferential treatment on, for instance, land allocation, provisioning of electrical supply, provisioning the communication infrastructure and so on. There were many such incentives largely promotional in nature that were offered to the IT industry, which on the one hand reduced the costs of setting up and operating an IT company and on the other, ensured preferential treatment compared to other industries of the old economy.

Texas Instruments which had set up office in 1984 in Bangalore, petitioned the Indian Government for leasing a 64k line for transferring data from India to the US. Indian Government, both at the center and state, were worried about what would happen if a 64 k line was given to a foreign company. So it took three years for the government to decide and give the 64k line to Texas instruments. The major problem area in the initial years for Texas Instruments was connectivity. The state monopoly which provided the last mile connectivity was called as the Department of Telecommunications (DOT) and was very inefficient. Texas Instruments wanted to connect the building they were in at Bangalore to their office in the US. They had to connect to a telephone exchange and the exchange then connected to a long distance company, BSNL, the local loop provider. It was the only provider available and it was a state monopoly. BSNL would connect to yet another company which provided the submarine cable and connect to the coast of United States. From United States coast it would be a reversal of this process. So there was half a circuit in India and a half circuit in the US. The US half circuit was very efficient. On the Indian side there was a state monopoly which was very inefficient. So it took a long time to get the connectivity. To get a simple telephone connection it used to take 2-3 years in the eighties. To get a huge data connectivity, it was even more time consuming and it was not reliable. The foreign companies like IBM got fed up of the connectivity problems and they wanted to pull out of the country.

Around this time the government started a competing institution called Software Technology Parks of India (STPI). India's first international gateway and

network operations for Information Technology were established at the STPI in Bangalore's Electronic City. The STPI is an autonomous society that was established by the government under the Ministry of Information Technology for the purpose of promoting export of software. The main issue at that time was efficient last mile connectivity. And the way the problem was solved in Bangalore was by the installation of a satellite tower on top of a building and the use of dish antennae. In Electronic City in Bangalore, even today the data is sent overseas through a satellite unit using radio waves and not through the ground. Digging the ground was avoided because of the inefficiency of the state monopoly. The Department of Telecommunications was collecting the signals through radio waves and directly sending them via satellite to Europe and from Europe it was easy to send to the US as the market there was well developed. This is how India solved the problem of connectivity initially and even today STPI in Bangalore has at least 1300 companies, which use this mode of transfer of data. Incidentally, IBM stayed on once the connectivity issue got resolved.

What was done for IBM was that the entire data transfer operations were set up digitally. The sector was liberalized and more private players were invited. Now there are other private firms like Bharati, Reliance etc which are known aggressive companies. Because of them the public sector has also become more efficient. Now there is intense competition for the connectivity. Now a company can get the connectivity in Bangalore including the last mile connectivity in less time than it takes in the US. This one development alone has significantly propelled the development of IT industry in Bangalore, where the telecommunications issue was thus taken care of.

Y2K Problem:

One of the fortuitous events that was to impact on the development of the IT sector in Industry in India in general and Bangalore in particular was what was called as the Y2K problem or the Millennium bug problem (Year 2000 problem). There were a very large number of companies which had legacy implications which

they would have liked to carry on and these were required to be attended to in the nineties. The legacy implication meant that one has to make the services available for the continuity beyond the year 2000. This was an opportunity for a large number of Indian companies to show to the world that they could deliver the goods in high technology areas. They started solving the problems of a number of customers all around the world in the mid 1990s. The Y2K problem ultimately resulted in two things. Firstly, it meant a lot of revenue for the fledging Indian companies and secondly, equally if not more important, it made a lot of customers outside India to have confidence in the capabilities of IT engineers in India and led to the belief that Indians can deliver. It was the success of Y2K that led to a lot of contracts. This resulted in giving an important impetus to IT development in Bangalore.

Diaspora:

The Indian Diaspora is estimated to be around 20 million with about 1.7 million in the US. There are around 1.2 million citizens of Indian origin in the UK. Canada has about 850,000 and Australia about 200,000.[12] Unlike other immigrants to the US, the Indian Diaspora in the US is largely made up of professionals and their families. The Indian Diaspora is characterized by having a high level of income, US$ 60,093 per annum versus US$ 38,885, the national average. The Indian Diaspora is also very highly educated. 62 percent have college education as against 20 percent for the US population. Around 300,000 Indian Americans work in technology firms in Silicon Valley with an average annual income of around US $ 200,000. Indian immigrants in Silicon Valley managed approximately 9 percent of all new start ups in the late 1990s. In early 2000, one third of all IT companies in Silicon Valley were either managed by Indians or employed skilled Indian IT workers within its ranks. These numbers have been boosted by the large number of Indian IT engineers who visit the US every year for short term stay and sometimes long term. The role of the Indian IT Diaspora has a

[12] See High Level committee on Indian Diaspora, 2001.

significant impact on the development of IT industry in India. A number of them were to head operations of MNCs in India. Their networks in the US coalesced with those of Indian engineers in Bangalore and facilitated the rapid dissemination of ideas, information about jobs, cutting edge software etc.

During the 1980s, Bangalore sent a lot of software industry engineers who took jobs in the US. These mangers of Indian origin were to convince their firms to consider outsourcing to India. A number of them returned and started new companies. In 1999, Indian IT workers were issued 165 000 out of the 200 000 H1B visas offered to foreign IT workers in the US20. Besides the US, European countries such as the United Kingdom (UK) and Germany have also offered visas to attract Indian IT workers. Even Japan has joined the fray to recruit Indian IT workers when it announced multi-entry visas valid for up to 3 years for Indian IT professionals working in Japan. The downturn of the IT market in early 2001 increased the flow of returning Indian internet veterans from Silicon Valley. These IT veterans brought back with them precious management expertise and knowledge of cutting edge technology which they used to establish their own startups in Indian IT hubs like Bangalore.

According to one estimate, 71 of the 75 multinationals in Bangalore's software technology park were headed by Indians who had lived and worked overseas especially the US. Companies like Yahoo, HP and General Electric opened operations in India as they were confident of the quality of Indians as there were a number of them working in their offices in the US. Indians also prefer working in the US for say a number of years and then come back to head the operations of their company. That way they are able to be in India and also not jeopardize their careers. As these Indians know the market in US and the needs they develop software suited to the US market. They are aware of the local conditions in Bangalore and offer the best interface.

In the last four years or so, a new trend has emerged. Young Indian IT engineer return to India after having worked in the US for 5-7 years. These are in

their late twenties or early thirties and in the last four years their number is in excess of 30,000. The major reasons why they are returning are that the salary levels which grown rapidly in the last decade just substantially narrowing the income levels for these engineers in the US and India, a profusion of large R & D establishments of the US firms like Microsoft, Cisco, Oracle etc where the job challenges match those encountered in the US and a booming Indian economy which has created oases of comfort comparable to the developed world and a possibility of staying close to one's family. So clusters like have been able to benefit from this "brain circulation".

Quality Issues:

The international benchmark of excellence for software development could be gauged using the ISO 900 certification and of the 300 leading IT companies with this certification, more than 170 are based in India. Another often used IT benchmark is the SEI-CMM standard developed by the Carnegie Mellon Institute in the US. The SEI-CMM standard ranges from a scale of 1 to 5 for excellence. There are over 50 companies worldwide with SEI-CMM Level 5 status. India has about 40 companies with CMM Level 5 and more than half of them are found in Bangalore.

Others issues:

It is relatively easy to get the computers and other machinery that one's competitor has. What is difficult to get is the skilled people who can come and do the research or write the software. Bangalore has a way of attracting these people to the city and that is the major secret why this city has been growing. IT professionals, who come to work in Bangalore, feel very comfortable to live there. With various cities in India vying to replicate the success of Bangalore, the IT professional can pick and choose where he wants to go. The personality and culture of Bangalore city is an intangible asset. So when a pool of people very highly technically qualified people are hired by an IT company in Bangalore from other parts of India, they are ready to come and work there. Good climate of the city round the year and accommodating nature of the people of Karnataka is

another factor. People of Karnataka accept people from other areas much better than people in any other province of India. The availability of good schools is one consideration for IT professionals with children when they decide to settle in Bangalore and Bangalore has a large number of high quality schools and colleges.

Impact on local economy

If we the tax collections in the state of Karnataka as a whole, the taxes raised in 2004 were about 25% more than that in 2003. But interestingly, when we analyze the data, if we remove the contribution of Bangalore in the total collections, the tax collections for the rest of the state were negative. But as tax collections in Bangalore city have gone up by 40-45% per annum of late, the overall figures for the state were positive, with the state recording an increase of about 25% over last year. This shows how much weight the single city of Bangalore accounts for in the overall tax collections for the state. Needless to add, the booming IT industry's role in this was significant.

Jobs creation:

A whole range of new jobs have been created to cater to the IT industry which has been rapidly growing in the city. Because there has been a mushrooming of IT companies in Bangalore, the sellers of hardware have opened offices. They cater not only to the sales but also to the after sales service for the tens of thousands of computers and related machinery. There has been a booming of the catering sector, the hospitality sector, the transportation companies etc. Many companies prefer to have their employees picked up and dropped at home after work to ensure there is no delay in the shift work they do 24 hours a day. This has resulted in each company engaging a fleet of transport vehicles and jobs in this sector have risen.

It has to be remembered that the IT professionals get paid the best salaries in India for a number of reasons. First, the productivities in this sector have been growing by leaps and bounds so the salaries of the professionals reflect that. Second, most of the professionals could easily move abroad for a job. So

companies try to attract them with high salaries. Third, is the attempt to ward off poaching by competitors who offer better compensation packages. IT professionals have been known to jump jobs frequently because of this. The net result of all these has been that the salaries of the IT professionals which was quite high to start with has been increasing at around 15% per year for the last few years – the highest for any segment of industry. In other words, the mass of IT professionals in Bangalore represent a huge block of purchasing power.

Thus the consumer goods industry in Bangalore has got a major fillip in the last decade and half. There have been tremendous rise in the sales of a whole range of consumer durables including expensive ones like automobiles. Some of the largest malls and largest stores in India in recent years have come up in Bangalore. Likewise the leisure industry has also been booming.

There are other interesting developments. Companies which are strictly not in the IT creation field have shifted to Bangalore. They are doing this because there is an IT culture in Bangalore and for these companies which want to imbibe industrial IT R & D it is easier to do so in Bangalore. For instance, there is the case of an electrical products company that makes very high tech sensors that have to be incorporated with a computer control. These are used in electrical power plants where one needs to regulate the power plant. This company has shifted to Bangalore as it found the existing culture of Bangalore was more conducive to its research and development.

Bangalore is the hub for Honeywell, ABB and many others including Japanese major instrumentation companies. Intelligent instrumentation requires the use of IT at the backend while the sensors are at the front end. Thus instrumentation industry has tended to develop in Bangalore. This has resulted in another spin off which is called as the development of embedded systems. Bangalore is now one of the leading places for the development of embedded systems.

Another spin-off is that when the IT MNCs employ Indians, their skill levels

go up. Some of them leave the company and start their own companies which then gives some service or product support to the MNC they left. Or many of them have managed to start their own companies which sell a niche product. The rapid growth of IT industry in Bangalore has impacted on several other areas. One of the significant areas is that of Biotechnology. The growth of IT in Bangalore provided the essential confidence that India can deliver in the high technology areas. The IT industry gave the confidence and empowerment, which made all the difference.

Problem areas:

Bangalore grew very rapidly. And the growth in civic infrastructure has lagged. And this has put a lot of strain on Bangalore's road infrastructure, water supply, quality of water and hence on the quality of life. The earlier Congress government was fairly responsive to the needs of the city and the IT industry. The assembly elections held in May 2004 brought back the earlier Congress back to power but only as part of a coalition of parties. With the politicians feeling that the hitherto urban-centric focus had led to a bad showing in the elections, Bangalore is not getting the kind of attention it used to get from the government. One result is the unmotorable roads are not getting the kind of attention they need; and traffic snarls are getting commonplace. The IT industry's that is well established in Bangalore is looking at other places like Chennai for further expansion.

Hyderabad

Hyderabad is the capital of the state of Andhra Pradesh. This hi-tech city has been rated among the fastest growing cities of world by a National Geographic survey. The overall literacy rate is 61% and for males it is 71% and for females 51%. Hyderabad has a population of 3.7 million. The export of software from the Software Technology parks in Hyderabad amounted to about US$ 1092 million in 2003-04 and reached US$ 1630 million in 2004-05. Hyderabad is easily rated as the strongest rival to Bangalore, as despite its lower level of software creation and exports, it has recorded very high growth rates among the various IT clusters in

India in the recent past. Historical advantages and other factors facilitated the formation of Hyderabad IT cluster. The very strong and dynamic role played by Chandra Babu Naidu, the earlier Chief Minister of the state, availability of a number of higher educational institutions, the presence of a large number of persons from Andhra Pradesh in the Silicon Valley in the US would be important reasons.

Government policies (local):

The local government has been quite favorably inclined to the IT sector, particularly under the earlier chief minister Mr. Chandra Babu Naidu. In fact Hyderabad which was a relatively less known places compared to Chennai, Mumbai etc was put prominently on the international map because of his dynamic role in the promotion of IT industry in the state. Naidu had the vision to see that IT was going to be the key knowledge industry. In terms of creating Hyderabad as a major IT cluster he was passionately involved and prepared to go to any length to attract IT majors. For instance, when he started working on IT cluster with a team, when he invited entrepreneurs from outside to come they typically raised the issue of what was it that was special in Hyderabad that scores over Bombay or Pune or Bangalore that they should come. Naidu started giving business from the government to attract them.

He promoted E-sewa which is for paying for utilities like electricity, water, telephone, as well as road tax all through the computer. E-sewa enabled the e-transformation and reduced the problem for the people who were going to different offices to pay bills, wasting their time. At the same time, E-seva created new business for entrepreneurs to come. For instance, Microsoft opened their first development centre out of Seattle in Hyderabad, because Naidu gave huge government business to Microsoft. When Microsoft came, it became an attractive place for many IT companies to follow.

In the same way Naidu used to network with big entrepreneurs. He behaved as though he was a corporate executive. Naidu would typically take his team to discuss and across the table he will make the commitment, and was

prepared to sign the document, corporate-style. This style of functioning, unknown in India, where the chief minister acted as though he was the CEO of the state gave tremendous confidence to the new companies.

The local government gave a lot of incentive for new start ups in IT in the state. While land was made easily available for this industry compared to others, rebates on land price were offered, depending on the number of jobs that were created. 50% of the registration and stamp duty were waived. 25% rebate was given on power tariff. A number of laws were liberalized and new incentives created to especially help the IT sector.

For the IT industry to grow one major issue to be considered is: how to make the place attractive for living and working. One reason why Bangalore became so attractive was because of the weather which is pleasantly cool round the year. Hyderabad's weather which was hotter was not so conducive. Further, Hyderabad was not an attractive and clean city in the early 1980s. One however could make the environment attractive, and that is what was done in terms of making the environment and other conditions attractive. Hyderabad was made an attractive place for living and working as well as for investment. The government invested in roads, in buildings, in creating parks, in improving the quality of local amenities, and in a hygienic environment. For instance, the municipal corporation services were privatized. The roads were swept at night before the daybreak. While these services were privatized there was efficiency in the delivery. Private investments were attracted to Hyderabad through these measures which meant that Hyderabad became an attractive place to live and work. Professionals and companies were thus attracted to Hyderabad. The perceived notions about the place are very important for human capital to move. If the image is bad, even if it is a good place no one wants to go and work.

The second aspect was that the IT industry was growing rapidly. Bangalore was getting a bit crowded and more and more expensive. New companies looking for a location as well as those already in Bangalore who wanted

to expand looked at places other than Bangalore. The proactive role of the state of Andhra Pradesh and the entrepreneurial role of the state was a key factor in attracting such entrepreneurs. Tax incentives, public infrastructure projects, educational investments, government purchases, R & D funding etc were some of the government initiatives that played a role.

Educational Institutions:

The city of Hyderabad has some world class educational institutions. The Indian school of business (ISB) is a world class business school which has been promoted by Wharton, Kellogg and London Business School and fortune 500 companies. The top private sector companies of India have contributed to the formation of the School and some of the best known names of Indian business are on the Governing Board. The International institute of information Technology supported by IBM, Oracle, Motorola and others offers high quality IT education. In addition there are about 226 engineering colleges that can turn out 86,000 engineers every year.

The Indian School of Business, at Hyderabad, funded by private sector initiative is turning out to be a world class institution training mangers with additional skills. Like the IIM, Bangalore, both these institutions fall outside the regular university system in India. They do not have any certification from the University Grants Commission (UGC) the autonomous body of the government of India that monitors, certifies and funds the various institutions of higher learning in India. These institutions and others like the Indian Institute of Information Technology (IIIT) are of very high quality and brand equity.

Diaspora:

The state of Andhra Pradesh accounts for as much 23% of the software professional in the US of Indian origin. While every 4^{th} IT professional in the Silicon Valley is an Indian, every fourth Indian IT professional in the Valley is from this state. In other words over 6% of the IT professionals in the Silicon Valley are from this state. While this figure is impressive in itself, the kind of networking that

is possible for IT professionals in this state with these Indians in the US has enabled them to be aware of the latest developments in this field and respond instantaneously. This applies to both market opportunities for selling products and in finding better jobs.

Further, this has helped in a large exodus of students from this state for higher studies in IT and engineering to the United States as the networks established by those already in the US gives them adequate and up to date information on the courses to do, the job opportunities etc. This is the reason why at most US Universities students from this state predominate among the Indian students.

Other aspects:

Electricity and water supply has never been a problem in Hyderabad. The climate of Hyderabad, though not as good as that Bangalore, is much better than Chennai, Pune Mumbai or the National Capital Region. Surprisingly, climate was cited as one of the reasons why IT professionals chose to settle in a particular IT cluster. The availability of good education institutions for the children was another important consideration of the IT professional. The cost of living is attractive as it is much lower compared to Bangalore or other metropolises. The roads are not choked as in Bangalore and there is enough space for the new IT start ups. The existence of the international airport right in the middle of the city was cited by some IT professionals as a plus point. With Bangalore getting saturated with a large number of IT companies and with infrastructure problems, Hyderabad is looked upon as the next best place to expand by a number of companies. In terms of the impact on the local economy much of what was said in the Bangalore context would apply to Hyderabad too.

Problems in clusters:

There are a number of problems areas for the IT clusters in India. The first would be the traffic congestion the glaring example for which is the city of Bangalore, where IT professionals are known to leave over two hours early to beat the traffic

jam though the work place could be reached in less than an hour under normal traffic conditions. The second major issue is the tremendous rise in land and rental prices in places like Bangalore which invariably lead to higher rises in salaries paid to the IT professionals, negating the cost advantages with the advanced nations.

Third, the high attrition rates of the professionals in the clusters are a cause for concern. There is constant poaching between companies and as some of the better known companies invest heavily in training their employees, the loss could be large. Though various measures have been tried by the companies, like stock options, tacit understanding to not poach etc, these have not worked as the demand for experienced and qualified IT professionals has been constantly rising.

There are a number of social costs among which the rising pollution and asthma and lung infection is just one. The increasing volume of traffic and the state's apparent inability to regulate the number of vehicles and set a minimum emission standard of vehicles will magnify the air pollution problem in the near future. The public transport system in Bangalore consists of buses that are around 20 years old or more and the system of roads are unable to accommodate this increase in the volume of road traffic. Large IT firms prefer to locate away from the congested city and have their business concentrated on sprawling campuses on the city's outskirts that are between 45 minutes to an hour's drive from the city centre. In most cases, funding for the expansion of Indian IT companies are not derived from venture capital firms but from "internal" sources or the stock market. These factors will have a great impact on the sustainability of clusters like Bangalore. Power shortages and increasing land prices will add to the costs of product development and the state government has to resolve these emerging problems.

Conclusions

Some of the pointers and lessons which flow from a study of Bangalore and Hyderabad are as follows:

① A strong role by the government in providing incentives and removing obstacles is a must to develop IT industry in any part of the world. This is

because unlike the manufacturing sector, software creation needs hardly any heavy investment in land, machinery etc. Thus anybody anywhere in the world can set up an IT company. So strong local incentives are a must.

② It is ultimately the quality of the human capital that determines the growth of this industry. Without the creation of high quality human capital, other advantages are not going to be of much help. The governments have to invest in the creation of high quality tertiary educational institutions.

③ To create an IT cluster, first a positive image of the location needs to be created and this has to be followed by the creation of new or strengthening of the existing locational advantages.

④ There are no hard and fast rules to follow to promote this industry. First there is no established “model” to study. Second, given the rapid changes taking place in IT development in the world what was valid two years back is no more valid today. So one needs to constantly learn.

⑤ Ultimately, despite locational advantages, what matters is quality. It has to be remembered the largest concentration of IT companies with the highest level of quality certifications in the world are in locations like Bangalore.

⑥ It might be good to create competition among different IT clusters in the same country. Most of the IT clusters in India are vying with each other in attracting new startups. Thus the local governments are prodded further and further to have ever increasing proactive roles which has immensely benefited India as a whole.

References:

Aspray, William , Frank Mayadas, Moshe Y. Vardi, Eds., 2006. *Globalization and Offshoring of Software: A Report of the ACM Job Migration Task Force* New York: Association for computing Machinery.

Balatchandirane. G 2004a. 'Education and Training" in **Development of IT Industries and Regional Innovations in BRICs - The Case of India,** The Asian Institute for Regional Innovation, South Korea, November 2004. pp. 75-87.

Balatchandirane. G 2004b. "Development of IT Industry in Bangalore and Hyderabad IT Clusters and the impact on the local economy" in **Development of IT Industries and Regional Innovations in BRICs - The Case of India,** The Asian Institute for Regional Innovation, South Korea, November 2004. pp. 105-17.

Basant, Rakesh 2006 *Bangalore Cluster: Evolution, Growth and Challenges* Ahmedabad: Indian Institute of Management Working Paper No. 2006-05-02.

Economist, 2006. "The New Titans", Survey: World Economy, 16th September.

Eischen, Kyle 2000a. *National Legacies, Software Technology Clusters and Institutional Innovation: The Dichotomy of Regional Development in Andhra Pradesh, India* University of California, Santa Cruz, Center for Global International & Regional Studies Working Paper Series – WP # 2000-2.

Eischen, Kyle 2000b. *Building a "Soft Region" on Hard Legacies: The Development of an Informational Society in Andhra Pradesh, India* University of California, Santa Cruz, Center for Global International & Regional Studies Working Paper Series – WP # 2000-3.

High Level Committee on Indian Diaspora, 2001. *The Indian Diaspora* Accessed at http://indiandiaspora.nic.in/contents.htm on 11 Dec 2006.

Kuchiki, Akifumi and Masatsugu Tsuji eds. 2005. *Industrial Clusters in Asia: Analaysis of Their competition and Cooperation* IDE-JETRO and Palgrave Macmillan.

NASSCOM 2006. *The IT Industry in India: Strategic Review 2006* New Delhi: National Association of Software and Service Companies.

NASSCOM 2005. *The IT Industry in India: Strategic Review 2005* New Delhi: National Association of Software and Service Companies.

NASSCOM 2004. *The IT Industry in India: Strategic Review 2004* New Delhi: National Association of Software and Service Companies.

Okada, Aya 2005. “Bangalore’s Software Cluster”, in Kuchiki, Akifumi and Masatsugu Tsuji eds. 2005. pp. 244-277.

Quah, Danny 2001. “ICT Clusters in Development: Theory and Evidence”, mimeo.

Ramachandran, Kavil and Sougata Ray, 2005. “Creating information technology industrial clusters: learning from strategies of early and late movers”, in Thatchenkery, Tojo and Roger R. Stough eds. 2005. pp. 149-166.

Saxenian, AnnaLee, 2001. *Bangalore: The Silicon Valley of Asia?* Stanford University, Center for Research on Economic Development and Policy Reform, Working Paper No. 91.

Schmitz, Hubert and Khalid Nadvi 1999. “Clustering and Industrialization: Introduction” *World Development* 27(9) : 1503-1514.

Sohn, Dong-Won and Martin Kenney 2006. *Universities, Clusters, and Innovation Systems: The Case of Seoul, Korea* mimeo.

Thatchenkery, Tojo Roger R. Stough, Govindasamy Balatchandirane and Rupa Ranganathan, 2005. “Information Communication Technology and economic development: the Indian context”, in Tojo Thatchenkery and Roger R. Stough eds., 2005. pp.29-46.

Thatchenkery, Tojo and Roger R. Stough eds. 2005. *Information Communication Technology and Economic Development: Learning from the Indian Experience* Cheltenham, UK and Northampton, MA, USA: Edward Elgar.

Wilson, Dominic and Roopa Purushothaman, 2003 *Dreaming With the BRICs: The Path to 2050* Goldman Sachs: global Economics Paper No: 99.