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INDIA'S IT SERVICES AND SOFTWARE INDUSTRY: ANALYZING THE UNPRECEDENTED GROWTH

Engineering

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ABSTRACT

This is a paper on technological catch up by India in the IT industry. We first try to define catch up then move on to India's standing among other countries in terms of GDP, after which we'll see a brief history of the software industry in India. We'll get to know the phenomenal growth rates achieved by the industry even when the whole world was reeling under recession, finally comparing India's IT industry with that of the world leaders to understand if India's technological growth can really be called a successful catch-up. The results of such analyses are used to conclude that the catch up is indeed a successful one.

KEYWORDS:

1.1 What is Catch up?

After the World War 2, most of the nations had lost most of their wealth. However, it created one major difference, the haves and have-nots not in terms of wealth but in terms of technology. The countries who had invested heavily on technology during the war got a head start over countries who couldn't [27]. The countries which were technologically backward applied different strategies to come to the level of other countries, if not in terms of technology, which is closely related to research and innovation, then other aspects of industry like efficiency or cost-effectiveness. Some countries succeeded in this. Such a phenomena is called a catch up. In order to identify a technological catch up, we show that it the country trying to catch up has already attained the levels of market share/ revenue of that of a country it was trying to catch up to or the growth levels are so high that it might attain the levels in a short period and if the technological innovations and infrastructure are at par with global standards.

The modern history is replete with instances of technological catch up. Countries like China, Japan, South Korea and Taiwan have successfully caught up to be able to compete with the developed countries in one or more sectors. Justifiably so, as advances in technology have brought the world so close it's easy to share science and technology and use this sharing of resources and knowledge to everyone's benefit. In the medieval period, knowledge wasn't as readily shared as it is today. Also with the regulations at place at the international level it is easier to collaborate in the current period.

1.2 Some Concepts

For analyzing the catch up, we'll use some concepts developed by Keun Lee and Franco Malerba in their 2014 paper 'Changes in Industry Leadership and Catch-up by the Latecomers: Toward a theory of catch-up cycles'. These concepts would be (a) sectoral systems, (b) windows of opportunities, and (c) responses/strategies by the actors.

Sectoral systems constitutes the inputs and resources - capital, knowledge, labor, technology; the demand conditions ; the actors - the firms, government and the market and also the universities and supply mechanisms; the institutions - IPR, laws, culture .

Window of opportunities is used to refer to periods where 'windows' "related to changes in the elements of a sectoral system may open up for the late entrants." (Lee and Malerba) [1]

2 Sectoral Systems in India

2.1 India's IT services and software Industry Catch up/Growth:

The economy of India is the tenth largest in the world by nominal GDP and the third largest by purchasing power parity (PPP). India's 2013 GDP stands at $1.87 trillion [2].These figures present a very rosy picture for India's economy, However, when we see India's GDP per capita (1,504.540$), India is ranked 140th, having less than a fifth of the world's GDP per capita (10,486$). So we see that India lags behind the world average by a very big factor. We need to keep this in mind to appreciate the growth of India's IT and software sector.

India exports software to 60countries and two third of the exports to US top 500 fortune companies. It is surprising to see countries with emerging economies, like India, which are not doing very good in terms of technology and innovation, but show tremendous growth and have become global competitors in the field in the time frame of 20-30 years. N. Radhakrishnan Nair, CEO of Technopark in Thiruvana nthapuram, one of the largest IT parks in India, said the country's success in IT and computer software sector had been so remarkable that many other nations are now trying to copy it.[31]

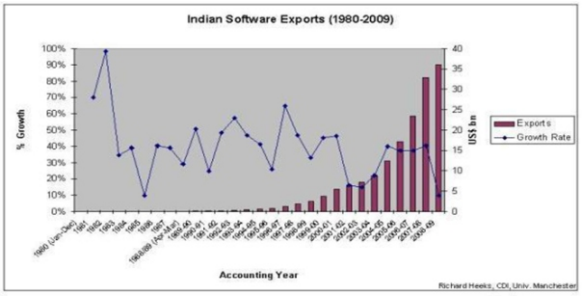

Fig. 2.1 Indian Software Exports[3]

"In 2008, the size of the information-technology (IT) services world market was almost US$1,057 billion, and 20% of this was provided by Indian firms. Although the Compound Annual Growth Rate (CAGR) of the global IT service industry from 2004 to 2008 was only 9.4%, the CAGR of the Indian industry for the same period was nearly 31.2%."[4]

The Indian IT sector has seen tremendous growth in the past two decades with more than 30% growth rate annually. From about $50 million in exports in the late 1980s to $200 million exports in 1993 with around 30% annual growth rate and in the mid- and late 1990s, software exports increased by 50-60% annually making it $6 billion by 2001.The current size of the software market export market is $86 billion and expected to reach $99 billion by next fiscal year as predicted by NASSCOM [The National Association of Software and Services Companies]. Including the domestic market Indian IT sector is currently pegged at $118 billion.

IT and software industry share in India's GDP grew from 1.2% in 1998 to 8.1 % in 2014. The IT services and software exports account for 77% of the total revenue generated in the services sector. IT and outsourcing accounts for 38% of the industries total exports in 2014 growing from less than 4% in 1998. [5]

2.2 India's IT service and software sector system characteristics

IT and software industry is a knowledge and technology intensive sector. In the early stage of development of the sector in India, because of poor level of R&D growth, it only provided low value adding

services of the sectors. Indian firms were not involved in high value adding businesses like product development and complete solutions, they just supplied manpower (*Bodyshopping*) or a favorable location for *offshoring*. The availability of low cost English speaking technically qualified pool of engineers made India a feasible and credible location. Microsoft chairman Bill Gates said "These top people are going to be hired. It's just a question of where." [6] while addressing US government regarding visa provision to Indian origin employees. The link developed by Indian diaspora placed in US firms catalyzed the process. The availability of 24-hour communication with customers in the US, considering the 12-hour zonal time difference between India and the US also made India a preferable option.

The demand for software engineers grew with growth in global software industry in 1970s. Indian firms export to more than 60 countries and United Stated accounts for about half of the exports market for Indian software. As per the NASSCOM review 2004 leading market US accounts for 69% followed by United Kingdom (14.9%) share of Indian exports.

The various actors which helped the growth of Indian IT and software industry were governmental bodies and technical and management universities (IITs and IIMs) which supplied the necessary workforce for the sector. The early investments made in human capital were more than the internal demands and were done mainly for boosting manufacturing growth. It also contrasted with the general investment in a technology intensive industry which are R&D and developing innovation systems etc.

Tata Consultancy Services in 1970s acted as major source of manpo wer in early stages. The management of TCS was overtaken by a US trained engineer in 1969 who used his connections in IEEE to flourish TCS and founded the Computer Society of India which became the key institution for promoting the interests of the sector further and increased industry academia interaction by organizing conferences.

The governmental committees have played significant role in the evolution of National Innovation System of the sector which helped in setting up institutes which later decided the rules of the game. The early actors were Bhabha Committee of 1963, Electronics Committee Chaired by Dr. V.A. Sarabhai in 1966, and the National Conference on Electronics of March 1970. These series of discussions led to setting up of Department of Electronics (DoE) to coordinate and implement policies for development of electronics industries including computer software in 1970.[7]

The Indian Software industry association, National Association of Service and Software Companies (NASSCOM), was founded in 1988 and works as major institution for policy reforms and improving the brand name abroad. NASSCOM membership has grown from 38 in 1988 to 1400 in last fiscal year and these company represent 98% of industries total revenue. NASSCOM vision is "To help the IT and IT enabled products and services industry in India to be a trustworthy, respected, innovative and society friendly industry in the world." NASSCOM's has obtained global credibility as a data source for Indian software industry.[28]

Software technology parks of India were also established in 1991 with aim of increasing exports of software in India. It benefited the registered companies by reducing import duties on software (1992-1995) and tax exemptions (1993-1999). STPI also plays important role in improving infrastructure for India's IT sector. It helps in providing high speed data transfer for the companies. STPI offers two main services: Softprint service, Secure and exclusive digital circuits for data and voice transmission and Soft link, Internet access on a shared basis[8].

3 Windows of Opportunities and India's response

3.1 The upsurge of IT industry

Computers were initially built to work as mainframe machines for physicist to carry out experimental computations and were part of governmental or commercial entities. But with the development of personal computers and client server systems in 1970's and 1980's opened up new technological window of opportunity for countries like US and UK and some early players like IBM greatly profited from the new IT and software industry. The paradigm shift in the technology opened up a demand window for customized software. Indian firms like TCS pitched in as they provided the qualified manpower for the transitional labor intensive work at much cheaper rate.

During the same time India's stagnant domestic market did not have attractive employment opportunities for qualified software engineers which forced many of them to migrate to America where they joined IT companies located in Silicon Valley and acquired the programming, management and entrepreneurial skills. 972 Silicon Valley technology firms were led by Indians by 2000, accounting for $50 billion in sales and nearly 26,000 jobs. Indians headed companies rose from 3% in 1980s to 10% in 2000s [8].The upsurge of IT industry in early 1990s provided opportunities for Indian software firms and these immigrants acted as "reputational intermediaries"[9] for brokering the initial contracts.

3.2 Y2K boom

The Y2K bug, also called the Millennium Bug, was a major bug, which resulted in a major debugging operation all over the world in the late 90s. It was caused by programmers' inclination to use two digits to denote the year to save on space and time. So, a lot many programs were expected to fail on 1st Jan, 2000. As the year would have gone from 98, 99 to 00, all the programs that used date comparison or date concatenation (current year = 19 +99(1999), next year = 19+00 (1900) or 19+100(19100)) were predicted to fail. This lead to a scramble among organizations to fix all the bugs in their code which opened a very big market of the Indian IT industry as they were known to be fast and cheap. The total exports revenue for the services provided by the Indian firms to MNCs was $2 billion nearly 40% of the total revenues of the Y2K contracts.[10]

3.3 Dot Com Burst

The term Dot Com Burst is used to refer to the period or rather the economic implications that occurred when the 'Dot Com Bubble' was 'burst'. Investors, or rather speculators in Benjamin Graham's terms, have a knack of investing in stocks which can be the next big thing. In the 90s, the internet was considered to be the next big thing and these investors flocked to invest in internet based companies thinking it would net them huge profits. This began the Dot Com Bubble. Share prices of internet companies rose heavily, and they weren't making any money to reflect their share price so, it was a boom without any strong base. Most of the companies went bankrupt in a few years leading to what we call the Dot Com Bust. This recession impelled many MNCs to invest in R&D and innovation and infrastructural growth in terms of internet but because of the market crashing the inland investments were not possible hence even the companies outsourced the R&D to cheaper locations like India, China etc.[25]

3.4 Pre and Post Liberalization Policies

After Independence in 1947, India pursued a policy of self-reliance and preserved the national industries (specifically manufacturing) in their infant stages. These guidelines inflicted the growth of manufacturing sector and made India a latecomer to the process of globalization. "The software industry flew under the radar of a bureaucracy pre-occupied with promoting computer hardware and semiconductor chips."[11] As the domestic market for the software and IT services was small, the industry was exempted from the regulations and laws that hampered the growth of manufacturing sector.

Indian IT sector was also benefited from the Foreign Exchange Regulation Act (FERA) of 1973 brought by Department of Electronics (DoE) to gain control of the Indian market from big giants like IBM and ICL which finally led to IBM's exit from Indian market in 1978. IBM controlled the IT industry as it had 80% of the market shares [12]. Indian government acquired the liquidated shares of IBM and used their infrastructure to open a nationalized company Computer Maintenance Services which was later acquired by TCS and led to further technological growth. IBM's exit from Indian market also pushed up the sales of ICL and Burroughs who basically depended on Indian software programmers for their conversion systems. During the 25 years of IBM before its exit from the Indian market it nurtured the IT culture in India and also generated highly trained professionals in hardware, software and programming skills.

After realizing the industry's potential government introduced policies that specifically targeted increase in software services export. DoE in 1972 introduced a policy of duty free imports for companies assuring software exports of double the amount of imported hardware within given timeframe. It formed a Software Export Promotion council and initiated the export promoting software policies in 1986. Indian

government also set up like institutes like NASSCOM (1988) and Software Technology Parks of India (1991) to further the growth.

The closed economy model led to foreign exchange crisis in 1991 and also led to the collapse of central government in June 1991. The new government with P.V. Narsimha Rao as Prime Minister and Manmohan Singh as Finance Minister took several measures to lift the Indian economy and liberalised the Indian market facilitating FDI(Foreign Direct Investment) with much reduced tariff rates. The opening up of Indian market coincided with the IT boom of 1990s emanating large scale MNCs investment to procure the low cost labor benefits.

"The Reserve Bank of India adopted several measures to support the IT industry. These included: simplification of the filing of Software Export Declaration Form (SOFTEX); acquisition of overseas parent company shares by employees of the Indian company; companies whose software sales were over 80 percent could grant stock options to nonresident and permanent resident employees; foreign exchange could be freely remitted for buying services; and companies which executed contracts in "computer software" abroad could use income up to 70 percent of contract value to meet contract-related expenses abroad."[8]

3.5 Clusters Establishment:

"Discussions of technology based industries commonly tend to emphasize clusters, and the Inter - firm learning in clusters, typically inspired by that most famous cluster of all, the Silicon Valley" [13]. The cluster formation helps in increasing the collaboration of the firms in terms of knowledge and experience sharing. It also attracts more foreign investments as handling governmental regulations is easier and there is already existing infrastructure, workforce and market. Bangalore, Delhi, Mumbai, Chennai, Pune are some of the main cities where Indian government has facilitated the development of IT and software Industries. But India is not gaining much from the cluster model as the resource sharing practices are not regular among Indian companies.

3.6 BodyShopping

Body shopping is the process of hiring workers for a short time on contract generally by IT companies for getting low cost services from companies with skilled manpower trained or trainable in low value jobs such as coding, testing and maintenance. The Indian Diaspora played a major role in the bodyshopping process as they served as trusted links. It serves as an appealing strategy for late/new entrants to the industry because it just requires skilled manpower and relations in the host country and in return the supplier county gets the benefit of learning by doing. Indian engineers worked on client site under client's management system understanding the complexities and requirements of the industry thus facilitating the early stages of development of India's service sector easy by following imitation etc.

TCS was the first Indian company to provide bodyshopped services to the high tech firms in US starting in 1971 with Burroughs (TCS just supplied manpower and had nothing to do with management of the human capital) leading to a joint venture Tata Burroughs in 1977. Some other companies like Infosys Technologies also joined the club and some US based companies like Mastech established by Indians also played significant role in bodyshopping.

3.7 Offshoring

Offshoring is a process when a company shifts or expands some of its operations from one country to another typically for cost cutting, internationalization. Texas Instruments was the first company (US company) to set up an offshore unit in Bangalore in 1985. This definitely helped in saving costs on employees but posed some problems like heavy capital investment, fighting local regulations etc. Indian IT sector companies like Infosys offered a solution to the offshore problem by acting as an outsource location for firms thus making offshore outsourcing a win-win situation at least for both the companies if not for the country's economies as whole because the company outsourcing its operations is providing employment opportunities for the other country. American firms now could enjoy the low cost labor benefit without taking risks of high investments and Indian firms expanded their customer base to international markets.[29]

Why specifically was India was chosen as a outsource location instead of other countries such as Ireland, Israel constituting the 3I's? Though these were countries which benefited from the IT surge and more open economies. The reasons was again cost, an average Indian software programmer wage was 25% that of US programmer and was the cheapest offshore location in this respect.

The offshore phase was a succession to bodyshopping through which Indian brand name got its credibility. The process acted similarly for service sector as reverse engineering is for manufacturing sector. The Indian firms worked under the guidance of top foreign firms which helped them learn from the experience and expertise of old players and improve their own services to meet global standards independently in Indian regulatory framework.

Indian governmental policy relaxation also enabled offshore opera tions in India. Though the reforms of 1980s were more constrained (liberalization by stealth) [14] it incepted the opening up for offshoring and outsourcing and policy reforms of 1991 enhanced foreign investments leading to development of telecommunication and other infrastructure required for further growth of the sector and then in 2002 India liberalized international long distance.

3.8 Becoming Global Leaders

From early stages of bodyshopping and offshoring Indian IT services and software Industry has come a long way. Indian firms like TCS, Cognizant, Infosys, Wipro and HCL have evolved into globally competent firms which provides whole range of IT services from low value adding services like coding to high value adding services like consultancy. Indian firms have also made a mark in providing software services to banking sector. A more formal term to describe the current stage of the companies would be Global Delivery Model. Gartner defines global delivery model as "the optimum combination of processes, end-to-end methodologies and quality procedures, with high-quality skills and resources available internally or externally, in requisite quantities, on a global basis, that enables organizations to maximize the quality of their solutions while minimizing the overall cost and delivery time of their IT services." [15].

TCS is the world's second most valued IT services company after IBM leaving behind Accenture and HP [16]. In terms of revenues generated TCS is the world's tenth followed by Cognizant, Infosys, Wipro and HCL in top 25 in terms of revenues. "The top five Indian providers grew 13.3 percent to reach $34.3 billion in 2012, exceeding the IT services industry growth of 2 percent according to Gartner, Inc."[17]

In the process of ascending the value chain there are entrepreneurial ventures by experienced professionals in field of software design directly for clients and product development which can create new demands and market(foreign as well as domestic). Indian product companies InMobi, Zoho, QuickHeal and Pubmatic have crossed or are on track for a $1 billion (Rs 6,000 crore) valuation. Also, another 26 product companies have the prospective for a $100 million valuation by next fiscal year. Zinnov studies shows the number of product companies starting from just a countable few have reached to 3700.[18]

The global competitiveness increased the need for information security and quality management to remain on the top position. An increasing number of firms in India have adopted measures and procedures to obtain ISO and CMM certification credentialing their international standards. The firms dedicate a huge amount of resources for Software Process Improvement (SPI).[26] Being a late entrant to the GDM level Indian companies as any other catching up company l*earnt from the experiences of other firms* and could employ quality systems at early stages of development of company. With improved global services, clients raised concerns about the confidentiality and data security. In response to the global requirements Indian government introduced IT Act 2000 further amended in 2008 that covered legal recognition of electronic signatures, documents, cyber-crimes.[19]. Also, Information Security Technology Development Council has been established for promoting the research in Information Security.

As mentioned Indian IT services and software sector grew with cheap technically skilled manpower though having a minimalistic knowle dge and technology base. But for firms to provide high value adding services globally the knowledge base and human capabilities need to be developed which is usually done by developing in-house R&D and training centres and this base is expanded by using external knowledge M&A and alliances.

3.9 Research and Development

"The level of investment in R&D depends on the nature of business, but some have suggested that high growth and technology intensive industries spend about 10% of their revenues in R&D, with about 1% in pure research. Microsoft and Cisco, for example, spend about 15% of their revenue in R&D"[20] . R&D share of India's current GDP is 0.9 compared to 4% in developed world[21]."Allocations of Rs 7060 crore for smart cities, Rs. 500 crore for bridging the digital divide, a 100 crore for a technology development fund and several other e-governance initiatives have given the Indian IT industry some reason to cheer the Budget 2014"[22].These steps will definitely increase the R&D investments in the IT sector and improve the infrastructural facilities of the sector which are currently poor compared to world standards. It will also help in development of new industrial clusters. The new budget offers incubation policy such as startup funds for the software sector which will give push to product development by the young entrepreneurs of India. Also, the IT and software focused budget throws light on governmental policies for making the sector an engine for economic growth of the county. "The budget speech today is clearly an indication of the Government's resolve to bridge the divide between the 'haves' and 'have nots'," said Jay Pullur, chief executive of Hyderabad-based PramatiTechnologies.[23]

The following analysis is based on the data IT Industry Competitive Index 2011 in which India ranks 34 overall[24] . It however ranks 63rd among 66 countries in IT infrastructure. We rank 10th in Human capital, 43nd in Business Environment, 15th in R&D environment, 49th in Legal Environment, 45th in support for IT industry development. So while we see that we are quite good in terms of human capital (which includes skilled labour) and RnD environment, we lag behind in other factors most notably IT infrastructure. Inspite of a lack of proper support system, our IT industry has still managed to get a 20% share in IT services and software market in 2008 (Datamonitor)

4. Conclusion

After this analysis, one might be tempted to conclude that India's IT growth story can be termed as a catch up. But we also have to see that this phenomenal growth has been achieved only by the IT services and software industry, we are still very behind in the hardware sector. So, while we can term the entire IT services and Software industry to be a successful catch up, the same can't be said about the Hardware industry. Also, we now have a huge competitor in the form of China who has already caught up in the ICT industry and is now trying to catch up in the software industry.

India however is trying to better its hardware industry too. The comments made by PM Modi on his recent visit to Japan stand testament to this. "India is known for its software services, Japan for its hardware. Let's work together to enhance the two," Modi said.[30]

Technological catch up is not just about catching up to the world leaders but its also about innovation and ability to contribute to the GDP of the nation. IT services and BPO constituted about 25% of the India's exports. Also the sector showed phenomenal growth even while the world was reeling under recession providing a glitter of hope for India in such times. Only time, will tell if it can become the world leader or if China overtakes it but it sure shows tendencies of a successful catch up story.

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