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Project:-"INDIA" --Can It Achieve Its Potential in Technology World?

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EXECUTIVE SUMMARY

In the paper, we are going to look at different aspects of India. First, we will have a general overview of the current condition of India in its economy and India's potential in the information technology. Also, we are going to identify problems lie in the future of India's development. After exploring the problems existing in India's society and what lies ahead in the future of India's development., the paper is going to do the analytical assessment of the problems and then we try to formulate some approaches that can be done to overcome the problems.

India's acceleration in economic growth has been impressive. Over the 2004–06 periods, real GDP has grown by over 8 percent a year, even though there is a decrease in GDP over the 2008-09 periods due to the global economic crisis. The significant growth has been driven mostly by an increase number in export-oriented, skill-intensive manufacturing (pharmaceuticals, petrochemicals, auto parts and assembly) and services (IT, business services, finance).

India's economic structure and its wide dispersion in productivity levels call for a broader interpretation of innovation. The positive perception of India's innovation potential by the international business press provides a useful context for the more quantitative assessment that follows. For example, in 2006 the Massachusetts Institute of Technology Review (MIT 2006) ranked six Indian-Americans among the top global innovators under the age of 35. Based on respondents from Asia and the Pacific, the Indian company Infosys is among the world's 10 most innovative companies, with only the Republic of Korea's Samsung also included among comparator countries—Brazil, the Russian Federation, China, Korea, and Mexico.

Despite the reputable, well-known publication in the field of technological innovation, India is facing a big problem both in the input and also output side of innovation.

On the input side, India has more than 12 million science and engineering graduates—of which 2 million are postgraduates and 100,000 are PhDs (NCAER 2005). Though there is no doubt that India has an impressive stock of skilled talent based on past investments in higher education, the more pressing question is the availability of qualified talent, measured by both quantity and quality. Another critical innovation input is aggregate domestic R&D spending, which in India has never exceeded 1 percent of GDP. Over the past 20 years, India's domestic R&D expenditures as a share of GDP have fluctuated between 0.71 and 0.91 percent, with the highest share recorded in 1987 (fiscal year 1987–88). In 2004, the last year with comparable data for India and its comparator countries, India's share stood at0.85 percent.

I. INTRODUCTION

India is the seventh largest country in the world. The population of India is 1,208 million as of 1st March 2001 Indian government report, which includes 532.1 million males and 496.4 million females. According to the world population ranking, India is the second top which only after China [1]. India is one of the oldest civilizations in the world with a kaleidoscopic variety and rich cultural heritage. It has achieved all-round socio-economic progress during the last 60 years of its Independence. India has become self-sufficient in agricultural production; and now India is the tenth industrialized country in the world and the sixth nation to have gone into outer space to conquer nature for the benefit of the people [2]. According to the India's government data, the constitution of India has recognized 22 national languages, among them Hindi is the official union language. And the literacy rate in the country stands at 64.84 per cent, 75.26% for males and 53.67% for females in 2001 census. India now becomes a hot word of the 21st century beyond a story of software, out-sourcing and faraway call centers. India is a medical and pharmaceutical frontrunner; an R&D powerhouse and a rising manufacturing hub etc. [3].

India is the only lately nation recovered from being under the Soviets' control to be the home of an IT and outsourcing revolution that has spearheaded an economic growth almost unparalleled in the world's history. In the technology world, IT(information technology), as the core of day-to-day life, runs everything from our computer and cell phone to almost every aspects of every company's activities. Moreover, IT also powered India's high-tech revolution and the India's brightest employees most in their twenties [3].

In other words, for India's economy, information technology is an important emerging sector. As we all now, whoever mentions India, the first impression coming out of mind is IT. It may because that India's software industries are so successful. In fact, IT has increased at a tremendous rate of 35% per year during the last ten years and its contribution to the nation gross domestic product is expected to be around 8.5% by the year 2010-2011, quite similar to United States today. In IT enabled services (ITES), India is emerging as one of the most preferred destinations for business process outsourcing (BPO). IT industry of India is broadly categorized into IT services and software, ITES-BPO, and hardware segments. Compared to the hardware segment of India's IT industry, its services and software segment is more robust. The revenue of IT services and software and ITES-BPO together reached US $22.2 billion during 2004-2005 out of which US $17.3 billion was entered through export. The ITES-BPO segment of the industry has merged as one of the key investment markets in the country, and it's still on a rapid growth path. It generated revenue of US $5.7 billion in 2004-2005, and represented a growth of 46%

over the previous year. Now, the industry's hardware segment is almost as big as its ITES-BPO segments. Presently, IT industry exports around 64% of the total IT sector revenue. The IT sector export revenue reached the mark of US $18 billion during 2004-2005, a jump of around 35% from the previous year. Compared to the export market, the domestic market still represents around 35% of industry [4].

II. INDIA'S POTENTIAL IN THE TECHNOLOGY WORLD

A. *India Ranks High Comparing to Its Competitors such as China in Various Fields.*

The competitors such as China, Philippine and Canada are below India in quality of the labor pool, cost advantage, linguistic capabilities and overall quality control [4]. For example, China, which has the most population in the world, has become a major economic and military power; in addition, US multinationals begin to lobby for still more favorable treatment for China because of the heavily dependent on their Chinese manufacturing bases and markets. It's also becoming apparent that the balance of global economic power is gradually shifting to Asia, especially China and India. According to "The Global Competitiveness Report of Nations", India has several advantages compared to China. First, India has a democracy, a free market and a free press, which can empower its people to be innovative and creative even at the grassroots level; while China has less chance for innovation in its relatively closed and state-controlled market. Second, India's growing workforce of people below the age of 25 is a secret weapon, the benefits of which will soon come out. However, For China, because of its one-child policy in order to reduce the population growing pressure, is making the nation age faster. The third is India's language advantage. Most Indians speak English but most Chinese don't. The last is policy advantage. In contrast to China's tightly regulated society, India offers her citizens an open and free environment to replenish their minds and souls. Moreover, because of the India's unique geographic position, India is able to offer a 24*7 services and reduction in turnaround times by leveraging time zone differences [3].

B. *large supply of IT skilled workforce of India*

The large supply of IT skilled workforce has been an important reason for the success of Indian IT industry. India's stock of IT professionals is estimated to be more than 1 million during 2004-2005, so that the IT industry revenue per IT professional is about US $27,000. India produced 284,000 engineering graduates during 2004-2005, out of which 165,000 can be categorized as IT professionals (computer science, electronics, and telecommunication) [4]. Both India and China are known for manufacturing, but India has lured many fortune 500 companies to set up high-end R&D centers on her soil. So compared to China's competitive edge in the low-margin goods, India's competitive advantage on the high-end value chain in manufacturing will drive India ahead of China as a global player [3].

C. *India's Information Technology Potential*

By increasing productivity in almost every sector of the economy, IT has its potential to raise the long-term growth prospects. Moreover, in a broader sense IT can play an important role in economic development, not just economic growth. To some extent, IT as a general-purpose technology can influence the national economy in numbers of ways, such as creating employment opportunities, reducing illiteracy, providing universal health services, and delivering good governance, and so on. Thus, we can say that the information technology can play a major role in overall economic development of the country. In the cost aspect, India has a comparative advantage in the global IT sector. With the benefit of large pool of workers having software and language skills, India is ready to move toward producing higher value-added goods and services. Although India has comparative advantage at least in certain segment of the IT sector, India's share in the global market is just 2%, which can also be considered as a great opportunity for the Indian IT industry. The global IT spending is expected to increase at the rate of 7.9% per year over 2004-2008(NASSCOM) [4].

India has made a tremendous effort to lift out its economic in recent years. More than 100 million people are lifting out of poverty. However the growing plaudits obscure some stark realities that could significantly limit the country's power prospects. In aggregate terms, India remains a very poor country. With hundreds of millions of people still mired in grinding poverty, it has the world's largest concentration of economic misery. According to a recent report quietly released by the Indian government, nearly half of the country's small children are malnourished [6].The per-capita income rate, literacy level and other key human development indicators also lag behind many other developing nations. India's economic boom has been powered disproportionately by a world-class technology sector that requires only a comparatively small number of highly skilled workers. Even as the economy soars, overall job creation has not kept pace with the growth of the working-age population, which is projected to expand by 70 million people over the next five years [6].

In conclusion, information technology has a big potential of not only accelerating the growth in the Indian economy but also promoting the broad-based economic development. The IT should be promoted to be used as a tool for raising the living standard of the common people and enriching their lives [4].

III. METHODOLOGY

The objective of this study is to evaluate and to assess the past condition, current condition and future condition of India in term of its capability to achieve its potential in the technology world. Towards meeting this objective, the paper provides an analytical and insightful perspective on the status of technology development in India, focusing on the opportunities,

challenges and recommendation to capture the opportunities and to remove the obstacles. The study started with highlighting the `lay-of-the ground' in the technology-related field in India.

Our primary research for this report was obtained from published information sources such as academic articles, industry databases and reports, press reports, government documents, expert analyses and reports, etc. The report has been divided into two parts. The first part provides a general overview of the current condition of India in its technological world and some of the problems lie in the future of India's technology development. The second part focuses on the analytical assessment of the problems described in the first part and then we try to formulate some approaches that can be done to overcome the problems.

IV. PROBLEM IDENTIFICATION

As described above, India has so many potential to make it as one of the future technological leader in the world. However having the potential and actually achieving it are two separate things. In the latest annual update study from Growth Environment Scores (GES), India scores below the other three BRIC nations, and is currently ranked 110 out of a set of 181 countries assigned GES scores. If India were able to undertake the necessary reforms, it could raise its growth potential by as much as 2.8% per annum, placing it in a very strong position to deliver the impressive growth [5].

So far we have discussed India's achievement and also some of the problems lies ahead that can prevent India to reach its potential in the technology world. We summarize those problems into 2 major problems that need to be addressed by India's government. The first is a chronic disease as in any other developing countries; under-investment in the country's human capital. Because India's rural poor, many of whom are young and illiterate, lack adequate access to educational and health care services, they do not possess the skills necessary to compete in the global economy. The second problem is a persistent lack of investment in physical infrastructure, particularly in the vital energy, research and development, and transportation sectors.

IV.1. Under-Investment in the Human Capital

A. *Education*

Education is proved to be a significant key for reducing poverty and unemployment, improving health and nutritional standards, and achieving a sustained human development-led growth. When we look at developed country i.e. United states, Japan, Germany, England etc. All those countries have a strong education system. Thus, India must achieve this foundation in order to thrive.

India with the world's second largest population (1.15 billion people) has great potential to become world's superpower. The India biggest challenge is to turn its population to be productive workforce. It has 17% of world's population, but some 40% of the world's illiterates

[7]. In 2005 study, Indian males complete just 2.9 years of schooling on average, females just 1.8 years [8]. India obviously needs improvement in education system.

The New Education Policy (NEP) in 1986 (revised in 1992) aimed to improve quality of primary education for children in ate age group of 6-14. There were approximately 200 million children in the country in the 6-14 age group in 2005-2006. Although the provision can be seen in the increasing number of schools, more than 93% of children are enrolled. This number is deluded because 49% of children drop out before they reach Grade VIII [9].

The literacy rate in India remains at a low 61%. Children from rural part typically have to leave school early to join the workforce due to poor economic status. According to the statistics given by Indian government there are 20 million child laborers while some agencies claim that it is 50 million [10].

Many rural public schools still lack for the most basic facilities (e.g. a closed-in building, drinking water, toilets, a blackboard). Many public schools are also understaffed; students-teacher ratio is very high due to high levels of teachers absence and low levels of teaching activity. Indian government set investment in education at 6% of its GNP, but in fact the government spends around 4%. According to Human Development report (2001), India ranked 104th with respect to the share of GNP spent on education among 143 countries [8].

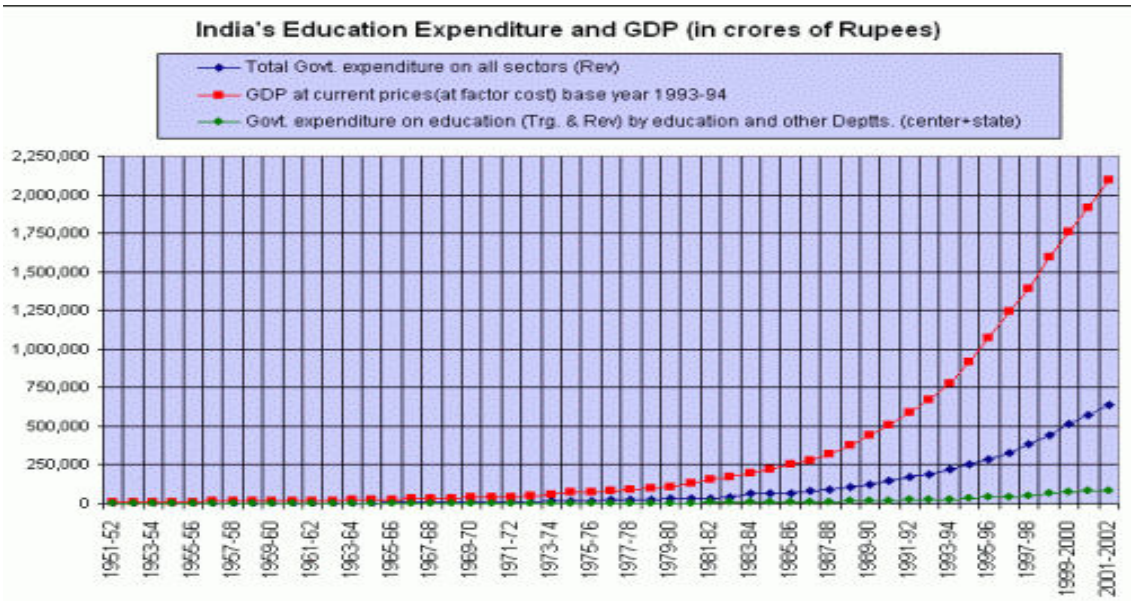


Fig.1. India's Education Expenditure and GDP (in crores of Rupees) [8].
Note: All figures above are in crores of rupees. A crore equals 10,000,000 (ten million)

After its independence, India has expanded access to higher education to increase social mobility and decrease disparity. The public universities have been built in strict commonalities

which fail to make distinction and excellence in institutions. The majority of higher education degrees in India are undesirable in marketplace. Students from affluent families largely choose to study abroad or private institutions [8]. There are more than 9 million students in universities and 2.5 million graduating each year. However, that number counts only 10 percent of Indian 90 million college-age population. Government officers always get involved in universities activity. The hiring and promotion of teachers is often politicized, providing teachers with unconditional job security and no accountability in improving student achievement [8].

The larger part of 15,000 colleges in India are Arts, Science, Commerce & Learning Colleges which account for 6 million tertiary students. About two-thirds of students major in Arts and Science and about 18 percent in commerce/management. This become another important issue because most private investment in higher education focus on engineering and medicine. So majority of students don't get benefit from private segment [8].

The impressive part of India higher education may come from the success of IIT and IIM. But some doubt the value-addition of these schools. Because these schools select only the best students (around 200,000 students take the IIT entrance exam for less than 3,000 seats) Therefore, the reputation of these schools might be achieved by the ability of their selected students not the quality of the schools [8].

The number of universities has increased 13 times and 26 times in colleges since 1947. India possesses half of the world's institutions of higher education. There are currently about 370 universities and 18000 institutions in India [9]. India institutes of higher education produce 400000 engineers and more than 2.5 millions graduated in other disciplines each year. The National Knowledge Commission has planned to increase the number of universities to 1,500 by 2016 [10].

Despite of the huge number of Indian graduates, according to study by McKinsey & Co. India will need 2.3 million IT and business workers by 2010 but Indian universities will not be able to meet that need so India will face a shortfall of 500,000 skilled workers [11].

The main problems are uneven quality in academic faculty and curriculums as well as weal spoken-English skills. There is estimation that less than one-fourth of Indian graduates are immediately employable in multi-national companies. India will lose its main competitive advantages from these problems [12]. To summarize, the main problems related to education in India are:

i) Access

The enrollment rate (GER) for higher education has increased from 0.7% in 1950-51 to around 10% in early 2000. However, it is still very low compare to the world average of 23.2% and an average of 54.6% for developed country, 36.3% of country in transition. Even if India

increase enrolment rate by 5% every plan period, it would take so more than a quarter century to come close to the level of developed countries.

ii) Fairness

There are big differences in opportunity to obtain higher education in India. The main factors are gender, caste, religion, habitation, and economic status. The table below displays this disparity.

TABLE I
ENROLLMENT RATIO UNDER DIFFERENT GROUPS OF POPULATION [13].

	Male	Female	Schedule tribes	Schedule castes	Hindu	Muslim	Rural	Urban	Poor	Non-poor
GER 2003	15.3	11.0	5.0	7.5	12.0	8.2	7.8	27.2	2.43	12.81

India has no more than 15% of graduates of general education and 25% of technical education are fit for employment. Majority of high level institutions fall into medium quality and low quality [14].

TABLE II
NAAC RANKING OF COLLEGES 2006 [14]

Total Colleges – 14000				
1)	A++, A+, A – (A)	245	High Quality	9%
2)	B++, B, B- (B)	1785	Medium Quality	66%
3)	C++, C, C- (C)	668+	Low Quality	24 %
	Total	2698		100%
4)	Collage not assessed (self financing and not permanently affiliated)	11302	Grade not known (presumably low quality)	

B. *Human resources*

India's economy is growing significantly, with GDP increasing at least 9% every year since 2005. The rapid expansion in the outsourcing business to India is a major factor in India's economic growth. However, outsourcing industry in India is now facing many problems relating to human resources. This is a big challenge for India to resolve.

i) Shortage in skilled labor

Low-cost skilled software engineers has been the competitive advantage for the software segment in India and well educated, English speaking for the BPO segment. However, both

segments are confronting labor shortages. In 2006, Nasscom reported that India could lose potential off-shoring work worth billions because of this problem.

IT segment. There were about 562,000 software professionals employed in 2007, roughly 50% increase from 297,000 employed in 2005. Nasscom predicted that demand of software professionals would surpass supply by a margin of 235,000 in 2009-10. Demand for this profession is growing consistently. Programmers with basic software skills (Java, C++, ERP, SAP, and J2EE), application developers, and database engineers are the urgent need of the market right now [15].

BPO segment. This segment contributes about $5 billion to the country's GDP. It has the rapid growth rates (about 50% per year on average). There were 415,000 workforces in this segment in 2005-06. According to the study of Nasscom-KPMG, the demand of this segment would grow to 1.41 million in 2009 and estimation of 262,000 people in this segment by 2009 [15].

ii) High turn-over rate.

Many companies in India now are struggling to retain their employees. Global outsourcing of foreign companies in India has created substantial opportunities and competition. The drawback of increased competition is a rising rate of attrition. This issue costs companies time and money to find, interview, hire, and train new employees.

IT segment. In 2004, the average attrition rate in this segment was 22%. Wipro reported an attrition rate of 17% in 2004. Infosys attrition rate was 11% in 2005. However, average turnover rate in the top 10 IT firms was over 20% in 2006-2007. The primary cause of attrition is the lack of opportunities to work on cutting-edge technology [15].

BPO segment. The average attrition rate in BPO is usually higher than other segments. In 2004 study of 7 large call centers showed average turnover of 30%, with a range from 12% to 62%. There is job-based variation in turnover as well. Average turnover in "voice-based processes" is 45-50%, while in "non-voice" operations is 15-20% [15].

Across the industry, we can summarize 12 typical cause of attrition, which includes: 1) Pace of effort required, 2) Sense of being overwhelmed, 3) Frustration of not being allowed to do a good job, 4) Repetition, 5) Day claustrophobia- being at the desk for extended time, 6) Rank and file regimentation, 7) The feeling of being scrutinized, 8) The feeling of not being appreciated by others, 9)Handling complaints and problems all day, 10)Odd work hours, 11) Pay, and 12)Better opportunities elsewhere [16].

IV.2 Persistent Lack of Investment in Physical Infrastructure.

A. Research and Development (R&D).

Number of R&D activities is a good milestone of the country innovation's level. The rapid growth of India economy is attributed primarily to the success of BPO and IT sector. India is

now planning to move its position from service provider to the major R&D hub. Many MNCs recently have been attracted to set their R&D center in the India. India's R&D level is still inferior in comparison to other countries such as Korea, Russia, China etc. However, India has a potential to be a leader in this field due to its huge resources.

Public sector in India plays a major role as investor in R&D activities accounting for 75-80%. The rest comes from 20-25 % by private enterprises and about 3 % by universities. There also has been more than 300 MNCs investing their R&D processes in India. This is reflected by the number of investment in R&D from private sector increased significantly from 0.8 billion in 2002 to 4.1 billion in 2004. Overall, India investment in R&D is hovering around 1 percent of its GDP which is lower than many developed countries.

The number of filed patents and publications in India has been increasing especially in computer/electronics and biotechnology. There were 24,505 patent applications filed in 2005-06 jumped from 10,592 in 2001-02. But these numbers do not reflect the real capacity of R&D in India. The process of filing patent in India is costly and intricate even when innovation is present. There is little competitive environment in academic field so faculties and scientists have less motivation to publish their works. R&D in India mostly in late stage which often not be reported.

B. Energy

Energy is the basic building block for socio-economic development. Future economic growth crucially depends on the long-term availability of energy in increasing quantities from sources that are accessible, easily available, socially acceptable and environmental friendly [17]. For India, in order to achieve its potential in technology world, energy definitely plays an important role in it.

With high rates of economic growth and over 15 percent of the world's population, India has become a significant consumer of energy resources. In 2006, India was the sixth largest oil consumer in the world. The global financial crisis and credit crunch have slowed India's significant economic growth particularly in the manufacturing sector, and GDP growth rates have declined from 9.3 percent in 2007 to 5.3 percent in the fourth quarter of 2008. Despite a recent slowing economy, India's energy demand continues to increase. In terms of end-use, energy demand in the transport sector is expected to be particularly high, as vehicle ownership, is forecast to increase rapidly once the global economic crisis abates and domestic spending levels resume [18].

India lacks sufficient domestic energy resources and must import much of its growing energy requirements. India is not only experiencing an electricity shortage but is also increasingly dependent on oil imports to meet demand. In addition to pursuing domestic oil and gas exploration and production projects, India is also stepping up its natural gas imports, particularly

through imports of liquefied natural gas. The country's ability to secure a reliable supply of energy resources at affordable prices will be one of the most important factors in shaping its future energy demand [18].

i) India's current energy situation

According to the International Energy Agency, 138 primary energy demands in the world will increase by 66 percent from the year 2002 to 2030, where Asia's share is projected to increase from 28 percent to 35 percent. The share increase will be especially significant as regards oil demand. The Asian developing countries will take the largest share, 38 percent in 2030 of which China will account for 16 percent and India 8 percent. India's demand will more than double during that period, 139 and India will also increase its share of total consumption of natural gas and coal [19]. Coal accounts for more than half of India's total energy consumption followed by oil, which comprises 31 percent of total energy consumption. Natural gas and hydroelectric power account for 8 and 6 percent of consumption, respectively. Although nuclear power comprises a very small percentage of total energy consumption at this time, it is expected to increase in light of recent international civil nuclear energy cooperation deals. According to the Indian government, 30 percent of India's total energy needs are met through imports [18].

ii) India's energy sectors

Of the three major energy resources, coal, oil and gas, coal is India's major source of energy. With 7 percent of the world's coal, India has the fourth largest coal reserves. The Carbon Sequestration Leadership Forum (CSLF) estimates that at the current level of consumption and production, India's coal reserves will last for more than 200 years. Unfortunately, in addition to environmental concerns, that coal is one of the dirtiest hydrocarbon fuels, coal cannot meet all of India's energy needs. The transportation industry requires oil, and much of India's coal is not of the type needed in steel and other industries. In spite of India's coal reserves, the Indian government's flagship steel company, the Steel Authority of India Ltd. (SAIL) imports 60 percent of its coal needs [20].

Most of India's gas is now used for the electricity sector, although the expanding use of compressed natural gas (CNG) for urban transport makes this a growing market segment. Most of India's current gas needs are met from domestic sources. Liquefied Natural Gas (LNG) has not figured prominently in the energy mix, but is slowly increasing. Experts estimate that by 2012 India's LNG imports will be on par with Japan's current LNG imports of 60 million - 12 -ones per annum. Although the Gas Authority of India Ltd. (GAIL) has already begun work on a National Gas Grid, there is considerable technological progress that has to be made in terms of extraction, transportation and delivery of LNG. It is estimated that once the grid is fully functional, LNG could offset a significant portion of India's energy demand [20].

iii) Inescapable challenges

Growth demands energy. It is no wonder that India, with an economy expected to grow at over 5 percent a year for the next twenty-five years, has developed a ravenous appetite for energy. India is the world's fifth largest consumer of energy, and by 2030 it is expected to become the third largest, overtaking Japan and Russia [21].On a per capita basis, India's energy consumption is still a fraction of that in developed countries. In 2003, India's primary energy consumption was 439 kgoe per capita, compared with 1090 in China, 7835 in the US and a world average of 1688 [22].

A rapidly modernizing India will inescapably face growing challenges on the energy-security front. Although it is already the world's sixth largest energy consumer, India is witnessing its energy consumption rise at one of the fastest rates in the world, owing to its accelerated economic modernization and continued population growth. A linear analysis of India's demand-and-supply situation over the next two decades shows a ballooning energy deficit [23].

The oil situation is particularly alarming. In the face of limited new discoveries of hydrocarbon resources in the country, the relationship between demand and domestically produced supply has increasingly adverse over the decades [24]. Over the past two decades, domestic production increased only marginally, because the government failed to provide exploration and production incentives to the private sector [25]. Today domestic production can meet less than 30 percent of the demand. In fact, the government has told the national Parliament that the country's current oil reserves are likely to last only until 2016 if no new major oil discovery is made in the meantime [24].

More than oil, however, it is natural gas whose consumption is growing the fastest in India. The demand for natural gas, according to the government, is expected to increase to 400 million standard cubic meters (MSCM) per day in 20 years, when India's production presently is barely 100 MSCM per day.7 Despite recent discoveries of significant quantities of natural gas at the Krishna-Godavari basin in Andhra Pradesh and in the states of Orissa and Gujarat, India will have to continue to import increasing amounts of natural gas – either in liquefied form or through prospective pipelines – to meet its domestic demand [23].

As the third largest producer of coal in the world, India relies on coal for at least 50 percent of its total energy needs. About 70 percent of the coal is used for power generation. However, given the high ash content and low calorific value of Indian coal, India has to import most of the coking coal it needs. Although India's coal consumption is growing by 10 percent every five years, low productivity and high cost of coal production have made imported coal cheaper and more attractive. Moreover, trade unions have stymied coal-sector liberalization, with the state-run Coal India Limited (CIL) controlling most of the country's 390 mines [23].

V. ANALYSIS AND DISCUSSION

A. Approaches to Under-Investment of Human Capital

India has huge manpower viz... a huge potential but still not unleashing it's potential. We have seen the lags in the primary & secondary issues part. An Indian along with education insufficiency also suffers from the governance problem. The major changes that Indian's facing are education standards, corporate governance, R&D, corruption, talent migration and money in external banks.

i) Education Sector

Barriers for Indian education system are as follow:

1. *Caste system*
2. *Low income for teachers*
3. *Lack of schools*
4. *Low quality of teaching*
5. *Inadequate classrooms to accommodate all children*
6. *Low teacher student ratio*

Education is primarily the most important part of human life, the standard of education in both primary and secondary is not up to the standards as Indian teachers chose teaching as an occupation by chance and not by choice and they get low income [24].

Girls & rural residents are the most effected due to caste system. Increasing the literacy rate would not solve the problem but increasing the standard of education in both primary and secondary levels would solve the issue of education in India. Though the government has come up with education schemes like *District Primary Education Programme (DPEP)*, *Sarva Shiksha Abhiyan (SSA)* and Mid-Day Meals program it is not able to overcome the deficiencies in teaching standards, unavailability of the faculty and teacher to pupils ratio which is very less. The quality of education provided by the public education system is low which translates into low educational abilities even for those who are able to complete primary education cycle. Moreover, the quality of 'literates' of the school system is very low compared to that of the graduate level. Our suggestion is to increase the teachers income & add few additional benefits of government employees like provident fund, retirement benefits so that those well qualified teachers looking for work in the private sector would turn back to the government sector schools where the literacy rate and the quality is low [25].

ii) Corporate Governance Issue

Corporate governance deals with the ways in which suppliers of finance to corporations assure themselves of getting a return on their investment [26]. The chairman, Ramalinga Raju, resigned after revealing that he had systematically falsified accounts, such things get down the

stock market along with unemployment and do not draw major outsourcing companies to India fearing loss [27].

India documented major gaps and lapses in the implementation of governance rules, particularly in relation to the role of nominee directors from financial institutions, stock-listing laws and regulations, insider trading, and dividend and share transfer transactions. Improvements in corporate governance can enhance investor confidence in firms in emerging economies and increase these firms' access to capital [28].

iii) Corruption Issue

The term corruption is a vicious circle to get corrupted its easy but it's not as easy as it looks to come out of it. This is due to various reasons like political interference in the law system to cover up their faults, low income levels of the government employees, easy settlement system outside the judiciary as it takes long time to settle through the law system. The author K. N. Gupta*("Corruption in India")* state's that corruption's ferocity makes Indian citizen distasteful due to corruption players like politicians, bureaucrats, businessmen, NGO's and criminals[29]. The best cure for the corruption is to cut it off at the root level than in the tree level it's not the responsibility of the government it's the responsibility of citizens of India to eradicate corruption by not involving in it.

iv) Money in External Banks

Indians money in external banks like Swiss banks is estimated to be $5.7 billion; up from $2.6 billion in 2001.This black money is majorly due to tax avoidance & corruption [30]. If this money is brought back that money could be utilized for development in education, R&D and for major projects in technology development.

v) Talent Migration (brain Drain)

Talent migration is majorly due to employment and talent recognition deficiencies and low pay scale for the talented ones. Majority of potential positions in government sector pay less to the qualified people leading to corruption, migrating from one position to a better position in private sector, unhappy people in private sectors lead their way to a better paying jobs in better economies. As per US immigration data nearly three-fourths of all of the systems analysts and programmers are from India. Consequently, many governments have taken significant steps to increase the inflow of Indian skilled talent into their countries.

There are about five million overseas Indian workers in this category all over the world. The Gulf has traditionally been the recipient of a large number of semi and unskilled labor, and the numbers continue to grow. More than 90 percent of these workers are in the Gulf countries and Southeast Asia. Family migration takes place due to talent migration for example women and children migrate with their husbands. This cannot be stopped unless the countries

that need Indian talent would make the visa process inflexible [31].

B. *Approaches to Persistent Lack of Investment in Physical Infrastructure*

Another major problem -- that is critical for India -- is the persistent lack of investment in physical infrastructure. As described earlier on the current condition of India's energy part, incremental demand for infrastructure will continue to increase due to economic growth and urbanization. Thus, there is both a stock and a flow problem. If India's economic growth were to continue as we thought, it will fuel demand for energy, transport, logistics and communication. Managing India's transition to the future will largely be a task for the Indians themselves. Power shortages and blackouts are common throughout the country and are an important drag on economic activity. Indian companies on average lose 30 days in obtaining an electricity connection, 15 days in clearing exports through customs, and lose 7% of the value of their sales due to power outages [32].

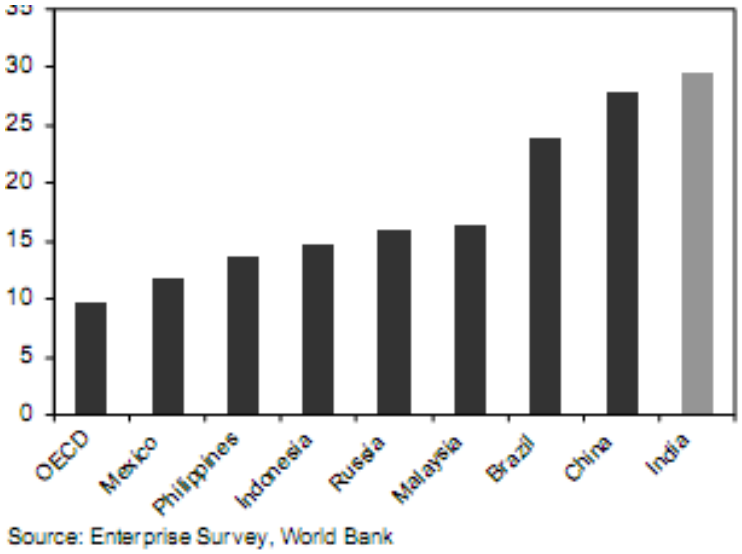


Fig.2. Delays in Obtaining an Electrical Connection

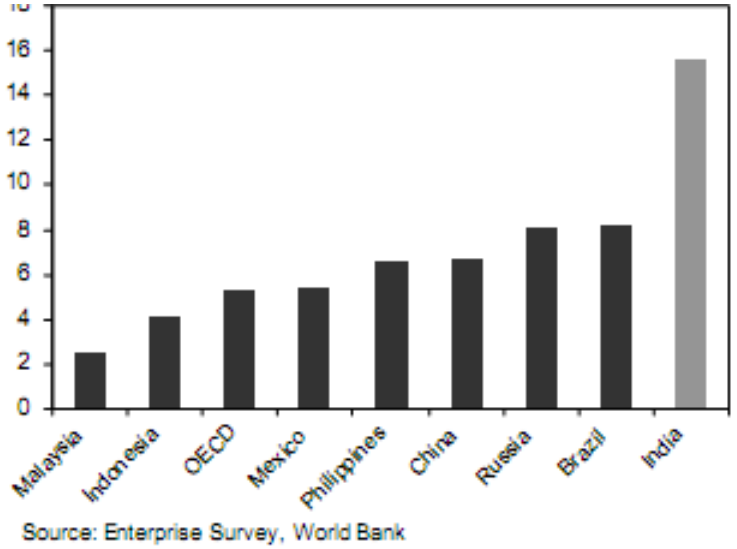


Fig.3. Average Time to Clear Export through Custom

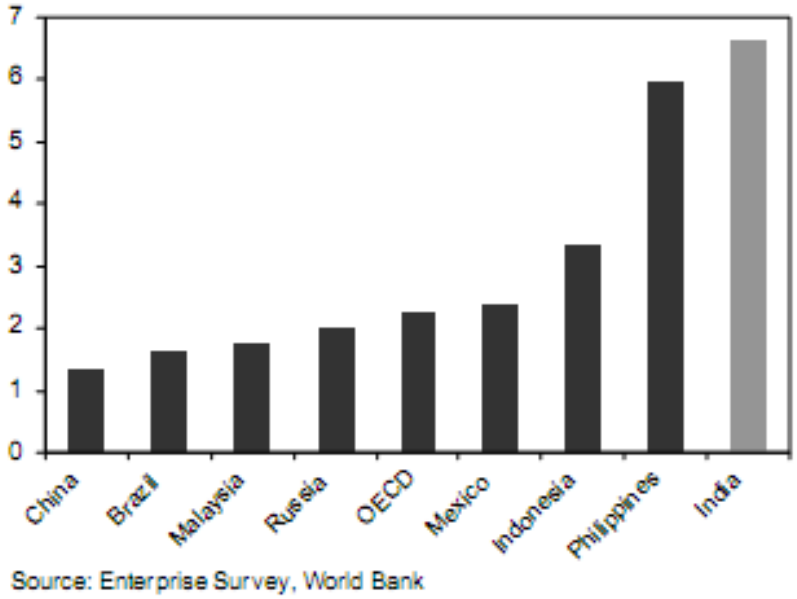


Fig.4. Value Lost due to Power outages

The deteriorating condition of road and rail networks, as well as port facilities, further undermines the potential for continuing rapid growth. A shockingly high percentage of each year's agricultural crop rots for the lack of efficient transportation. A leading business group in India recently estimated that more than $330 billion needs to be spent on infrastructure over the next five years in order to boost the country's competitiveness. This amount, however, is beyond the budgetary resources of the Indian state [33]. To overcome these problems, based on the

literature review on the current condition of India's energy supply-demand curve, there are some alternatives to be considered by the India's government:

i) Financial issue

We describe earlier that India's government will need at least $330 billion to be spent on infrastructure over the next five years. Some of the alternatives to overcome this issue are:

- India needs to develop its capital market
- Attract more Foreign Direct Investment in the banking sector.
- Develop more public-private partnership model.

ii) Develop short term and long term solution for energy issue

The Indian economy has clocked an average growth rate of 7 percent in the last decade. To maintain this pace, experts believe that the country will have to increase its energy consumption by at least 4 percent annually. This relentlessly increasing demand is a massive challenge for India, affecting not only the domestic economy but India's foreign policy. We talked about the three major energy sources in India; coal, oil and gas in our problem definition above. However, as we described, coal cannot be use as their main sources of energy due to its nature as one of the dirtiest hydrocarbon fuel and also there is a concern about the level of India's coal purity to be use in the steel industry for example. This condition demands for a short term and long term solution.

For the short term solution, the government should increase the level of involvement of private sector in the energy sector. India's energy sector is dominated by the public sector. Within the electricity supply industry, there are some private electricity generating operations, but almost all are required to market through the State Electricity Boards (SEBs), owned and controlled by individual states. The petroleum industry and gas industry are currently dominated by the Oil and National Gas Corporation (ONGC), the Gas Authority of India Ltd (GAIL), and the Indian Oil Corporation (IOC). Private sector involvement has been restricted to the refining section of the energy industry. ONGC, the government's oil exploration and production enterprise, is one of the most profitable companies in India and is responsible for 77 percent of crude oil production and 81 percent of natural gas production [20].

For the long term, India's government needs to think the possibility of developing and using alternatives energy. We conducted literature review to find out the alternative energy that can be applied to India and we found some valuable information on the growing interest of using wind as the source of the alternative energy. Wind energy, with an average growth rate of 30%, is the fastest growing source of renewable energy in the world. India is in rank 5 after USA, Germany, Spain, and China in term of wind energy generation and has an installed capacity of more than 9756 MW as of January 31, 2009 [34]. New technological developments in wind energy design have contributed to the significant advances in wind energy penetration and to get

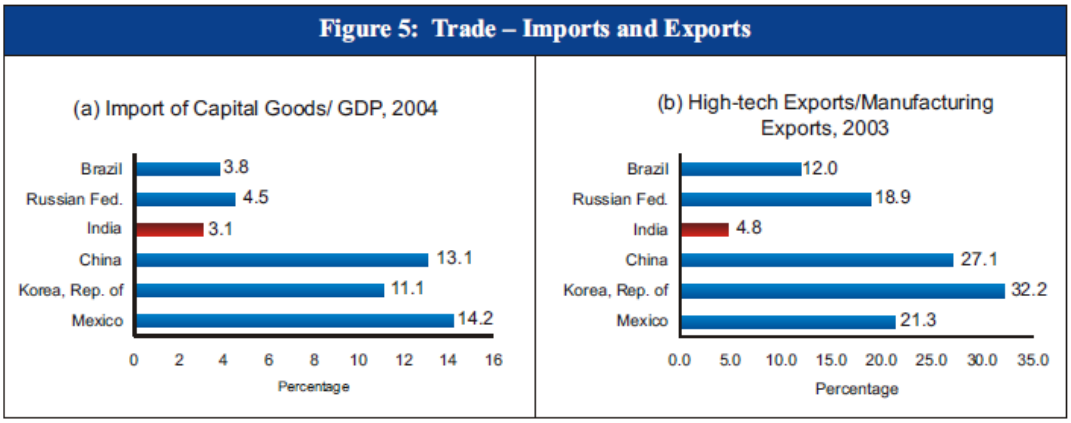
optimum power from available wind.

iii) Research and Development Issue

So far we have discussed about R&D in India, the current condition, the limitation and what lies ahead in the future of India's R&D. We come to the conclusion that in order for India to be able to compete and increase the capacity and the capability of its R&D, several actions need to be done through the absorption of existing knowledge and technology. Absorption of existing knowledge and technology will be one of the approaches that can be implemented. India could have done a better job in R&D if it improved its application of existing knowledge from other countries. There are many ways to pursuit and disseminate global technology such as trade, foreign investment, technology licensing and diasporas.

a) Increase Trading

Import and export activities can expose Indian firms to new technology from foreign companies. It is normal that firms from developing countries purchase machines, products, materials from developed countries. This incident exposes the firms to new technology and know-how. "India import of capital goods as percentage of GDP(2004) and high technology exports as a share of the total manufacturing exports(2003) are the lowest compared to other countries" This outcome can be results from deficit in infrastructure and awkward bureaucratic processes.



[3]*Source: Unleashing India's Innovation The World Bank*

Fig.5. Trade Imports and Exports [39].

b) Technology Transfer

The most direct way to get new knowledge is technology licensing. Other countries such as Korea, China, and Brazil have spent tremendous amount of money for purchasing technology licensing whereas this investment is rare in India. India can strengthen its knowledge base from this channel. There are many Indian workers in major global companies. These expatriates can influence their companies to invest in India as well.

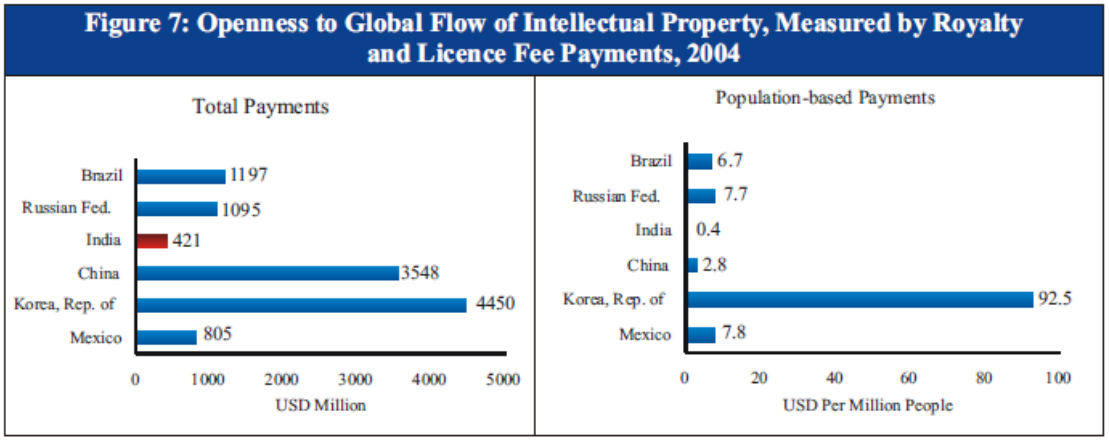


Fig.6. Openness to global flow of intellectual property, measured by royalty and license fee payments [39]

c) Financial Support for Domestic R&D

Domestic R&D investment is crucial for innovation. As innovation in India is still in its nascent stage, 80 percent of the domestic R&D is undertaken by the public sector, while the remaining is funded by private enterprises. The allocated science budget in India has increased at a CAGR of 12.3 percent between 2004 and 2008, to INR 242 billion. Fig.7. depicts the increase over the period 2004 – 2008 [35].

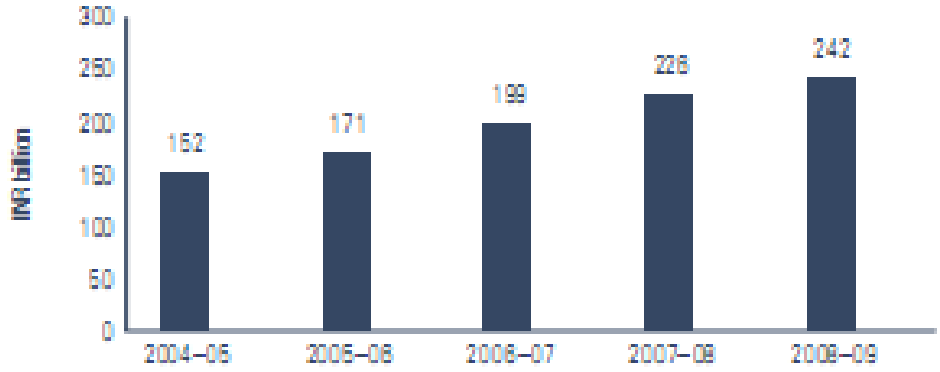


Fig.7. India's Science and Technology Budget 92004-2008) [35].

In countries such as China and the US, the contribution of the public sector towards R&D is only 30 percent. In 2006, India's R&D spends stood at about 0.8 percent of GDP, as compared to China's 1.23 percent. R&D spending for other countries in 2006 is provided in Table 7 [36].

COUNTRY	R&D CONTRIBUTION OF PUBLIC SECTOR (%)	R&D AS A PERCENT OF GDP (2006)
India	80	0.80
Japan	18	3.40
US	30	2.76
Germany	30 (2004)	2.50
Canada	35	1.94
UK	32 (government and higher education)	1.90
China	30	1.61

Fig.8. R&D as Percent of GDP [36].

The government needs to encourage private sector to get more involve in R&D through certain kind of policy such as fiscal incentive that is beneficial for both government and the private sector. Money is the biggest concern in R&D since this activity rarely generates revenue in early and growth stage, the financial support must be available. Venture capital and private equity play a vital role in country's innovation. The early stage of business relies mostly on the funds from these sources. The number of deals from venture capital and private equity in India grew fivefold from 2003 to 2006. However, the funds usually go to late stage of the companies. Early stage funding was accounted only 13 percent of the total deals from venture capital and private equity.

d) Guarantee of Intellectual Property Right

The security of intellectual property is the important factor that MNCs evaluate to invest their R&D in any country. They need guarantee that their works will not be stolen. For example, India patent laws do not protect software. Software is only protected by copyright law. IP protection plan will be incentive for foreign companies to start R&D in India confidently.

e) Rebalance India's Industrial Structure through Foreign Direct Investment (FDI).

The match between supply and demand in the R&D's manpower guided the flow of foreign R&D to the shores of developing countries, including India. The comparative advantage of the Indian supply side can be understood from the responses of 500 senior executives in a recent global survey by the Economic Intelligent Unit 19 of the The Economist. As described in Table 8, India tops the preference list when it comes to "access to highly skilled labor force, R&D activities and new opportunities in outsourcing". Overall, however, China scores over India in the UNCTAD study on FDI for R&D [37]

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

Fig.9. Destination of FDI: Choice of the 500 Executive [37].

Figure 2 shows the results of the UNCTAD survey on attractive prospective locations of R&D centers [38]. India, according to the survey, is the third most preferred destination after USA and China. The survey refers to the period 2005–09. In an earlier survey for 2004, India's position as an attractive R&D destination was sixth. India has thus moved up by three positions.

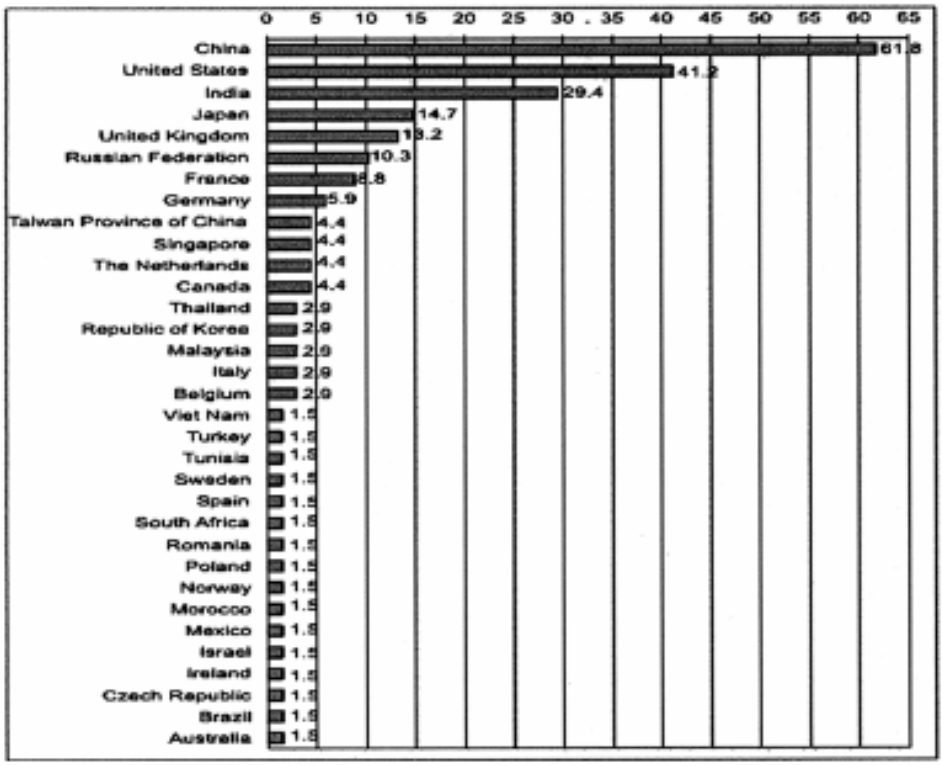


Fig.10. Most Attractive Prospective R&D Location, 2005-2009 (per cent of the respondent mentioning the location) [38].

f) Government Support to Promote R&D.

This can be done through various programs such as: through academic infrastructure; promotion of entrepreneurial venture by scientist; facilitating small and medium enterprise to get access to science and technology.

VI. CONCLUSION

India, with the second population in the world, is growing to be another important economic entity. India has huge manpower. Information technology is the indispensible driving force in India's economy. The IT industry also has potential to have the long-term development and to promote the broad-based economic development. India has the large supply of IT skilled workforce. Thus, India has lured many companies to set up high-end R&D centers there. It is becoming another major R&D hub in the world.

However, India still remains a very poor country. India has the world's largest concentration of economic misery. Hundreds of millions of people are still in poverty.
India's human capital is still in great under-investment condition. Quite a portion of India's population is still illiterate, lack adequate access to educational and health care services. The Indian government has realized that education is proved to be a significant key for reducing poverty and unemployment.

India is also facing critical issues such as other lack of investment in physical infrastructure, particularly in the vital energy and transportation sectors. Energy is the basic building block for socio-economic development. India needs to resolve the issue of how to better absorb the existing knowledge and technology to better promote its technology development.

India is still having great development space and numerous opportunities as long as it can develop short term and long term solution for those problems.

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