

India as a Knowledge Economy: Aspirations versus Reality

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“A knowledge economy is one that relies intensively on human skills and creativity, the utilization of human intellectual capital supported by life-long learning and adaptation, the creative exploitation of existing knowledge, and extensive creation of new knowledge through research and development.”

The success of Indian firms and professionals in the information technology (IT) arena during the last decade has been spectacular. Entrepreneurs, bureaucrats, and politicians are now advancing views about how India can ride the IT bandwagon and leapfrog into a knowledge-based economy. Isolated instances of villagers sending and receiving email messages or surfing the Internet are being promoted as examples of how India can achieve this transformation, while vanquishing socio-economic challenges such as illiteracy, poverty, and the digital divide along the way. Likewise, even while a miniscule fraction of the population has access to computers and the Internet, e-governance is being projected as the way of the future. There is no dearth of fascinating stories about IT-enabled changes, yet there is little discussion about whether such changes are effective and sustainable in the absence of the basic infrastructure that is accessible to the citizens of more advanced economies.

The statistics speak loudly and clearly. Seventy nine percent of India's population lives in villages without the basic amenities and infrastructure that can sustain a knowledge economy. While over 60% of the population is considered to be literate, note that the relevant definition of literacy that supports this statistic is being able to read and write simple words in any language, acquired with or without formal schooling. This criterion is so basic, that it is almost irrelevant in the context of a knowledge economy. Yet, the central and state governments in India are investing millions of dollars in promoting IT-based initiatives and the IT industry as vehicles of social and economic transformation. Are we putting the cart before the horse here? Even if substantial IT investments

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are justifiable, how must the IT revolution proceed so that the nation is benefited in a wholesome and balanced way?

This commentary aims to open a debate regarding the impact of IT on a developing country like India. We argue that India should aggressively pursue traditional manufacturing and agriculture-based industries to build a robust industrial economy that can be made more efficient and productive with IT. In turn, policy makers should moderate their obsession with IT and IT-related ventures as a panacea to solve socio-economic problems. IT-related projects must definitely be pursued, but the private sector must bear the risks and capture the returns related to these projects, much like it does in any other sector of the economy. We argue that government actions cannot be disproportionately skewed towards a single industry when its benefits to the common man are still not well understood, and when the role of IT within the broader framework of national development has not yet been adequately articulated. Not everyone will agree with this viewpoint — but then, neither does this commentary pursue such a consensus.

Such a debate is even more critical with the recent worldwide bursting of the IT bubble. Booms and busts have long existed in all kinds of markets — during the 17th century tulip bubble, for example, the *irrational exuberance* of tulip buyers drove the value of each tulip to several thousand dollars. In 1637, a single Semper Augustus tulip sold at a price that was three times the value of the most expensive estate in Amsterdam! However, such booms and busts apart, in a reflection of the well-known IT “productivity paradox,” even serious researchers, CIOs, and economists in the corporate world (including Stephen Roach, the respected Chief Economist at Morgan Stanley) have struggled to convincingly demonstrate the benefits of IT to the corporate sector.

Equally important, proponents of “new growth theory” including noted Stanford economist Paul Romer have convincingly argued that ideas and knowledge, rather than scarce physical resources, increasingly fuel economic growth. Ideas and knowledge are, in turn, endogenously generated within an economy, as a function of the prevalent levels of education, the skills of the workforce, and proper market incentives. The message in the Indian context is straightforward — progress into a knowledge economy will not come without substantial, widespread development of India’s human potential. Against this backdrop, before embarking on a series of irreversible commitments related to IT, it behooves Indian policy planners and politicians to ponder the following issues.

India as a knowledge economy

The economic value of IT depends greatly on the levels of economic progress a nation has already achieved. IT has the potential to make existing processes more effective and efficient, but cannot substitute for the lack of a basic infrastructure. What is good for a developed country like the U.S. is not necessarily optimal for a developing country like India when those basic elements of infrastructure that support a successful economy such as educational opportunities, healthcare, electricity, drinking water, and capital are still in short supply.

The impact of IT is best understood when the fundamental differences between the innovations and ventures of industrial and knowledge-based economies are recognized. Industrial growth yields from investments in large-scale infrastructure (e.g., railroads, roadways, power grids, and dams). These investments, in turn, support the growth of physical-asset intensive industries (e.g., the steel, chemical, and transportation industries) that create and move physical entities (e.g., people, water, and goods). The ventures of an industrial economy typically employ large numbers of workers with minimal training, education, and skills. These ventures have the potential to uplift large sections of the population.

In contrast, innovation in the knowledge economy usually engenders highly specialized knowledge-intensive products, and the large-scale capture, movement, and usage of information using sophisticated network infrastructure (e.g., computers, cable, fiber, and routers). Beyond the physical labor required for initial construction, building and maintaining this kind of infrastructure requires specialized skills and training. It follows that the IT sector, in itself, would offer relatively modest employment opportunities for India's teeming population, even if India was to become the world's software factory.

Further, despite all the hype of moving into a "new" economy, the fact is that economic development is cumulative. The past matters because economic development builds on preceding accomplishments. The industrial economy made agriculture more efficient and productive. The productivity of agricultural labor skyrocketed with the use of industrial and biological innovations including tractors, fertilizers, irrigation systems, pesticides, and genetically engineered seeds. It is not surprising, therefore, that the greatest source of real productivity, growth, and efficiency attributed to the information economy derives in the long run not from the information economy itself, but from its effects on the industrial economy. For example, the intelligent use of IT can help product distribution channels and manufacturing plants to work more efficiently.

Historically, sustained industrial innovation in developed economies has created great wealth and improved living standards across societal divides. This progress has set them up in an ideal position to exploit and create knowledge as they transform into knowledge-based economies. One aspect of this transition is that, increasingly, labor-intensive manufacturing and low-end service jobs are being outsourced to countries with lower labor costs. China has captured much of the lucrative manufacturing market, ensuring millions of jobs for its citizens. India would benefit much from aggressively pursuing such manufacturing facilities that have potential to serve both the export and domestic markets, particularly in view of its high levels of unemployment.

The “leapfrogging” argument, whereby India skips massive industrialization and moves straight into the information economy, is suspect. Proponents of the leapfrogging argument frequently advance the example where Indian villages without any electronic communications directly adopt a cellular phone, rather than work their way up through physically connected communication systems. The problem with this example is that, while it provides for some excellent symbolism, the underlying argument is not scalable to a national economy. Consider, for instance, the industrial transportation system. The rules of physics do not allow IT to substitute the physical movement of goods from one location to another by a “virtual” movement! A lightning-fast information network will not in itself help achieve the faster and cheaper transport of goods — better roadways and railways will.

IT, job growth, and government investment

From a social planner’s perspective, it is important that wealth not only be created at a societal level, but that different sections of society benefit in some measure from such wealth. The development of IT in India has, by and large, focused on developing and delivering IT services to support the more advanced economies of the world (e.g., U.S., Japan, England, Germany). Even if the most optimistic projections of the IT-related job creation (including jobs associated with IT outsourcing, call centers, and design centers) in the next decade come true, this industry will employ at the most a couple of million people. In a nation with over 1 billion people, this level of employment can make but a minor dent in the employment statistics.

Further, in the zeal to establish call centers in India, many have ignored the fact that numerous English-trained and highly educated members of the workforce are being relegated to tasks that are generally manned by workers with much more modest levels of education in the advanced economies. Moreover, is this model economically sustainable in the long run? Call centers,

by and large, are commodities. Due to intense competition, prices for some of these services have fallen so dramatically that many call centers are already struggling to survive. Also, it is very likely that other developing nations with even cheaper labor and growing English-speaking populations will compete with India in this area in the near future. Call centers, unlike manufacturing plants, can be shifted easily from one country to another — it is difficult to achieve “lock-in” in this arena.

Further, the IT industry holds limited potential for wealth to trickle down to the poorer sections of society. Unlike a steel plant or a power plant, IT engenders few opportunities for the unqualified. Any transfer of wealth from the IT sector (e.g., by taxing the IT sector to fund social spending) would be achieved through the heavy hand of government, which represents, at best, a dubious economic proposition. In fact, one consequence of the IT revolution in India, at least in the short term, will likely be the establishment of a digital divide, where the rich and educated are empowered and enriched by IT, and the poor are oblivious to its impact.

Before embracing IT as the engine of growth, Indian social planners need to take a hard look at those investments that are likely to yield the greatest returns at a societal level. Let us consider, for example, one sector that is far removed from high-tech world – the jute industry. How many of us have seriously evaluated the fact that the jute industry, though declining, sustains over 5 million Indian households? In late 1980s, while working for an industrial development bank, one of us was puzzled about the government’s blanket ban on the use of plastic material (e.g., HDPE) to package cement, fertilizers, sugar, food grains and other commodities — only jute was to be used. From a purely economic perspective, considering that jute bags were more prone to spillage and rat-induced destruction, this regulation appeared to have no rational basis (jute packaging has much improved since then). However, in retrospect, given the millions of people employed in that industry, and the economic and political upheaval that would incur if that industry rapidly declined, this policy probably had some important redeeming features.

What does IT have to do with the jute industry? At first sight, very little; but on deeper introspection, plenty. Rather than harping on the IT industry itself, imagine using the power of IT to expand the domestic and export market base for jute products, to position jute as a biodegradable material that is safe and cheap relative to plastics, and to improve the efficiency of local jute markets so that jute growers can get better prices. Now imagine how the benefits that would potentially flow from such initiatives could positively affect millions of Indian households.

This does not call for Internet access to every jute cultivator or processor, or for computers in each village. A public or private agency with the right incentives, and with access to both domestic and international marketplaces can orchestrate these initiatives. Further, governmental initiatives for R&D related to strengthening jute products and finding other uses of jute would deliver significantly more social benefits than email access for jute farmers. In the rush toward IT, it is easily forgotten that the greatest returns to government investment at the societal level may be achieved elsewhere.

We need to be particularly careful not to give short shrift to the manufacturing sector. Consider China, our northern neighbor. China is not currently known for its strengths in IT, although it has been moving toward establishing its presence in this area. But, what China has accomplished building its core industrial base is striking. The foreign direct investment in China was of the order of \$40 billion during the year 2000 despite all the noise about alleged labor and human rights abuses. Total Chinese exports worldwide exceeded \$200 billion in the year 2000. The U.S. alone annually imports over \$100 billion worth of goods and services from China. In fact, the value of “footwear” exported annually by China to the U.S. (approximately \$9.2 billion) itself compares with or even exceeds the total value of India’s annual IT exports.

Why are these numbers relevant? Exporting footwear creates millions of jobs for citizens who lack education and sophisticated skills. According to some reports, a total of 34 million jobs have been created in China on account of exports, with exports to the U.S. alone directly accounting for the creation of over 20 million jobs during the last decade. These jobs have had a significant and widespread impact on the Chinese economy, increasing the standard of living for a substantial fraction of the Chinese population. There is much we need to learn from China about how the manufacturing sector can contribute to robust and equitable economic growth. Taiwan, Malaysia, and South Korea are other countries that have flourished using a similar approach.

In contrast with the manufacturing sector, IT-based industry generally involves knowledge intensive work (with the exception of mundane data-entry jobs). The direct benefits to IT (e.g., employment in IT firms) are likely to flow to those who already have the benefits of education. The trickle-down effects of the production of information products (e.g., cleaning and maintenance staff for IT firms, restaurants, hotels) are likely to be modest or none in areas other than large cities. The benefits of IT implementation across other industrial sectors (e.g., employing IT toward making transportation infrastructure more efficient, and toward improving the performance of supply chains

and distribution systems) are likely to be substantial, but the industrial policy does not point in this direction at the moment.

The current emphasis on IT would be less objectionable if it did not contrast sharply with the treatment meted out to other core industrial sectors. Consider the case of the Vijayanagar steel plant. This plant had the potential to transform the poverty-stricken Bellary district and surrounding areas in the state of Karnataka. The feasibility study for the plant was completed in 1967, and its foundation was laid in 1972. Finally, in 1995, more than a quarter century after taking the first steps, the government divested its interests in the (yet incomplete) project. A scaled-down and much modified version of the project is now up and running under the auspices of the private sector. Meanwhile, the global and domestic market for steel has evolved to an extent that the economic assumptions that anchored the initial feasibility assessments are worthless.

The actions of the government in the recent past have tilted in favor of the IT sector. For instance, taxes levied on software in the state of Karnataka were removed hastily within a week in response to pressure from powerful IT companies. Yet, the same government takes a long time to approve new manufacturing projects. Many workplace inspection procedures have been suspended for IT companies, whereas traditional firms are subjected to myriad regulations, many of which have not been seriously reevaluated for relevance and effectiveness in decades. The government needs a more balanced policy – one that ensures that the core industrial sector is not ignored in the rush toward IT.

IT, population, and education

It is almost fashionable now to say that India's population constitutes one of her greatest assets. That viewpoint, in our opinion, is misleading. People are assets only when they can meaningfully participate in the cycle of value creation and consumption — either by exercising buying power, or creating products and services of value to others, or by creating and harnessing knowledge. By these standards — and at the risk of sounding draconian — a good fraction of India's population is a liability rather than an asset. The government can help transform this situation by building two pillars that have supported the growth of every successful economy, i.e., a reliable infrastructure core, and widespread access to education and training. We have touched on the interface between IT and infrastructure earlier — let us now discuss the IT-education interface.

Distance learning and e-learning are already being touted in some quarters as solutions to India's education challenges. The proffered argument is that IT can enable the cheap and widespread delivery of education (although there is no published report on the costs of creating such an infrastructure). This reasoning ignores the real problem facing the Indian educational system — i.e., how can the children of the poor and the uneducated be provided with the incentives to come to school, stay in school, and progress to higher institutions of learning? The answer to this challenge lies in understanding physiology and economics, rather than in implementing technology. For all the drawbacks and inefficiencies encountered in its implementation, the mid-day meal program in the state of Tamil Nadu that was launched by the late chief minister M.G. Ramachandran, and that has now been adopted by some other states, addressed this challenge head on. The program was designed in recognition of a simple, but fundamental fact —the brain cannot feed when the stomach itself is unfed. It provided parents with the incentive to send their children to schools, rather than to toil in the fields. For the children to whom the benefits to education seemed like a distant, hazy mirage, it provided an immediate, meaningful reason to stay in school.

Apart from the initial excitement and novelty value that it will doubtless generate, there is little reason to believe that an IT-based learning environment will advance the cause of Indian education in any substantial way. Problems that are enmeshed in the social and economic fabric of our society need to be primarily addressed with solutions that are of a social and economic nature. Throwing technology at these problems will not make them go away.

There are also economic reasons why distance learning and e-learning have a high probability of failure. Creating the infrastructure and content to support effective e-learning will be very expensive. Many startups and universities in the U.S. are still struggling to effectively deliver content and achieve learning objectives in the virtual setting. This problem will be compounded in the Indian environment due to diverse languages and the lack of underlying infrastructure. Further, the ability to surf the Internet alone does not imply a readiness to learn using the virtual medium-- the new medium in itself does little to address fundamental issues related to the lack of incentives and motivation. A rush into e-learning in this situation will only lead to squandered resources.

Presenting technology as the solution to India's educational challenges is troublesome in two ways. First, it diverts our attention from issues that should really be on the front-burner. Once our attention and resources are diverted, building back the momentum in the correct direction is a monumental task. Second, by building castles in the air that will soon be blown away by the winds

of reality, it does a serious disservice to the more limited, but yet substantial and real benefits of technology.

IT and culture

A knowledge economy is characterized by a culture of innovation. Such a culture has some key characteristics — incentives for innovation, and intellectual property protection.

A culture that truly enhances innovation supports the view that to try hard and fail is perfectly fine. Yet, the educated Indian psyche has historically been averse to blessing the risky venture—in fact, education has been viewed as a way to avoid risky options, rather than as an enabler of intelligent risk-taking and entrepreneurship. This is a cultural mindset that hinders innovation, because meaningful innovation is almost never without significant risk.

This attitude transcends into the corporate arena. It is mind-boggling to think about how static the Indian automobile industry was for almost 3 decades before the winds of competition brought about rapid change. Competition breeds innovation—when competition is absent or minimal, there is little incentive for corporations to innovate. Not surprisingly, even as markets have become increasingly competitive, R&D spending by U.S. firms has increased sharply, at an annual rate of over 6% from 1995-2000.

While one side of the cultural coin pertains to the incentives for innovation, the flip side pertains to its protection. Ideas, unlike property, cannot be protected by building a fence around them or by hiring guards to watch over them. The protection of intellectual property is not a purely economic issue — it has important cultural aspects as well. The economic angle can be addressed by defining newer and stronger patent laws and punitive procedures. However, the cultural issues will decide whether such protection can be enforced meaningfully. Addressing the cultural angle is a challenge — it requires that even without the threat of punishment, we learn to draw a clear, disciplined boundary in everyday life between what is ours to take and keep, and what is not.

Making the cultural shift requires that we stop treating intellectual property rights in a casual manner. For example, a frequent argument heard in support of piracy goes along these lines — “If we could afford it, we would pay for it. We are using a pirated version because we cannot pay for it.” But then, how does an inability to pay for something ever translate into a justification to obtain it for free? One would be highly challenged to apply this logic to hotel stays, vacations, sea cruises, or even a television set. Piracy does exist to some degree in every economy, but rampant piracy dilutes

the incentive to innovate. In the context of intellectual property, economic measures and cultural shifts should proceed hand-in-hand before the spirit of entrepreneurship in India can take full flight.

The Road to Technology

A society that is deeply divided by social and economic fissures must think carefully about how it achieves economic and technological advance. The path, in some ways, is more important than the outcome itself. Modern day Russia provides a striking example of the results of chaotic advance. The Russian economy is now in sharp decline and is expected to contract for several more years, with no light visible at the end of the dark tunnel into which it has ventured.

In the Indian context, particular attention needs to be paid to when, where, and in what form IT and technological advances are encouraged. There are, indeed, many low-hanging fruit that can be harvested. A recent New York Times article described, for example, how a fisherman working off the coasts of Kerala used a cell phone on the seas to obtain and compare information about spot market prices for fish at Cochin and Quilon (85 miles apart). This fisherman netted an additional \$1000 in annual income merely deciding to deliver his catch to the more remunerative market each time his boat came in. This striking example of how simple information flows can enhance market efficiency is being repeated in many ways across markets and regions within India. However, the stakes are quite different when it comes to the formulation of national economic policy.

The formulation of national policy requires the implementation of important tradeoffs between the benefits to industrial sectors, regions, and classes of people. The quest for superior technology must be moderated by an understanding of its implications at the social level — what might be good for a private corporation or an entrepreneur may not always be good for society, and vice-versa. For example, a municipal corporation that purchases automated road-laying or cleaning equipment may find that it either does not use the equipment at all, or that it uses the equipment and allows numerous laborers on its payroll to idle, or faces significant resistance from labor unions. Technology adoption and labor retrenchment are inextricably linked in this case, and is shortsighted to advance doggedly on one front while turning a blind eye to the other.

Successful technology adoption will move in measured steps, at a pace and in a direction that are in harmony with changes in the socio-economic fabric. The role of the government in ensuring such harmony cannot be underestimated. This is especially true in a country like India where the

government remains responsible for a significant fraction of the economic output, and where it is actively involved in shaping rules and regulations as India integrates into the global economy. From the triumph of the capitalist systems across the globe, there is now ample empirical support for the view that governments must ultimately govern with a light touch. At the same time, several economies that have attempted rapid, unstructured transitions into the capitalist mode have declined. There is a strong argument to be made that the Indian government must not simply get out of the way in the spirit of *laissez-faire*, but must instead play a key role in pacing and shaping this transition.

Concluding thoughts

The growth of the IT sector in India symbolizes the potential of Indian industry to perform at world-class standards. Led by some visionaries and supported by thousands of employees and entrepreneurs, the IT sector embodies much of what can go right when the spirit of human enterprise is given free rein.

IT can change how the society communicates, collaborates, lives, works, and plays. However, IT offers little value to the large fraction of the population that is more concerned with day-to-day survival. It is not surprising, therefore, that while India is considered a software superpower, in terms of Internet penetration India is grouped along with Latvia, Thailand and Indonesia as a low penetration country.

The success of IT at the corporate level in India cannot be translated into a panacea that will solve India's myriad economic challenges. Just like copious rainfall can lead to dramatic floods that cause widespread destruction, an obsession with IT and the knowledge economy is not useful in the Indian context. To be truly beneficial, the rain of IT must fall at the right place, in the right quantity, at the right time, and for right purpose. Economic policies of a developing country cannot be based on "herd" behavior, and on what is hot in the international market for that year or decade. Neither does the aggressive pursuit of IT represent the sole, or even an obvious, pathway to a first class economy despite the glowing success of high-profile private companies in the IT realm. Noted economist Paul Krugman, in arguing against the belief that someone who has made a personal fortune will know how to make an entire nation more prosperous, probably phrased it best. "A country," he wrote in an article in the *Harvard Business Review*, "is not a company!"