

How Technoparks Contribute to ICT in India?

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Abstract. This paper describes the IT sector as part of India's National Innovation System. The Indian National Innovation System is a network of interconnected structural elements, in which the technology parks (technoparks) serve as the country's research and production centers for IT. The authors hereof underline the role technoparks have to play in solving such major socioeconomic problems in India as unemployment, low living standards, and regional HR allocation issues. The paper notes the role of technoparks in raising India's high-tech exports. Over 90% of the country's software and IT service exports is generated by technopark-hosted companies. This paper emphasizes India's ICT sector as the most successful sector of the national economy; it focuses on how technoparks have been a booster to the industry by providing the sector with infrastructures, tax benefits, equipment, and human resources. In today's economy, ICT is a crucial production factor that stimulates the economy of knowledge. Many researchers believe that knowledge, innovation, and cutting-edge technology are the crucial components of economic growth. The paper points to the imperativeness of analyzing national innovation based on technological breakthroughs: in the era of global digitalization, information, and robotics, sustainable economic development of a country and entering the global high-tech markets are impossible without boosting the innovation potential. For India, the potential lies in ICT first and foremost. The paper describes the core outcomes technopark operations in India to show their contribution to the country's innovation.

1. Introduction

In the late 1980s, a new conceptual framework emerged in science, technology, and innovation research. This was one of the first next-gen concepts at a time when linear innovation model reigned. It was subbed National Innovation System (NIS). Its structure implies that R&D systems seek innovation per se, and that the NIS is itself a part of a major system that comprises the state, universities, research centers, industries, and their environment. In addition to conventional research centers such as state-funded research institutes, R&D and production center in the NIS include technology parks (technoparks), which contribute to the potential in research and technology.

NIS creation and maturity has been theorized upon by C. Freeman, an English economist affiliated with the Science Policy Research Unit, University of Sussex, UK; R. Nelson, Columbia University, USA; and B. Lundvall, Uppsala University, Sweden. These and other scientists have done rigorous analysis of innovation in various countries; their contributions shaped different concepts of NIS. Thus,

C. Freeman defines the innovation system as “...the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies.” [1] B. Lundvall states that the national innovation system comprises “...the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state.” [2] For American researcher R. Nelson, the national innovation system is “...a set of institutions whose interactions determine the innovative performance ... of national firms.” [3]

Analysis of national innovation systems is crucial for today’s economics, as it provides guidelines for economic success in the age of information, where cutting-edge technologies and innovation are key to leadership in a global economy.

The most generalized concept of NIS can thus be defined as a set of interconnected organizations (elements) that generate and commercialize cutting-edge, one-of-a-kind technologies and knowledge within national borders by converting an innovative idea into a full-fledged commercial product that is both economically and socially beneficial. This definition makes it clear that the most important factor of success in a system lies in the performance of its participants (elements). Such elements include technoparks, a major part of India’s NIS infrastructure. India’s ICT market is based on technoparks, which are the key catalyst of sectoral growth in this country.

No economy can grow intensively without ICT. Globalization, internationalization, and other processes of today’s global economy force countries to seek ever greater innovation, ever higher potential in research and technology, so as to stay competitive in the globalized market of innovative ICT goods and services. ICT is of special importance to India’s innovation market. ICT implies research and use of computers and telecommunications of any kind to store, retrieve, and send information. The portability of IT and the deployment of ever faster and more reliable broadband networks have made ICT an increasingly important part of public milieu. ICT is used to automate simple and routine tasks such as text processing, or complex processes such as manufacturing, planning, and logistics. Thus, it is the IT that enables companies to be efficient and profitable. The technological advancements of recent decades have exacerbated competition. Companies use software, computers, and the Internet to evolve from small local enterprises into competitors on a national or even global scale. Technological breakthroughs force businesses to be flexible, to adapt their processes to the new advancements.

2. Technoparks as part of India’s NIS

Most developing countries are yet at their infancy in terms of innovation. India is a country that seeks to solve its socioeconomic problems and to enter the global high-tech market; as such, it perceives innovation as being fundamental to the challenges facing the nation. Technoparks are the source of creating, accumulating, and diffusing innovation both inside and outside India. In an attempt to identify the role and significance of technoparks to India’s innovation system, this research assesses their contribution to solving the country’s crucial socioeconomic challenges, as well as to boosting India’s high-tech potential, e.g. in ICT.

The strategic documents that set forth India’s scientific and technological advancement include the Scientific Policy Resolution, 1958; the Technological Policy Statement, 1983; and the Research and Technology Policy, 2003. R&D and innovation are at the core of India’s five-year plans that the country’s Planning Commission has been devising since 1947. The latest of such plans covered years 2012–2017 and prioritized the following R&D sectors: aerospace, pharmaceuticals, IT, biology, nuclear energy, and ocean studies [4]. The current decade (2010–2020) has been dubbed the Decade of Innovation in India; the National Innovation Council (NIC) has been established urgently to devise the innovation roadmap for the decade so as to address the major socioeconomic challenges facing the country, such as poverty and low living standards, by means of cutting-edge technology [5]. This is how India tries to apply science and technology to boost various sectors of its economy, to handle a majority of socioeconomic problems. Gradually, India evolved a state-managed national economic system.

India's NIS is generally structured as follows, see Figure 1: investment (R&D investment and state funding, venture capital and FDI; infrastructure (R&D institutes, intellectual property rights, public policies, ICT and culture; knowledge and skill acquisition (advancement of education and HR, flexible labor); relations and networking (alumni networks, public R&D, R&D globalization, transnational networks).

Technoparks serve as India's R&D and innovation centers, thus being catalytic to the country's innovation system. They contribute to the R&D potential, to the country's socioeconomic development. Technoparks are what defines the R&D culture of India's NIS, to which the country's ICT sector is integral.

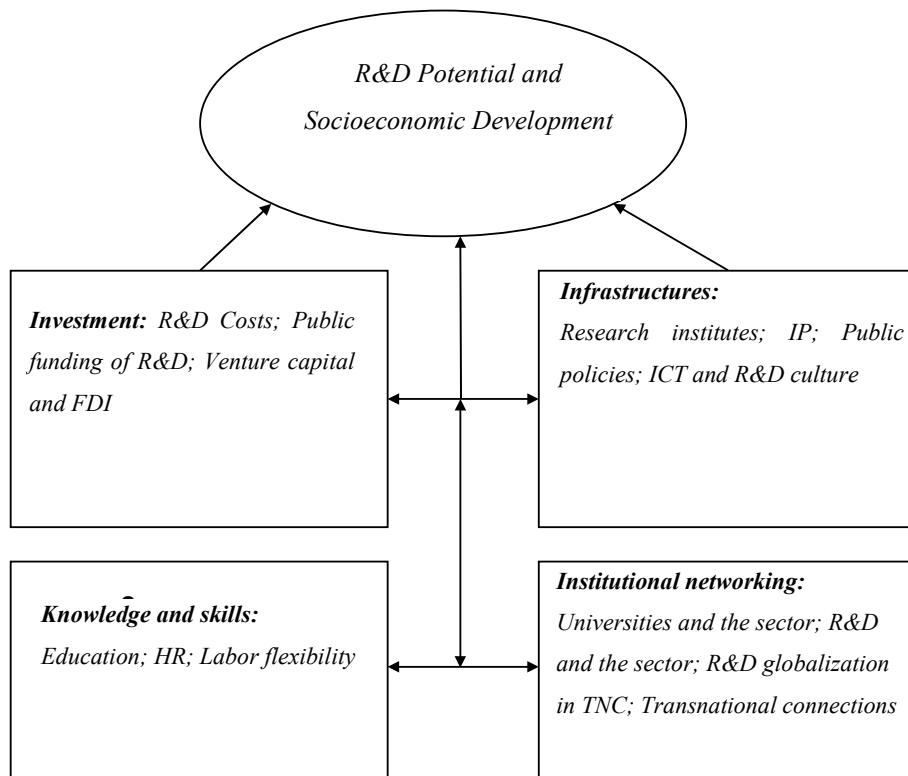


Figure 1. Key components of India's NIS [6].

Thus, information and communication technology (ICT or IT) coupled with the R&D culture that includes technoparks is a part of India's NIS and are pivotal to its infrastructure. ICT forms an important sector of India's NIS, as IT is crucial to the country's innovation and breakthrough market.

3. India's ICT

Information and communication technology is an umbrella term that covers any and all technologies used in telecommunications, broadcasts, smart control systems, audiovisual data processing and transmission systems, as well as in network-based management and monitoring systems. Although ICT is sometimes considered an extension to IT, it has far broader use. UNESCO defines ICT as technology that is used to transfer, process, store, create, display, and share information electronically. It includes not only the more traditional technologies such as radio and television, but also newer tech such as cellphones, computers and networks, hardware and software, satellite systems, as well as various services and applications that make use of IT infrastructures, e.g. videoconferencing.

India's ICT sector remains stable; its total revenue rose by 8% in 2016–17 and totaled 154 billion US dollars in 2017. IT exports are growing every year. They totaled 108 billion US dollars in 2015, rose to 117 billion in 2017; for 19 years in a row, India has been the world's leader in ICT exports and

is one of the world's major players in the ICT outsourcing market. India's international contracts extended to 2018 total 50 billion US dollars [7].

Despite a global recession and geopolitical uncertainty in India in 2016–2017, the country's ICT sector continues to grow in terms of employment figures. There was almost 4 million jobs in the industry in 2017. ICT generates 7.7% of the country's GDP, 49% of total exports, and 55% of the global ICT market. With more than 4,750 startups initiated in 2017, India ranks third in the worldwide ICT startup rankings [7]. To raise more funds for IT startups, the Indian Government has allowed 100% FDI from international venture capitalists. This will give Indian innovators access to the tools they need for innovation.

India is about to start its digital revolution, which all the sectors of economy will embrace, including education, health, financial services, manufacturing, and agriculture. Innovation in these sectors are projected to raise the country's digital economy to 1 trillion US dollars by 2025 [8]. E-commerce is also a major contributor to India's digital economy. The sector is expected to pass the USD 33 billion milestone in 2016–2017 and is likely to reach 100 billion US dollars in the next five years [8]. Greater cellular internet coverage, more affordable smartphones, and increase in digital online payments will further boost e-commerce.

In January 2018, the Everest Group published their own analysis of India's ICT market. Focus was made on extended contracts. The Group identified about 196 ICT contracts priced above 100 million US dollars each that Indian companies (including the local subsidiaries of transnational corporations) had earlier made with Indian or international integrators and extended in 2018. Contracted sums totaled >50 billion US dollars in 2018 alone [9].

According to the researchers, India's ICT market had 12 orders in progress as of early 2018 whose value was in billions of US dollars. Of highest value was the contract between the Indian branch of Siemens and Atos, a France-based ICT provider. At 2.5 billion dollars, second came the cooperation agreement between Citigroup and TATA Consultancy Services (TCS), an IT outsourcer. The last Top 3 contract was the one between Royal Dutch Shell and the Indian office of AT&T, valued at 1.5 billion US dollars [9].

4. Role of techoparks in ICT

India's technoparks are closely linked to the country's ICT, as the technology parks pertaining to this sector are most advanced. India's ICT success story comes from businesses' R&D efforts as well as from the country's strong research base. The research base also comprises the technoparks scattered around the country.

IT companies tend to concentrate in Software Technology Parks (STPI), where they have all the necessary infrastructures at hand. Technoparks are integrated research centers that feature advanced infrastructure and cutting-edge tools for R&D in electronics; they enable quick commissioning of latest technology and know-how; they also contribute to greater IT exports.

India's high-tech exports were skyrocketing from 2002 to 2016 as reported by the World Bank, see Figure 2. Products are classified as high-tech if R&D costs make up a major portion of total costs; the term applies to aerospace, computer technologies and IT, pharmaceuticals, research instruments, electrical equipment.

Indeed, the global financial crisis did affect high-tech exports; still India was able to recover — and multiply — its exports. From 2010 to 2014, India's figures rose by 6.5 billion US dollars to 17.3 billion in 2014. However, despite skyrocketing absolute numbers, high-tech never reached as high percentage after 2010 as it once had done in 2009, when high-tech industries generated 9% of the GDP. Over 1995–2016, high-tech share of India's total exports weighted-averaged at 6.73% (7.13% in 2016).

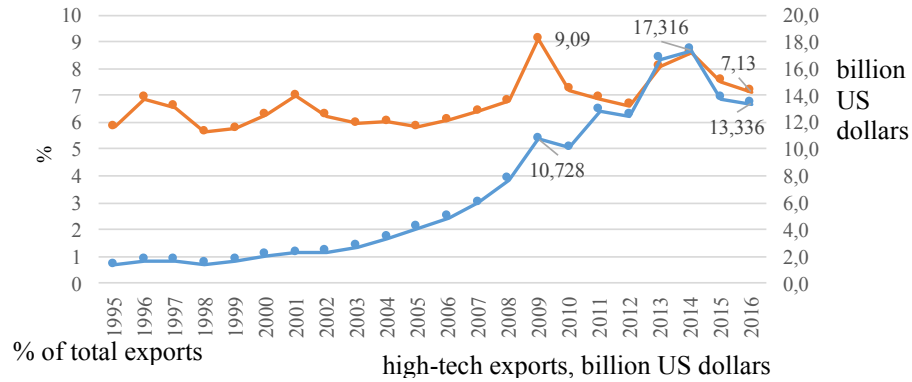


Figure 2. India’s high-tech exports, billion US dollars, % of total exports [10].

Notably, over 90% of the country’s software and IT service exports is generated by technopark-hosted companies. Technoparks are present in nearly 50 cities, including Bangalore, Chennai, Hyderabad, Lucknow, Kanpur, Allahabad, Patna, Gandhinagar, Mumbai, and Kolkata [11]. Large-scale construction of new technoparks in India (and the country had 142 of them as of 2017 [12]) gave rise to new national companies; there also appeared subsidiaries and branches of the world’s largest software, telecommunications, and electronics suppliers, such as Intel, AMD, Microsoft, Cisco, Ericsson, Motorola, Siemens, Kyocera, etc. Aside from opening new parks, India seeks to expand the existing ones. In 2017, a new building was inaugurated on the campus of the Gurugram Technology Park, adding 5,202.57 sq. meters of space [12]. The Technology Park Program has effectively incentivized international portfolio investment in the country’s major IT companies. Those include Tata Consultancy Services, Infosys Technologies, and Wipro Technologies.

The exports of STPI companies rose from 25.8 million US dollars in 2007–2008 to 50.3 million in 2016–2017, with a weighted average growth rate of 9.7%, see Figure 3.

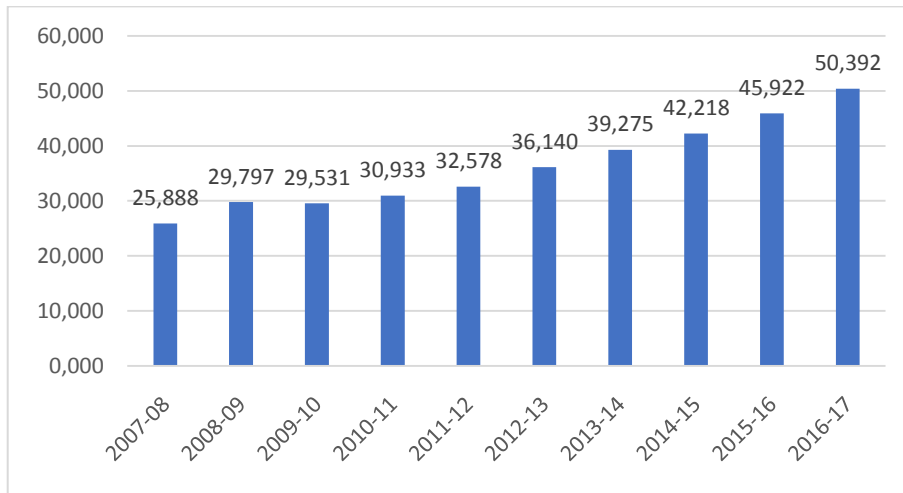


Figure 3. Exports of STPI companies, million US dollars, in 2007–2017 [13].

One of the Indian technoparks’ most significant contributions to increasing software exports is that they provide high-speed data communication services (HSDC) to their residents. Indian technoparks have developed SoftNET, a common high-speed network software exporters can enjoy using at a competitive price.

Technoparks provide the following HSDC services: international private leased circuit (IPLC), SoftPOINT; cloud-based Internet access, SoftLINK; Internet access via small-scale satellite terrestrial systems; colocation services (hosting customer equipment at STPI data centers). SoftLINK is a service

that provides collaborative and dedicated Internet access. It was launched to meet the demand for high-quality stable connection. The service is in high demand today. In 2016–2017, technoparks provided Internet access at 6,776 Mbps country-wide. The service is mainly used by STPI residents.

Local access to international gateways at the technoparks is enabled by single-point or multi-point microwave receivers in the LAN, which overcomes the ‘last mile’ issues and gives an uptime of 99.9% (disconnected for less than an hour a month in total across all connection points). These communications contribute significantly to offshore software development and have been fundamental to many Indian IT companies’ success [13].

India’s software market totaled 7.1 billion US dollars in 2018. In 2016–2017, software exports totaled 2.3 billion US dollars. Software and services sector employed 98,500 persons in 2017, a 8% increase YoY [13].

Aside from high-tech exports generated by the STPI system, technoparks offer an increasing range of other services to other organizations. STPI residents enjoy a broad range of ICT, project management, consulting, and IT security audit services. Technoparks offer their services not only to IT companies, but also to governmental departments, research institutions, foreign governments. STPI’s extensive ICT knowledge, technological capabilities, and industry skills enable better IT strategies to advance India’s IT industry.

Electronic system design and manufacturing, ESDM, is one of India’s fastest-growing sectors. It is projected to reach 400 billion US dollars by 2022. Electronics manufacture is expected to reach 104 billion US dollars in value within the same timeframe. Communication devices account for 31% of the industry, followed by household electronics at 23% [14]. To support newcomers in the sector, STPIs cooperated with the University of Delhi and the Indian Electronics and Semiconductor Association in 2016 to create the Electropreneur Technology Park at the University of Delhi. It currently supports about 50 ESDM startups. The Park seeks to have at least five newly created global companies by 2020 [18]. It focuses on localized electronics, which will generate more added value for the country; the Park will bear witness to a one-of-a-kind integration of academia, industry, government, and other agents in the country’s NIS.

To handle some of India’s socioeconomic problems, STPIs collaborated under governmental supervision to devise the so-called balanced regional development plans. The goal there is to create 1,6 thousand new jobs for local youth from small towns by 2020 as well as to raise funds for the overall development of the regions the programs target [19, 25].

India’s technoparks support SMEs by creating a favorable IT environment. STPIs offer event, conference, and training organization services to develop human capital, which will contribute to high-tech exports.

In addition to the STPI system, India established its Electronic Hardware Technology Parks, EHTP, in 1991; these parks provide duty-free import of any goods that might be necessary for computer hardware manufacturing. Technoparks provide consulting and training for its residents. It is technoparks that have boosted Indian offshore programming, now a dominant sector of the national IT industry.

All technoparks share a benefit system and enjoy infrastructural support from the state; as such, they are granted importation duty and local tax exemptions; they use simplified registration and customs procedures; finally, they are allowed to use foreign capital at 100%. Technoparks remain the most important tool for opening and running IT business in India.

4. Conclusions

India’s ICT sector has catalyzed the National Innovation System and created an immense number of jobs. India has major IT parks that employ over 3 million people, making India a global leader in IT.

This paper emphasizes how technoparks have been a booster to India’s ICT sector. It shows that creating and further expanding technology parks has considerable impact on the country’s high-tech export potential. Aside from boosting its high-tech trade with the outside world, India’s technoparks help raise the living standards by enabling the locals to use ICT in everyday life. Technopark-hosted

IT companies develop more extensively as they enjoy such benefits as tax exemptions, competitive pricing for equipment, other infrastructures. Technoparks boost national IT companies and help raise foreign investment in the country's ICT sector.

India makes use of ICT to improve the performance of IT companies as well as to tackle some socioeconomic issues such as unemployment, low living standards, and regional problems.

Technoparks serve as India's R&D and innovation centers, thus being catalytic to the country's innovation system. They contribute to the R&D potential, to the country's socioeconomic development. Technoparks are what defines the R&D culture of India's NIS, to which the country's ICT sector is integral. Technoparks offer their services not only to IT companies, but also to governmental departments, research institutions, foreign governments. India's technoparks support SMEs by creating a favorable IT environment. Thus, we may conclude that technoparks constitute a crucial component of India's National Innovation System, where ICT is one of the most successful sectors of economy, as it continues to grow in terms of IT exports, production, and outsourcing.

References

- [1] Freeman C 1995 The National System of Innovation in Historical Perspective *Cambridge Journal of Economics* **19** 7-8
- [2] Lundvall, B 1992 National Innovation Systems: Towards a Theory of Innovation and Interactive Learning (London)
- [3] Nelson R 1993 National Innovation Systems A Comparative Analysis *Oxford University Press* (NY)
- [4] Twelfth Five Year Plan (2012–2017) Faster More Inclusive and Sustainable Growth http://www.planningcommission.nic.in/plans/planrel/fiveyr/12th/pdf/12fyp_vol1.pdf
- [5] Towards a Decade of Innovation 2010-2020 National Innovation Council 2018 http://innovationcouncilarchive.nic.in/index.php?option=com_content&view=category&layout=blog&id=25&Itemid=28
- [6] Development, Innovation and International Political Economy Research (DIIPER) Aalborg University [https://vbn.aau.dk/en/organisations/diiper--development-innovation-and-international-political-economy-research\(5265c06c-bebd-4176-9aad-dae5e4d5243d\).html](https://vbn.aau.dk/en/organisations/diiper--development-innovation-and-international-political-economy-research(5265c06c-bebd-4176-9aad-dae5e4d5243d).html)
- [7] The official website of TAdviser, the IT market of India http://www.tadviser.ru/index.php/Article:IT-Indian_market
- [8] National innovation systems: India's perspective OECD <https://www.aeonprime.net/pdf-national-innovation-systems.html>
- [9] Official website of the analytical company Everest Group <https://www.everestgrp.com>
- [10] The World Bank DataBank World Development Indicators <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators&Type=TABLE&preview=on#>
- [11] Information portal India in Russian Indian IT Revolution <https://indonet.ru/statya/india-it-revolution>
- [12] Annual Report 2016-17 of Software Technology Parks of India <https://www.stpi.in/upld/ar2016-2017.pdf>
- [13] The official website of STPI <https://www.stpi.in/11011>
- [14] Official website of Amritt Inc Electronic System Design & Manufacturing <https://amritt.com/industries/manufacturing/electronic-system-design-manufacturing/>
- [15] Mascarenhas R 1982 Technology Transfer and Development: India's Hindustan Machine Tools Company. West View Press (Colorado)
- [16] Cooper C 1988 Supply and Demand Factors in Technology Imports Technology Absorption in Indian Industry Wiley Easter Limited (New Delhi)
- [17] Getty S 2003 BT: call centers better in India *Metro* (London)
- [18] Khandelwal K 1981 The electronics industry: aspects and prospects *Commerce* 142 10-13
- [19] Bhojani R 1985 Electronic policy: a package of surprise *Commerce* 150 807-808

- [20] Charges for the use of intellectual property receipts Royalty and license fees Index Mundi <http://www.indexmundi.com/facts/india/royalty-and-license-fees>
- [21] The official website of the magazine FB.ru The average salary in India The standard of living in India <http://fb.ru/article/388435/srednyaya-zarplata-v-indii-uroven-jizni-v-indi>
- [22] The World Bank DataBank World Development Indicators <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators&Type=TABLE&preview=on#>
- [23] Information and analytical journal "Political Education" India: scientific and technological development and innovation <http://lawinrussia.ru/content/indiya-nauchno-tehnologicheskoe-razvitie-i-innovacii>
- [24] Innovation and Technology The Planning Commission of Government of India http://planningcommission.gov.in/plans/planrel/fiveyr/11th/11_v1/11v1_ch8.pdf
- [25] Pesterev A P, Yakovlev V A, Kirillina A A, Solovev D B 2019 Environmental Problems Mining Industry in the Arctic *IOP Conference Series: Earth and Environmental Science* **272** paper № 022055. [Online]. Available: <https://doi.org/10.1088/1755-1315/272/2/022055>