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Information Technology: An Essential Prerequisite for a Knowledge Based Economy in Pakistan Hassan Nabi Dar

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Executive Summary

The advent of information technology (IT) and information communication technology (ICT) has revolutionized our society and economy. We are currently living in the Information Age, which requires a knowledge based economy, and to create one, the use of IT and ICT is essential.

This brief gives an overview of the challenges faced by Pakistan in the domains of IT, ICT, and the development of a knowledge based economy. Among the foremost challenges are the digital and knowledge divide within Pakistan, the lack of proper ICT infrastructure, and the need for upgrading higher education and research facilities. Issues of cyber security and privacy have also been sighted.

The brief also points out to the dire need for a coherent national policy, that aims to integrate science, technology, and innovation into all sectors of the economy. Pakistan needs to declare a national education emergency with at least 5% of GDP allocated for education. The government must also must modernize educational standards and make IT and ICT courses compulsory for educational institutions. There is also an urgent need for high quality research institutions which can help in upgrading our various industries. In addition, we require knowledge transfer from abroad and it is suggested that knowledge transfer be linked with foreign direct investment, so as to make Pakistan self-sufficient.

The government must develop IT and ICT infrastructure not only in the major cities, but throughout Pakistan. Such an equitable distribution will help prevent a digital and knowledge divide in the country. In addition, various fiscal incentives to the IT industry, promotion of startups and incubation centers through financial support are recommended.

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Introduction

The advent of IT has revolutionized our society and economy; IT has transformed the way we work, educate, communicate, and socialize. In essence, modern technology has redefined how we live. We are now living in the Information Age which requires a knowledge based economy, and to create one, the use of IT and ICT is an essential prerequisite.

A knowledge based economy can be defined as an economy that relies on the use of ideas, information, and intellectual capital, instead of focusing only on the production of physical and tangible goods. The economics of a knowledge based economy is not of scarcity, but of abundance. Unlike tangible resources that are depleted when used, information can be duplicated, shared and eventually grow through utilization. Creating a knowledge based economy is also closely linked with 'human capital', which is essentially the quality of labour and information present in a country.

For a developing country like Pakistan, the transition from a traditional based economy to a knowledge based economy will depend on the level of education, information, research, and technology available in the country, as these factors are crucial to initiate structural change. Additionally, both physical and human capital are interlinked to ensure economic development. Without any mental effort, innovations cannot be produced. In other words, big investments are required in education, creation of knowledge, and research institutions that makes it possible for the country to raise the standard of living in the long term.

The human race has never witnessed so much change in its history as it is facing today. Paradoxically, it is both the best and worst of times because the arrival of such technology has had unintended consequences, which have both benefits and disadvantages.

The arrival of IT and ICT has allowed globalization to take place. Instant communication through platforms such as the internet, has led to the sharing of information, exchange of ideas and access to free education through e-learning. IT also provides cost effective measures for businesses and the creation of new jobs.

However, at the same time, the arrival of such technology has brought forward new problems. Problems such as the uneven distribution of IT and ICT that causes a 'digital and knowledge divide', which means that individuals who have access to IT and ICT technology and are able to make efficient use of it, will have a superior advantage over those who don't.

Furthermore, in the Information Age, new technological innovations will keep on happening, making not just old technology and methods redundant and obsolete, but also humans. For example, many believe that in the new next few decades, Artificial Intelligence (AI) will push humans out of the job market, as mechanical robots will be able to perform tasks better and more efficiently than humans through machine learning. Societies that are unable to keep up with technology will simply be left behind, whereas those who manage to learn and use technology which results in scientific innovation, will leap ahead¹. Economic usefulness now goes hand in hand with political power, so nations who lose their economic usefulness, will also eventually lose their political power as well².

Additionally, the impact of the internet and social media has brought forward new issues of privacy, hacking, misinformation, psychological warfare, espionage, and cyberwarfare. To tackle these issues, governments of the 21st century, especially Pakistan, must fully embrace technology so that they don't become vulnerable to the threats posed in the Information Age.

The digital divide and knowledge divide

The term digital divide refers to the disparity between countries and regions that have access to modern ICT technology and those that don't or have limited access. This involves the use of technology such as the telephone, television, personal computers, and the internet. Furthermore, the digital divide is one important part of the larger 'knowledge divide'³.

A knowledge divide describes the divide in the standards of living between people who are able to find, create, manage, process, and disseminate information or knowledge. This means that mere access to technology is not just the solution to achieve technological advancement, but the ability to effectively make use of such devices once they exist within a community. This brings three important factors at play: information accessibility, information utilization, and information receptiveness. Therefore, access is a necessary (but not sufficient) condition for overcoming the digital and knowledge divide⁴.

According to UNESCO, "Closing the digital divide will not suffice to close the knowledge divide, for access to useful, relevant knowledge is more than simply a matter of infrastructure – it depends on training, cognitive skills and regulatory frameworks geared towards access to contents⁵."

The main problem for the developing world is that most of them have not been able to keep up with the growing research output of the developed nations. Moreover, developing countries lack sufficient research and development activity because their scientific institutions are fragile, under resourced, highly susceptible to political and economic instability, unable to produce any significant knowledge output, and are heavily dependent on foreign aid.

¹ Harari, Y. (2017). The Future of Humanity - with Yuval Noah Harari. [video] Available at: https://www.youtube.com/watch?v=XOmQqBX6Dn4 [Accessed 18 Jun. 2019].

² Harari, Y. (2017). Homo Deus. London: Penguin Random House, pp.1-83.

³ David, S. (2015). Building Inclusive Knowledge Societies: A review of UNESCO's action in implementing the WSIS outcomes. France: UNESCO. ⁴ Berger, I. (2015). Bridging the World's Knowledge Divide | MIT Initiative on the Digital Economy. [online] Ide.mit.edu. Available at:

http://ide.mit.edu/news-blog/blog/bridging-world%E2%80%99s-knowledge-divide [Accessed 12 Jun. 2019].

⁵ ibid

How can Pakistan transform into a knowledge society

To transform into a knowledge based society, Pakistan needs to make science, technology, and innovation the main focal points for development. The global market is now mainly composed of medium and high-technology products, while natural resources and low-technology products have a lower overall value and constantly need to be replaced. To manufacture high tech products, large number of scientists, engineers and economic incentives for such labour are required⁶.

In order to create a knowledge based economy, Pakistan should focus on four essential components:

- ICT infrastructure
- An efficient and robust innovation and technology adoption system
- Institutional regimes that help provide economic incentives to the IT industry
- A well-educated and skilled population

Lack of a national education policy is the biggest hurdle in achieving economic and social progress in Pakistan. The country's literacy rate is one of the lowest in South Asia⁷ and has the second largest amount of out-of-school children⁸. Additionally, Pakistan produces around half a million university graduates annually, including 10,000 students who specialize in IT, but unfortunately, most tend to be of poor quality⁹. To make matters worse, most students who are lucky enough to graduate from leading universities in the country prefer to work abroad after graduating rather than working inside Pakistan because of lack economic opportunities. This leads to a 'brain-drain' which is why Pakistan has been unable to sustain a well-educated and skilled labour force¹⁰. Additionally, like many other sectors, the education sector of Pakistan seems to be dominated by the private sector, who's main priority is to maximize profits. Therefore, receiving quality education in Pakistan is simply out of reach of the people at large because it is not affordable. Government run schools on the other hand, are not given enough resources, quality teachers, computer labs, and are using an out dated curriculum.

Pakistan's human capital is quite large and is predominantly young. According to a report by the UNDP, 64% of Pakistan's population is below the age of 30^{11} . If educated and trained properly, this youth bulge can be converted into an asset. However, if neglected this asset can transform into a major liability if the youth of this nation are not able to find adequate jobs and financial security.

¹⁰ Ali, S. (2015). Graduate brain drain: An alarming exodus. [online] Pakistantoday.com.pk. Available at:

⁶ Amjad, R. (2011). Why Pakistan Must Break-into the Knowledge Economy. The Lahore Journal of Economics: Special Edition, pp.77 - 87. ⁷ neighbors, P. (2017). Pakistan's literacy deplorably low when compared to its neighbors. [online] Pakistan & Gulf Economist. Available at: http://www.pakistaneconomist.com/2017/08/14/pakistans-literacy-deplorably/ [Accessed 12 Jun. 2019].

⁸ REPORT, R. (2018). Out-of-school children: Pakistan stands second in world ranking: Unicef official | Business Recorder. [online] Business Recorder. Available at: https://fp.brecorder.com/2018/04/20180427365834/ [Accessed 12 Jun. 2019].

⁹ Raza, S. and Naqvi, S. (2019). QUALITY OF PAKISTANI UNIVERSITY GRADUATES AS PERCEIVED BY EMPLOYERS: IMPLICATIONS FOR FACULTY DEVELOPMENT. Journal of Quality and Technology Management, [online] VII(I), pp.Page 57 - 72. Available at:

http://pu.edu.pk/images/journal/iqtm/PDF-FILES/04-facuty%20development%2031-5-11.pdf [Accessed 12 Jun. 2019].

https://www.pakistantoday.com.pk/2015/03/07/graduate-brain-drain-an-alarming-exodus/ [Accessed 12 Jun. 2019].

¹¹ Kundi, A. (2018). Pakistan currently has largest percentage of young people in its history: report. [online] DAWN.COM. Available at: https://www.dawn.com/news/1405197 [Accessed 12 Jun. 2019].

Due to the current economic crisis in the country, the Higher Education Commission (HEC) is facing unprecedented budget cuts up to 40%¹². This will cause further disruption to the quality and conduct of higher education and research within Pakistan. However, it is important to note that increasing investments or funding does not necessarily ensure a knowledge based society. A knowledge based economy can only exist when the country is able to produce high quality graduates who are innovative. This can only happen if we change the paradigm of education from memorization towards developing critical thinking, creativity, innovation, and problem solving skills. Then, the problem of retaining these high quality graduates within the country needs to be tackled by providing them job opportunities.

How can the IT industry stimulate economic growth

Research has shown that the use of personal computers, cell phones, and internet penetration are now the main drivers of economic growth in developing countries¹³. Neo-Schumpeterian and neo-classical growth theories have also highlighted that a significant positive relationship exists between economic growth and the use of ICT. These theories point out that once ICT enters as an input into the economic supply in the form of capital, it causes an improvement in the production process because of advancements in technology and an improved labour force¹⁴.

Equipped with advanced technology and an improved labour force, the IT sector can further stimulate economic growth mainly through two channels: exports and investments. Developing countries initially face a challenge promoting IT manufacturing industries, as it requires heavy investment expenditures, but once they have passed that obstacle, they can benefit immensely through exports of IT manufactured goods, which in turn stimulates economic growth. The second channel, which is investment, requires that governments make their business and production procedures more effective and efficient so that ease of doing business is ensured, to attract foreign investments.

Effective IT planning by the government is also critical. Countries such as Singapore¹⁵, South Korea¹⁶, and Malaysia¹⁷ have been successful in achieving economic growth because their governments invested heavily in critical ICT infrastructure at an early stage to foster ICT diffusion. Furthermore, to facilitate the IT absorption capabilities for their citizens, these countries made big investments on education, training

¹² Asghar, Z. (2019). HEC budget cut will further erode productivity - Daily Times. [online] Daily Times. Available at: https://dailytimes.com.pk/413872/hec-budget-cut-will-further-erode-productivity/ [Accessed 19 Jun. 2019].

¹³ Bahrini, R. and Qaffas, A. (2019). Impact of Information and Communication Technology on Economic Growth: Evidence from Developing Countries. [ebook] Jeddah: Molecular Diversity Preservation International and Multidisciplinary Digital Publishing Institute (MPDI). Available at: https://www.mdpi.com/2227-7099/7/1/21/pdf [Accessed 12 Jun. 2019].

¹⁴ Evangelista, R. (2017). Technology and Economic Development: The Schumpeterian Legacy. [online] Journals.sagepub.com. Available at: https://journals.sagepub.com/doi/pdf/10.1177/0486613416666565 [Accessed 19 Jun. 2019].

¹⁵ Edb.gov.sg. (2018). Singapore flexes its standing as Asia's technology capital. [online] Available at: https://www.edb.gov.sg/en/news-andevents/insights/innovation/singapore-flexes-its-standing-as-asias-technology-capital.html [Accessed 12 Jun. 2019].

¹⁶ Techinasia.com. (2017). Why the Korean IT industry is one of the best in the world. [online] Available at: https://www.techinasia.com/koreait-industry [Accessed 12 Jun. 2019].

¹⁷ Rohman, I. and Tajuddin, M. (2018). Malaysia's 20-year Tech Investment Is Paying Off...Big Time - Our World. [online] Ourworld.unu.edu. Available at: https://ourworld.unu.edu/en/malaysias-20-year-tech-investment-is-paying-off-big-time [Accessed 12 Jun. 2019].

institutions, and research and development. Their success proves that the use of IT and ICT can be a major push factor in economic development.

The role of the government in developing ICT- related infrastructure and human resources is crucial because the infrastructure, such as computer networks, telecommunications, and IT training are a kind of public goods. Once ICT-related infrastructure is developed throughout a country, the entire populace benefits from the infrastructure. This is known as positive externality, which occurs when action that affects others can be taken by an individual or company without paying for a beneficial outcome.

Currently, Pakistan's IT industry is estimated to be worth \$ 3.5 billion, but it is a drop in the ocean as compared to the global IT industry which is now estimated to be \$ 5 trillion¹⁸. With proper government support, this industry can be used to galvanize the economy in a significant way.

Issues of cybersecurity and privacy in Pakistan

As the world has become more interconnected through the use of the internet, or digitized through adoption of ICT, issues of cybersecurity, mass surveillance, data mining, espionage, and misinformation have become a serious source of concern for modern governments and society. Pakistan is no exception.

According to a report published by Comparitech, Pakistan currently ranks 7th in the world in terms of countries with the worst cybersecurity apparatus¹⁹. Most recently, in October, 2018, hackers successfully hacked into local banking security systems in Pakistan and stole information regarding thousands of credit and debit cards. This attack affected 22 banks within Pakistan, and caused an economic loss worth \$ 6.5 million²⁰.

Furthermore, according to Delta Tech, one of Pakistan's leading private cyber security solution provider, Pakistan's critical infrastructure is extremely vulnerable²¹. This includes utility companies that provide electricity, gas, oil, water and etc. A cyberattack on Pakistan's critical infrastructure could bring its economy to a standstill.

Pakistan needs to develop a coherent ecosystem for cybersecurity in Pakistan to tackle such issues. Thus, the following requirements are essential:

- A national cybersecurity policy
- Implementation of cybersecurity laws
- Cybersecurity certification system

¹⁸ EM360. (2019). Global IT industry is on pace to reach \$5 trillion in 2019 | EM360. [online] Available at:

https://www.em360tech.com/business_agility/tech-news/technews/global-it-industry/ [Accessed 13 Jun. 2019].

¹⁹ Moody, R. (2019). Which countries have the worst (and best) cybersecurity?. [online] Comparitech. Available at:

https://www.comparitech.com/blog/vpn-privacy/cybersecurity-by-country/ [Accessed 12 Jun. 2019].

²⁰ Profit by Pakistan Today. (2018). BankIslami becomes victim of \$6.5 million cyber-attack. [online] Available at:

https://profit.pakistantoday.com.pk/2018/10/29/bankislami-becomes-victim-of-6-5-million-cyber-attack/ [Accessed 12 Jun. 2019].

²¹ Dunya News interview of Nahil Mahmood CEO DeltaTech On Pakistans Latest Banking Cyber Attack. (2019). [video] Lahore: Dunya News.

- Active roleplaying emergency response teams (CERT)
- Vulnerability management tools

Another problem that Pakistan faces is the issue of unauthorized mass surveillance done both by foreign and domestic intelligence agencies. WikiLeaks documents show Pakistan is one of the top three countries in the world being heavily monitored by Western intelligence agencies²². It also highlighted that these intelligence agencies managed to infiltrate the communications networks of both Pakistan's civil and military leadership²³. According to Privacy International, Pakistan is signatory to an agreement that allows the sharing of signal intelligence with Western intelligence agencies. In exchange, Pakistan received funds and technical assistance in the form of software and hardware related to surveillance technology²⁴.

Furthermore, it is important to mention that Pakistan is signatory to the International Convention on Civil and Political Rights (ICCPR), and Article 17 of the ICCPR specifies that no one shall be subject to unlawful interference with regards to their privacy²⁵. Pakistan is also signatory to the Cairo Declaration on Human Rights in Islam, in which Article 18 of the declaration clearly states that "everyone has the right to privacy in the conduct of his/her private affairs, that is not permissible to spy on anyone, and that the state shall provide protection from arbitrary interference²⁶." However, despite being signatory to these agreements, recent bills passed by the parliament, such as the Fair Trials Act (2013) and Electronic Crimes Act (2016) permit certain exceptions to these fundamental rights. There is no doubt that with the current security situation, extraordinary measures are required. Hopefully, once the security situation improves, the issue of mass surveillance will come to a halt.

The more serious concern is the very real possibility that our civilian and military leaderships' communication may have been compromised by foreign intelligence agencies²⁷. If past governments had focused on the development of IT and ICT technology we would never have had the need to approach foreign companies and agencies for their services.

- ²³ Khan, S. (2017). The state bytes back: Internet surveillance in Pakistan. Herald Dawn. [online] Available at: https://herald.dawn.com/news/1153312 [Accessed 11 Jun. 2019].
- ²⁴ Ibid

²⁶ Cairo Declaration on Human Rights in Islam. (2019). [ebook] Organization of Islamic Conference. Available at:

²² Younus, U. (2017). Unchecked surveillance. [online] DAWN.COM. Available at: https://www.dawn.com/news/1312951 [Accessed 11 Jun. 2019].

²⁵ International Covenant on Civil and Political Rights. (1966). [ebook] New York: UNITED NATIONS. Available at:

https://treaties.un.org/doc/publication/unts/volume%20999/volume-999-i-14668-english.pdf [Accessed 19 Jun. 2019].

http://www.bahaistudies.net/neurelitism/library/Cairo_Declaration_on_Human_Rights_in_Islam.pdf [Accessed 19 Jun. 2019].

²⁷ Geo.tv. (2016). US hacked NTC to spy on Pakistan military, political leadership: Snowden documents. [online] Available at: https://www.geo.tv/latest/112040-US-hacked-NTC-to-spy-on-Pakistan-military-political-leadership-Snowden-documents [Accessed 19 Jun. 2019].

What policies should the government implement to harness a knowledge based economy

In order to harness a knowledge based economy, the government in Pakistan should implement the following policies:

A National Education Policy

• As stated earlier in an IPR brief²⁸ by eminent scientist and IPR advisor, Dr Atta-Ur-Rahman, there is an urgent need for a coherent national policy that aims to integrate science, technology, and innovation (STI) into all sectors of the economy; ranging from industry, agriculture, health, social services, communication, and the government sector. Effective implementation of such a strategy will require both attention and support from the highest levels of government.

Declare National Education Emergency

• In order to implement an effective and successful STI strategy, the government must first declare a National Education Emergency to tackle the dismal quality of education as soon as possible. Quality education is the key to prosperity and modernization, which is why increased spending, a minimum of at least 5%, should be allocated for education. This will help improve access, as well as quality of primary, secondary, technical, vocational, and higher education in the country.

Research Institutions

• In order to keep up with the rapid technological advancements occurring in the 21st century, there is a need for high quality research institutions that specialize in biotechnology, nanotechnology, material sciences, artificial intelligence, genomics, bioinformatics, mechatronics, industrial processing and advanced agricultural technologies.

Link Knowledge Transfer with FDI

• Knowledge transfer from abroad is also vital for upgrading the industry. Therefore, all foreign direct investment approvals should be linked with mandatory knowledge transfer, so that training, research and development facilities are part of the investment proposals. This will allow Pakistan to become self-sufficient.

Improve IT & ICT Infrastructure

• The government must take adequate steps to ensure further development of IT and ICT infrastructure, not just in major cities, but throughout Pakistan. Equal distribution and diffusion of IT and ICT will help prevent a digital and knowledge divide in the country. The better the infrastructure, the more chances of increasing broadband penetration. Currently, Pakistan has 44.61 million internet users, which amounts to 22% of the total population. According to a study published by the World Development Report, every 10 % increase in broadband penetration leads to a GDP growth of 1.3% in

²⁸ Rahman, D. (2018). General Recommendations to Promote Science, Technology, and Innovation in Pakistan. [online] Institute for Policy Reforms. Available at: https://ipr.org.pk/wp-content/uploads/2018/05/Recommendations-to-Promote-ScienceTechnology-and-Innovation-in-Pakistan.pdf [Accessed 20 Jun. 2019].

developing countries²⁹.

Fiscal Incentives

• The government needs to promote the production of high tech gadgets and their export. This can be achieved by granting "pioneering status" to high tech industries with adequate tax exemptions and government support for high tech development through innovation funds. Furthermore, banks should avoid demanding collateral for project financing for IT startups and shift towards 'soft loans'.

Access to Capital

• Private sector run incubators are in need of venture capital and institutional funding. The absence of a coherent digital eco system prevents startup incubators to receive large scale funding. Incubators will play an important role in reversing the 'brain drain' the country is facing. Well educated citizens prefer to study abroad because of lack of job opportunities in the country. Promoting startups and incubation centers will help provide more job opportunities to fresh graduates.

Industrial Clusters and Tech Zones

• Another government initiative would be the establishment of regional industrial clusters assisted by technical training institutions to ensure cost effective and demand driven industrial production. Additionally, the development of special 'technology zones' should be encouraged by offering them financial incentives such as tax exemptions or reduced electricity rates.

Compulsory IT & ICT Learning in Schools

• The government also needs to modernize its educational standards by making IT and ICT courses compulsory for both government and private educational institutions. Government schools should be equipped with proper technological facilities such as computer labs to help students assimilate modern technology from a young age. This will help change the societal mindset where everyone wants to become either a doctor or an engineer.

²⁹ Minges, M. (2016). Exploring the Relationship Between Broadband and Economic Growth. [online] Pubdocs.worldbank.org. Available at: http://pubdocs.worldbank.org/en/391452529895999/WDR16-BP-Exploring-the-Relationship-between-Broadband-and-Economic-Growth-Minges.pdf [Accessed 13 Jun. 2019].

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