REPORT- SEMINARS/ROUNDTABLES

RESETTING AND REBOOTING PAKISTAN'S ICT SECTOR

2nd SEPTEMBER - 7th OCTOBER, 2020

INSTITUTE FOR STRATEGIC STUDIES, RESEARCH AND ANALYSIS (ISSRA)

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CONTENTS

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President
National Defence University

Foreword

The global ICT sector has completely transformed the dynamics of the world's economy and played a central role in enabling economic prosperity across the global landscape. With a population of over 60 million in the 15-29 age bracket, Pakistan has more than 300,000 English speaking ICT professionals with expertise in both current and emerging technologies. This pool of experts is continuously growing; with 20,000 ICT graduates and engineers entering the sector every year. According to Oxford Internet Institute (OII), Pakistan is ranked as the fourth most popular country in the world for freelance development, after India, Bangladesh and US. Likewise, Pakistan is also consistently ranked among the top destinations for IT outsourcing because of the exponential growth of the ICT sector. However, there is still great potential to further expand existing $3 billion ICT export market. There are not only issues relating to the availability of latest ICT but also many barriers persist in the implementation of ICT in Pakistan's multiple sectors. Further, this is not an issue relating to Pakistan but more and less many developing countries are facing barriers in Implementation of ICT Infrastructure. In Pakistan's context, the readiness of our society to use ICT, the actual usage by all stakeholders and the impact that ICT to create enabling business friendly and governance friendly environment should be the core point in focus.

I believe that together, private and public sector of Pakistan can work in synergy for revamping and rebooting our ICT sector in a holistic manner and steer it onto the path of progress and infinite attainment in each sector of our country.

I congratulate DG ISSRA, Major General Asif Ali, HI (M), Director Defence Studies Branch, Brigadier Masroor Ahmed (Retd) and his team for a timely effort as the findings and recommendations acquired from series of events including the initial seminar and subsequent brainstorming sessions would surely enable the policy making and implementation circles to formulate, improve and ensure smooth execution of the strategies proposed in this comprehensive report for rebooting and resetting of the ICT Sector of Pakistan.

Major General Asif Ali, Hilal-e-Imtiaz (Military)

Director General
Institute for Strategic Studies, Research and Analysis (ISSRA)

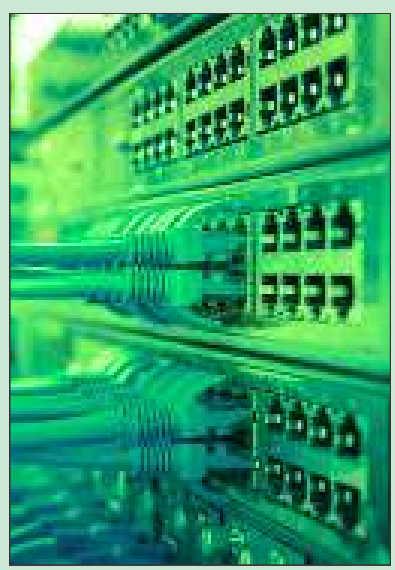
Preface

The unfolding of ICT revolution has created a quantum gap between the international technological advancement pace and our national standing in this domain. ICT is a key driver of an increasingly knowledge based global economy. Technology has transformational power. It is a great leveler of opportunity within and across economies. Recognizing this potential, several economies in Asia – Pacific have invested heavily in infrastructural and human resource development in ICT. Pakistan has a budding ICT industry and needs special focus as it has immense potential for economic boost for the country. The countries, which are reaping the benefits of ICT today, started thinking about it decades ago. The leading countries had put in place plans and resources in 80s. Hence, there is dire need to evaluate existing situation of Pakistan's ICT Development Industry, discover ICT trends, iIdentify gaps, undertake gap analysis and probe ways to significantly boost Pakistan's ICT Sector. The role of emerging technologies in relationship with public policy, business corporations and education for advancing economic prosperity in Pakistan cannot be ignored. The flux in the global economy highlights the need for constant reappraisal of policy and implementations along with exploration of new markets and services for the uplift of this sector. A conducive policy environment and a concerted strategy is the need of time.

This month long deliberative exercise investigated the barriers, challenges and the way forward in Resetting and Rebooting Pakistan's ICT Sector. The need of the time is to promote a vision for AI led knowledge-economy, innovation and inclusion that will definitely steer the country towards advancement and better productivity in all fields of life.

Seminar / Brainstorming Sessions

Resetting and Rebooting Pakistan's ICT Sector



Background

NDU was tasked by GHQ to carry out an intellectual exercise and come up with a way forward to Reset and Reboot Pakistan's ICT Sector. In order to accumulate policy recommendations for IT industry's growth and progress, it was decided that the subject will be further explored in collaboration with all stakeholders, experts, technical specialists, academicians and practitioners from ICT public/private industry of the country to take this exercise to an objective and logical conclusion.

Methodology Adopted

NDU decided to hold an initial seminar on '**Resetting and Rebooting Pakistan's ICT Sector**' on 2nd September 2020 for setting the stage and then further brainstorm the whole ICT Sector under three different Sub Sectors via focused roundtables in September to October 2020. Lastly, a final seminar was planned to be conducted in 1st week of October 2020 where all decision makers were planned to be invited and The findings and recommendations collected through these brainstorming sessions to be proffered in front of them.

NDU conducted the workshops by dividing the whole ICT Sector under three different Sub Sectors, namely **""HR and Connectivity Development in ICT", "ICT Market Development and Software Export" and "Use of ICT in Socioeconomic Sectors"** on 9th, 16th and 23rd September 2020, respectively.

During the discussion, equal opportunities were provided to all the participants to proffer practical suggestions relating to overcoming the challenges faced to their respective sectors in order to crystalize the thought process and finalize the recommendations. The final paper is elaborated in succeeding paragraphs. Program of the Final Seminar of 7th October 20 is attached as **Annex A**.

Sequence

The report comprising the accentuation of the overall seminar and brainstorming sessions is divided into following parts: -

Executive Summary

Part - I	ICT Landscape Comparison with other Countries
Part - II	Key Priority Interventions (Issues of National Significance)
Part - III	National ICT HR and Infrastructure Landscape
Part - IV	Promotion & Development of ICT Industry
Part - V	Use of Emerging ICT Tools in Socioeconomic Sectors
Part - VI	Recommendations Requiring Immediate Actions

Executive Summary

This executive summary highlights key recommendations made during the course of elaborative intellectual exercise conducted by National Defence University in collaboration with all relevant stakeholders, experts, regulators, industry specialists and academia from ICT sector.

Vision

This exercise aimed to generate familiarity about ICT sector, understand its landscape and dissect major interventions required to reset and reboot Pakistan's ICT Sector, while extending the benefits of this effort to the global ICT ecosystem and the wider knowledge economy of Pakistan. The recommendations provided in this document take into consideration the rapidly evolving ICT environment and stress that policy interventions will require continuous assessment against set objectives.

Objectives

This exercise underpins the exponential role of the disruptive ICT sector in enabling income generation, employment promotion, export potential, effective governance and innovation. The main objectives of this exercise are summarized below: -

- Evaluate the Existing Situation of Pakistan's ICT industry.
- Discover Emerging IT Trends.
- Identify Gaps, Undertake Gap Analysis to and Probe Ways to Significantly Boost Pakistan's ICT industry.
- Generate Impactful Debate for Advancing Excellence and Growth in ICT Sector.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- Promote a Vision for AI-led Knowledge-Economy, Innovation and Inclusion.
- Identify Possible Policy Interventions and Facilitatory Mechanisms.
- Elicit Suggestions for Improving ICT Infrastructure to improve the Sector's Economic Contributionto the GDP.

Key Priority Interventions

Following Issues of National Significance were deliberated extensively as part of this exercise:

a. **National IT Policy:** National IT Policies from 2000 to 2018 were discussed at length during this exercise. Government's declared vision 'to become a strategic enabler for an accelerated digitization ecosystem to expand the knowledge-based economy and spur economic growth' served as the underlying objective of the whole exercise. Government has undertaken a productive exercise in identifying key areas of concern, and spelled out a policy document to share its vision (Digital Pakistan). However, during the course of this exercise at NDU, we identified a few challenges and gaps in policy framework like correlating Cyberspace Sovereignty, Infrastructure and use of AI. There is also a lack of clarity in policy ownership, its implementation and governance. Some of the policy recommendations addressing these challenges will be covered in subsequent paragraphs.

b. **National AI Strategy:** As a key outcome of this exercise, an impetus has been placed to actively promote a vision for a robust National Artificial Intelligence Strategy to shape an inclusive, prosperous and thriving future. According to PwC, Artificial Intelligence could contribute up to $15.7 trillion to the global economy by 2030. Meanwhile, realizing the disruptive potential of emerging technologies, more than 22 countries have already formulated a National AI strategy in the past three years. Formulating a National AI Strategy & Framework can accelerate our journey towards becoming a leading Digital Nation.

c. **National Cyberspace Sovereignty:** National Cyberspace sovereignty means that the state exercises control over all aspects of the Internet within a country's boundaries; including political, economic, cultural and technological activities. This report details the challenges in the cyberspace and ways to overcome those challenges.


Opening Session
NATIONAL DEFENCE UNIVERSITY
PAKISTAN

Key Recommendations

After undertaking a detailed landscape study of Pakistan and its peer countries in the region, this exercise identified key challenges / recommendations / expected impact to inform policy formulation.

a. Human Resource Development

Challenges	Recommendations	Expected Impact
1. **Employability –** Lack of specialised skills	1. **Theoretical** and **applied knowledge** of Emerging Tech e.g. AI, Big Data, IoT	1. Significantly **improving revenue** per ICT resource
2. **Quality** – Outdated Curriculum and Lack of Trained Teachers	2. Incentivizing **Industry-Academia Liaison**	2. FDI influx
3. **R&D** – Lack of Investment	3. **Increase R&D investment** in emerging fields	3. Highly Trained HR
		4. Cutting-edge R&D

Key Takeaway

Developing skilled human resource is key to unlocking Pakistan's ICT potential

b. Infrastructure Development

Challenges	Recommendations	Expected Impact
1. **Broadband –** Availability and Cost	1. Improving affordability & quality of **internet penetration**	1. **Increase in internet penetration** will help adoption & promotion of ICT
2. **RoW** – Complexities in deploying Fiber	2. Formulating a **National RoW policy** for Fiber Deployment	2. **Simplifying RoW** will help in harmonizing tariff & policy controls
3. **Power**– Costly and unstable supply of electricity	3. Implement **Energy Wheeling Policy** for offsetting expensive energy costs	3. **Energy Wheeling** will bring in private sector investment and facilitate local data centres establishment

Key Takeaway

ICT Infrastructure is the spine of sector that requires special attention

a. Development of ICT Industry

Challenges

1. **Infrastructure –** ICT Conducive Physical Environment
2. **Digital Ecosystem** – Data Oriented Mindset
3. **Investment** – Access to Capital for innovators & entrepreneurs
4. **Timeliness –** Adopting next generation tech

Recommendations

1. STZ's to promote EoDB,
2. Declare cities as **ICT Hubs/Digital Cities**
3. **Digitalization** of governance, **automation** of Public Sector
4. Removing **barriers to entry** for VCs and Angel Investors
5. **Incentivize** investment in 5G

Expected Impact

1. **STZs** will bring in private sector investments, encouraging industry-academia collab.
2. **Digitalization** will result in better transparency, accountability and corruption-resistance
3. **VC regimes** will bring in FDI, make towards Pak-based *Unicorns* possible

Key Takeaway

Overcoming key challenges is imperative for meaningful growth rate of ICT Industry

d. Emerging ICT Tools in Socio Economic Lens

I. E-Agri, E-Health, E-Energy

Challenges

1. **Agritech** – adoption and empowering farmers
2. **Healthtech** – Value chain integration and adaptation
3. **E-Energy** – Lack of encouragement for industry-scale alternate energy sources adoption

Recommendations

1. Enabling farmers to adopt Precision Farming practices
2. **Digitalization** of EHRs, adoption of AI in Telehealth
3. Removing **barriers** for large scale adoption of alternate energy sources

Expected Impact

1. **IoT and AI led Agri-tech** will save water wastages & increase crop yields
2. **Healthtech** will allow Predictive Disease Spread Analytics, make healthcare more accessible
3. **E-Energy** will improve national energy mix

ii. E-Commerce, E-Justice, Fintech

Challenges

4. **E-Commerce** – Digitization and regulation
5. **E-Justice** –Initiative & Capacity building
6. **Fintech** – Enabling infrastructure & digital banks

Recommendations

4. Improved **Digital Payments** Infra, simplifying taxation
5. **Digitalization** of judicial processes, **automation** of courts
6. *'Made in Pakistan'* technologies to be adopted

Expected Impact

1. **E-Commerce** will enable improved flow of commerce & increase documented economy
5. **E-Justice** enabled courts will be efficient in dispensing justice
6. **Fintech** will reduce unregulated movement of capital & improve digital environment for FDI

Key Takeaway

Encouraging new technologies adoption in socioeconomic sectors will enable Pakistan's journey towards becoming a truly digital nation

iii. Proptech

Challenges

7. **Prop-tech** – Unregulated investments, lack of planning & transparency

Recommendations

1. **Transactions** – using technology to make them safe, secure & transparent
2. **Digital Inventory** management & Data Acquisition
3. **Planning** – PPA Collab to study & database land parcels

Expected Impact

1. **Housing Demand** requires efficient planning based on organized data
2. **Transparency** achieved through utilization of emerging tech
3. **Investments & Job Creation** will enable hockey-stick sectoral growth

Key Takeaway

Effective use of Pro-Tech can significantly improve transparency & documentation of the real estate economy, enhance investment profile in the second and generate snowball impact.

PART I

ICT LANDSCAPE COMPARISON WITH OTHER COUNTRIES

ICT Landscape Comparison with other Countries

The Global share of Pakistan´s IT industry is estimated at US$3 billion, including global sales revenue of US$1.6 billion. According to MoITT, an estimated strength of 300,000 skilled English-speaking IT professionals workforce exists in the economy, of which 110,000-125,000 are engaged in freelancing. There are almost 6000-8000 IT companies in Pakistan, according to estimates of Pakistan Software Houses Association for IT & ITES (P@SHA). On paper, nine STPs offering around 700,000 square feet of IT-enabled office space exist. Seven multinational companies have ´Development Centers´ in Pakistan. Regarding the Digital Landscape of Pakistan, there are more than 169 million mobile subscribers, more than 80 million internet users, 20% of total population having bank accounts and only 1% have credit cards in the country.

Global Innovation Index analyzes global innovation trends and performance of approximately 130 economies. Most of the top science and technology clusters are in the USA, China, Germany, Brazil, India, Iran, and the Russian Federation, and Turkey also makes the top 100 list, whereas, Pakistan's rank is 107. In terms of top Global Outsourcing Destinations which depends upon factors such as Financial Attractiveness, Skilled Personnel and Availability, Business Environment and Digital Resonance, Egypt is at 14th rank while Pakistan has gone down by 12 places since 2015 and currently rests at 37th position (Details attached as Annex B, C). Egypt's Tech Parks/Zones have created over 196,000 jobs and its ICT sector exports increased from 1.87 billion USD in 2015 to 3.26 billion USD in 2017. (Details attached as Annex D). IT Growth is directly linked to Talent Pool; Egypt achieved this, in part, by developing Special Technology Zones. Egypt produces 50,000 IT graduates per year; Pakistan is

estimated to produce 20,000. On the other side, (Details attached as Annex E) Philippines BPO exports over $30bn annually and employs over 1.2mn. Pakistan's exports from BPO accounts for 26% out of total national IT exports. (Details attached as Annex F)

Pakistan has been ranked 76th out of 100 countries on the Inclusive Internet Index 2020 released by the Economist Intelligence Unit (EIU), falling into the last quartile of the global index overall. The Inclusive Internet Index benchmarks countries on the Internet's availability, affordability, relevance and the readiness of people to use it. According to the Internet Penetration of Asian Peer Group Countries Survey by the World Bank, Pakistan has the lowest Internet penetration among developing countries as compared to India, Bangladesh, Vietnam, Nepal, Laos, and Indonesia. Internet Speed Index also shows Pakistan at the lowest position as compared to other regional and Asian countries. (Details attached as Annex G) Pakistan's e-commerce percentage of retail is very low (<0.5%) as compared to India (2.2%), USA (9%) and China (23.1%). (Details attached as Annex H)

Domestic Revenues & Exports are co-related with each other e.g. for every $3bn Indian IT Exports, India has a domestic demand of $1bn IT business. (Details attached as Annex I) Therefore, it is pertinent to encourage domestic ICT spend, fulfilled by local ICT Companies. Empowering the domestic industry supports capacity building, enhances exports capacity, import substitution, employment creation, skill development, builds profile/brand and increases product development & local innovation. (Detailed attached as Annex J).

In comparison to mature markets like India; Philippines, Sri Lanka, Vietnam, Egypt, Mexico etc., Pakistan's share in global offshore services exports is minimal, at 0.1%. Most of the activities of Pakistan's offshore services firms are concentrated around low value-added services in ITO and BPO, which have a cumulative share of 65% in total offshore services; very few firms are active in vertical and knowledge process outsourcing.

The actual size of Pakistan's ICT industry is unknown, exports are often booked as remittances, constitutes approximately 1% of GDP. By contrast, India which started off in 1998 and stood at 1% share in GDP now stands at 8% of GDP contributed by its ICT industry in 2020. India's IT industry generates $191 billion in revenues and generated 4.4 million jobs in FY 2020. According to estimations, Pakistan's digital financial market potential is worth $36 billion. It has the potential to improve GDP by 7%, creating 4 million jobs and $250 billion worth of deposits into circulation.

Pakistan's Potential

According to a report published by State Bank of Pakistan (SBP), Pakistan's ICT is one of the three sectors with the potential to boost the country's overall exports by manifolds as part of the global trade system called as Global Value Chain (GVC). Services provided under the ICT are one of the most promising areas for Pakistan's future exports. The sector, which was almost non-existent in the early 2000s, grew extensively during the last decade. This is

evident from the double-digit growth in exports of segments such as the software consultancy services, call centers and other software and computer services during 2006 to 2019.

Digital growth in Pakistan is going through a rapid evolution. IT/ITeS Sector is one of the fastest growing sectors of Pakistan contributing about 1% of GDP of Pakistan at about 3 billion USD. This has doubled in the past four years and is expected to grow another 100% in the next two to four years to $7 billion. This growth rate can be significantly improved by meticulous policy interventions. According to SBP estimates, IT exports were recorded to be the highest at $1.067 billion in the fiscal year 2017-18 compared to $939 million registered in the previous fiscal year. Internet penetration increased from 2% to over 30% in the past 4 years. Pakistan earned US $161.980 million by providing different information technology (IT) services in various countries during the first month of ongoing financial year 2020-21. This shows growth of 40.90% when compared to $114.960 million earned through provision of services during the corresponding period of last fiscal year 2019-20. However, the country's freelancers also earn another $1.2 billion in exports, an amount not recorded by the central bank as they are not registered. Moreover, another $600 million in exports are from those companies that do not bring their revenues to Pakistan. In accordance with Pakistan Vision 2025 and the Digital Policy of Pakistan 2018, the ICT industry size is targeted to reach $20 billion by 2025.

There exist a promising conditions for the advancement and growth of the ICT/IT sector in the present environment, as most importantly, the security situation of Pakistan has improved. Startups like Careem, Afiniti, Daraz, zameen.com, rozee.pk and their successes are bringing investment into Pakistan. Pakistan was

ranked at the number four for a freelance development in the world. Traditional investors from other Pakistani sectors like textile, fertilizers are also taking special interest in the startup ecosystem. In the traditional IT outsourcing, other South Asian nations are becoming increasingly expensive and these countries are finding it hard to compete in technology areas like artificial intelligence, internet of things, cyber security, automation, etc. Relevant stakeholders must work together for the progress and export promotion of the IT sector. In this regard, this report encompasses concrete sector wise recommendations, which if adopted in true letter and spirit can be a roadmap for policy development, amendments and efficient implementation mechanism in the future.

PART II

ISSUES OF NATIONAL SIGNIFICANCE

Issues of National Significance

General

We now live in an age where ICT has become the key driver for progression of any nation. Investment, development and fostering of the ICT sector is proportionally linked to Innovational, developmental, GDP and HDI indicators of progressing economies. This relationship holds true not only for the developed western economies but also for the developing regional economies of South Asia. In Pakistani geo-political context, in addition to the policy, procedural, regulatory and industry-related issues, there are some vital strategic issues of national significance with long term implications and national security connotations.

1. National IT Policy

National IT Policies from 2000 to 2018 were discussed at length during this exercise. The Government has undertaken a productive exercise in identifying key areas of concern and spelled out a policy document to share its vision. Government's declared vision 'to become a strategic enabler for an accelerated digitization ecosystem to expand the knowledge-based economy and spur economic growth' served as the underlying objective of the whole exercise. However, there are challenges such as discrepancies in policy ownership, its implementation and governance. In light of the IT Policies review, a few gaps were identified in the policy framework that will be covered ahead.

Background

- Due to the economic and social significance, ICT is increasingly the focus globally of national policy to chart directions for ICT development and develop a place for the local industry in the global production system.

- ICT, or lack of, impacts all aspects of public sector, private sector and communities. The barriers to cost, access and capacity, along with technical and policy infrastructure will

impact how much of the social and economic development potential of ICT can be capitalized on.

- With or without an effective IT or ICT policy; technology and services will evolve on a national and global level. A focused and overarching policy will create an enabling environment, allow harmonizing ICT direction across sectors, and ensure local industries are a part of and can take advantage of mainstream global developments and new technologies to remain or become globally competitive.

National Policy Consideration

- There is a lack of focus on laying down coherent strategies on AI, Cyberspace & Infrastructure Sovereignty.
- There are discrepancies in Policy Ownership and Governance.

A concrete roadmap for implementation needs to be charted out, with strategies defined in continuation of policy specification.

2. National AI Strategy

Disruptive technologies are redefining the relationship between governance, prosperity and humanity. The eco-system of Artificial Intelligence is considered the most strategic and disruptive technology of the 21st century. Andrew Ng, Co-Founder Coursera and formerly Chief Scientist at Baidu and Google Brain, compares 'the transformational impact of AI to that of electricity 100 years back'. Artificial Intelligence could contribute up to $15.7 trillion to the global economy by 2030, according to PWC. AI will eliminate 1.8 million jobs but create 2.3 million by 2020, according to Gartner. According to researchers of University of Oxford, on average, 35% of jobs are at risk of automation over the next two decades. Hence there's a compelling need to make a proactive human resource strategy keeping in view the global emerging trends. In context of these trends, more than 22 nations around the world have already formulated a National AI Strategy. Within our region, both UAE and India have already announced respective National AI Strategies. It is imperative for Pakistan to actively work towards launching a long-term National AI Strategy and Initiative. Different aspects of Artificial Intelligence Policy include: academic research, imparting skill and education, talent development, standards and regulations, data and digital governance, etc.

Background

- Today, we as human species stand at the cusp of transitioning in era of the Augmented age from the Information age. Economic Prosperity, Social Empowerment and Quality of Life are all interconnected and increasingly enabled via the disruptive ecosystem of AI. Key driver in embracing disruptive technologies without getting disrupted lies in the culture of Innovation. According to WIPO, Pakistan ranked 107 out of 131 on the scale of Global Innovation Index in 2020. There is a dire need to promote culture of impactful innovation and brainstorm a roadmap in embracing Artificial Intelligence for Public Policy and Private Industries. There are

multiple high volume, high impact use cases for AI adoption; from traffic congestion to cancer detection.

- With AI ecosystem at the forefront of our everyday lives, data-driven governance services are now possible for all the organs of executive, legislative and judicial branches. This will not only increase efficiency of services, but counter corruption with inherent transparency and accountability. How public policy and businesses engage with embracing and adopting AI practices will determine the future of Digital Pakistan.

- While Emerging and disruptive digital technologies continue to converge, the rapidly evolving landscape of AI and its impact for economic transformation is inadequately understood. How we choose to utilize AI across public policy and governance, industries and educational institutes and throughout society will impact how Pakistan progresses as a Nation. It is, therefore, pertinent to understand and engage substantially with Artificial Intelligence to shape an inclusive, prosperous and a thriving future for Pakistan. A National AI Strategy can aid in promoting a culture of impactful innovation and improve Pakistan's innovation competitiveness.

National Policy Consideration

- Articulate Pakistan's robust National AI Strategy.

- Actively promote a vision for AI-led knowledge economy, innovation and inclusion.

- Advance academic and applied knowledge of disruptive technologies for a vision of digitally thriving Pakistan.

- Utilize Emerging Technologies such as Artificial Intelligence, Big Data, Blockchain and IoT in full spectrum of governance, internal and external security.

- Build a sustainable supply of quality human resources trained on the Emerging Technologies.

3. National Cyberspace Sovereignty

In the content of Internet governance, cyberspace sovereignty describes governments' desire to exercise control over the Internet within their own borders, including political, economic, cultural and technological activities; that is, to extend the concept of sovereignty to include all aspects of the Internet. Cyberspace used to be merely a medium of exchanging information and communication. However, the value of data residing in cyber-space, the significance of information being exchanged and threats from cyberspace effecting physical and economic securities of nations has prompted a number of developed and developing countries to rethink the control and sovereignty dimensions of cyberspace.

Background

- Key global powers have different views – projected and enforced – about cyber sovereignty. China has championed the idea of cyber sovereignty, and while the U.S. and its allies have long opposed this concept, it has become more attractive to

some countries as a way of managing cyber threats and mass demonstrations.

- China continues to push its narrative that countries need to exert sovereignty over the internet within their borders and that it is the responsibility of all nations to develop, use and govern the internet responsibly. Russia also favors a cyber-sovereign point of view with respect to its cyberspace governance.

- Western nations have long advocated for an internet that is both global and open, in which the state elements exert minimal control over the traffic passing through its borders. With strong economic foundations, low unemployment, state welfare and settled political ideologies, populations of developed nations are less prone to the warfare of narratives, and thus the threat of effective influence operations by adversaries are reduced. Conversely, it is in the interest of developing economies to enforce cyber sovereignty.

- For Pakistan, it is difficult to apply domestic laws to assert cyber sovereignty because most of the popular services and content are not hosted in our jurisdiction.

National Policy Consideration

- At a policy level, we need to consider Pakistan's position with respect to cyberspace sovereignty. Our policy position has to be informed by our specific geopolitical constraints, which include a complex mixture maintaining the political system's integrity, assuring national security and sovereignty, facilitating economic development and balancing the regional pressures arising out of various global powers' geopolitical projections in and around South Asia. Issues arising out of cyberspace deeply impact the fragile balance of our national harmony, for example influence operations carried out by hostile elements aiming for ideological subversion and subjugation, controversial content (blasphemy videos) published through foreign-origin and foreign-based service providers and sectarian rift created through social media platforms, etc.

- States can regulate cyberspace issues falling within their jurisdiction by application of domestic laws. However, application of such laws is practically difficult when content providers are not incorporated within the country's jurisdiction or the content is not hosted in datacenters that are situated within the country's jurisdiction i.e. from the state's point of view, the content and service providers are operating locally but are based overseas. The only solutions to this conundrum (other than outright blocking the content/service provider from the state's jurisdiction) are to either require the content/service provider to localize their data centers, or require them to conform to the state's control / filtering/compliance. Both of these options require incentive and facilitation for the content/service provider e.g. having a market that is sufficiently lucrative to make financial sense to adopt either of

the options.

- Falling short of outright censorship of foreign-based content and service providers – which is an unsustainable solution in the long term – Pakistan must develop ICT sector to an extent that it becomes a technically feasible and financially lucrative market for all major content/service providers to host localized content. A primary pre-requisite for this scenario to realize is establishment of large-scale Tier 4 datacenters across Pakistan.

4.Communication Infrastructure Sovereignty

Network and data sovereignty are the efforts of a state to create boundaries on a network and sensitive data and then exert a form of control (law enforcement, ownership, etc.) over such boundaries. Communication Infrastructure Sovereignty can thus be defined as exerting control over the communication infrastructure as well as sensitive data of the said network e.g. fiber optic cables, copper lines, wireless links, international cloud, etc.

Background

- There are plans to bring terrestrial international cables to Pakistan where the inbound/outbound data traffic of Pakistan may travel through other countries and may be susceptible to interception attempts.

- Foreign country entities, though friendly, have been allowed to lay their own fiber optic network cables that run across Pakistan. It is expected that such cables will remain solely owned by foreign entities and remain proprietary with respect to data that is communicated over these fiber optic links.

- There is a lack of standardization and policy enactment to ensure the sovereignty of information and customer data, and to ensure that sensitive information and personal data of Pakistan stays within the geographical and jurisdictional boundaries of Pakistan.

National Policy Consideration

- We need to consider the threat of utilizing international IP traffic cables in which there are either ownership stakes of hostile country entities or such entities have been awarded contracts for operational management of the submarine cables. We need to consider what long terms alternatives we can develop for gaining independence from such arrangements that have the potential to impact national security. In addition, the preferred method of deploying international links is through submarine optic fiber system. Any international fiber optic links that traverses through other territories is susceptible to interception and should be considered with caution.

- At a policy level, we need to reconsider allowing foreign entities to lay, and operate their own fiber optic cable infrastructure in Pakistan in order to minimize the threat space with respect to communication infrastructure sovereignty.

- Currently, there is a lack of clarity on the policy of storage and processing of customer information and other sensitive information on infrastructure hosted internationally. Data is the most valuable commodity in the information age, and preservation of sovereignty and integrity of data should be a national policy objective. Pakistan has the size and scale to make local storage and processing of data a viable economic option. It should be encouraged (or rather mandated) to store and process all sensitive information (relating to critical sectors like banking, telecommunication, healthcare, education, manufacturing, services, etc.) within the geographical and jurisdictional boundaries of Pakistan.

5. National Developmental Indicators

As is evident throughout this report, the metrics and data on the various facets of IT industry and ecosystem – from a wide variety of references and sources – paint a poor picture. The state of affairs doesn't improve even when we widen our lens and review other sectors/pillars in terms of developmental indicators.

Background

- Various international bodies publish sector-wise annual reports covering cross-spectrum performance of countries across a large number of indicators. Generally, such measurements are partitioned into pillars (e.g. Markets, Human Capital, etc.), each of which have a certain number of indicators (e.g. Skills, Health, Market Size, etc.).

- In addition to the on-ground realities and true state of these indicators with respect to Pakistan, one of the major factors that influence our standing in these indicators is the lack of factual and recent data that is available to undertake the indicators' measurements. In absence of data, the researchers gap-fit the data or default to no points. The result of which is that Pakistan performs poorly across such indicators.

- More significantly, in absence of data means that effective evidence-based decision making cannot be done within the Government to improve the sector-wise performance and KPIs.

National Policy Consideration

- The government must actively pursue the goal of improving Pakistan's standing across all indicators annually. Not only these indicators are important for the soft image of the country, but are also used as a critical decision-making factor by foreign investors before investing in a country.

- A number of indicators are based on data that cannot be provided by a single ministry or department. In fact, most indicators are measured based on data that falls in the remit of a number of ministries. The government must ensure that data of national indicators is being monitored, measured and recorded with provenance by all relevant ministries and departments. Local ICT industry can be utilized for development of tools and provision of services to fulfill this requirement.

- Each developmental indicator that is important to the development of Pakistan's growth in general and that of ICT sector in particular should be assigned to a Ministry, which will then be held accountable for Pakistan's performance on that indicator.

- Ministry of Information Technology and Telecommunication should be made in-charge of driving the government's machinery towards the ultimate goal of improving

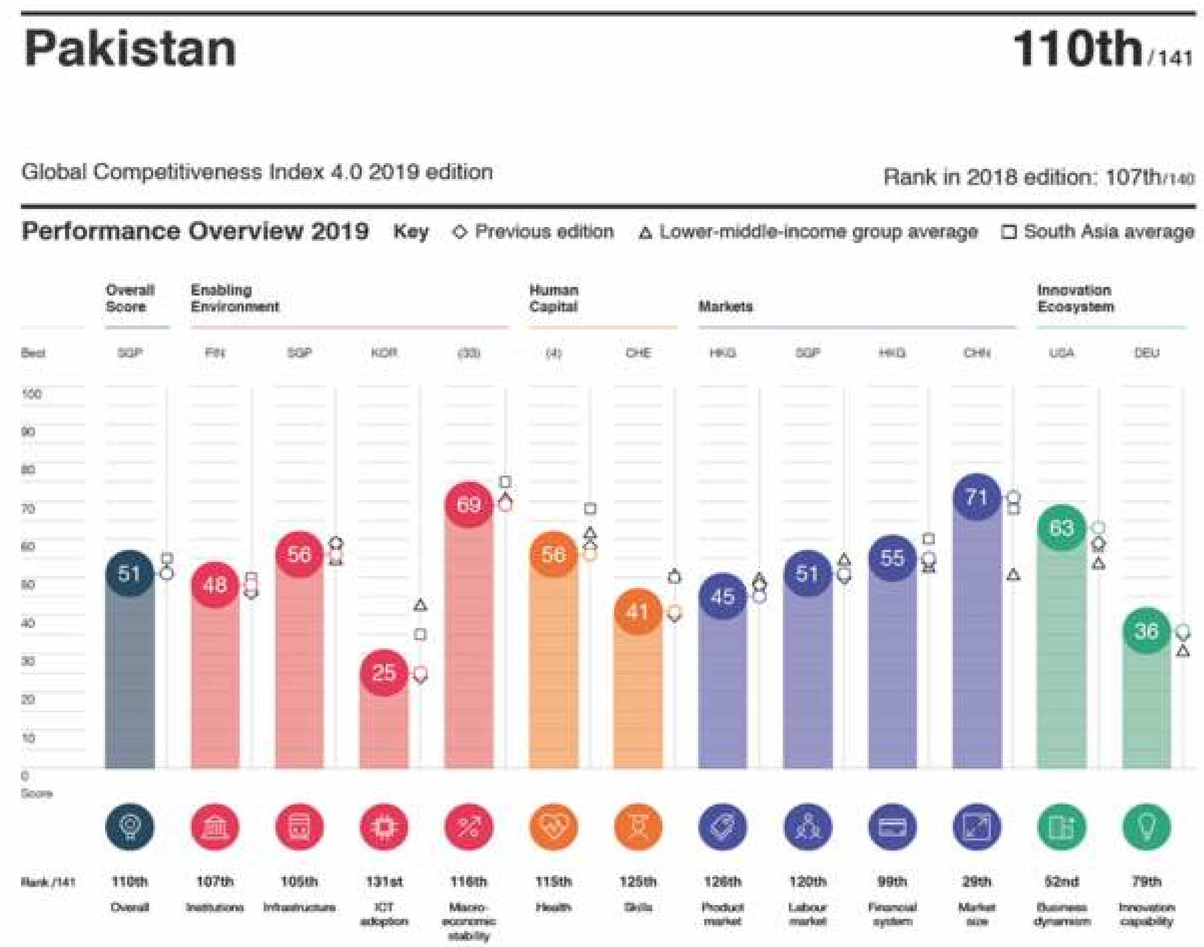
Pakistan's performance on the indicators as much as possible.

6. National Spatial Data Repository and Utilization

In the world of governance there are two parallel realities, i.e. what exists in the real world and what is on file. Regimes that minimize the difference between these two realities are efficient, successful and effective. Those that cannot, end up being inefficient, inept and not in control of the complete state of affairs, which allows space for corruption and manipulation. Eventually data corruption causes not only financial damage but also greatly enhances human suffering and even loss of life. Generational damage is caused when planning and decision making is done without data or on the basis of invalid data e.g. brand-new roads are dug up and remade while remote areas remain cut off, river banks disappear and habitats are destroyed while environmental agencies pour money into conservation. Agricultural land is converted into housing schemes while the country faces food insecurity, etc: -

Significance of Geospatial Data

- At its heart, a government is a matter of geography, and governance is an optimization problem. Cities, provinces, and districts all have borders and within these borders are layers upon layers of infrastructure, resources and population clusters. Not only do these layers need to be accurately



mapped but also constantly monitored to record and update the ever-changing landscape. Failure to do so has led us down the path of gross misallocation of resources resulting in a country that is squandering its potential in many sectors.

- There have been many attempts in the past to mitigate this problem and make available better data in government to improve decision making. Solutions planned and implemented in silos are as vulnerable to abuse as the paper systems they replace. The only way to effectively mitigate the distortion in information is to make Geospatial data ubiquitous in all facets of the government. Not only does Pakistan need to monitor our landmass but also permanently store this data for future accountability.

- Governments around the world have found that Geospatial Data is a critical tool in resource management, regional planning, and economic development. When integrated with demographic, economic, social and cyber data; Geospatial data becomes the invaluable core of effective decision making. The applications for Geospatial Technologies stretch across almost every aspect of public administration.

- Governments across the globe rely on geospatial technology to improve operations and services to citizens, track and evaluate activities to meet mandates and support initiatives and perform analyses that lead to better decision making e.g. in e-Governance, infrastructure monitoring, urban and regional planning, agriculture, irrigation, climate change monitoring, revenue collection and assurance, economic planning, defense, disaster management, energy security and law enforcement, etc.

National Policy Consideration

- Making utilization of geospatial data mandatory and ubiquitous in all aspects of governance is critical towards reducing corruption, increasing transparency and introducing efficiency in the workings of government. Unfortunately, Pakistan does not have a vibrant and competitive geospatial industry, with the majority control and experience in the geospatial sector lying with one state entity.

- Allow private sector to work freely in the acquisition, production and utilization of geospatial imagery without threat of compromising national security. Our regional adversaries have raced ahead through the effective combination of the private sector expertise and government funding to develop a wide array of indigenous geospatial technologies, all led by private enterprise. In contrast, we have to rely on foreign services and companies for our most basic geospatial data and service needs.

- In order to bridge this divide, Pakistan needs to formulate a Geospatial policy. In the short run we will need to incorporate existing technologies in government decision making and make their use mandatory in all aspects of government. In the long run Pakistan needs to grow an independent and robust geospatial industry whereby we have strong local players that can provide us the tools to be self-reliant in all kinds of geospatial technologies. Failure to do so will be a threat to our national security, indigenous capability and cyber sovereignty.

7. Role of the National Telecom Career in the Nation's Digital Agenda

Economy is the backbone upon which every society prospers. During the industrial age, production and consumption of physical goods and services were the key drivers of economic

activity. However, as the world is transitioning from industrial age to information age (4th industrial revolution), trading of physical goods and services is being increasingly supplanted by electronic commerce, where the trade is being conducted via bits and bytes. Strategic Lines of Communications (SLOC), which were the lifeline of any traditional national economy, are now being replaced with Strategic Lines of digital Communication (SLOdC). SLOdC are typically undertaken to include national and cross-border fiber connectivity, undersea cables for voice and data, datacenters, and an operational framework that brings it all together. Ownership, advancement and protections of the SLOdC are as important as SLOC for any nation, and the national carrier plays the primary role in this regard.

Designating and maintaining a national telecom carrier is a common mechanism across a number of developed and developing countries for ensuring telecommunications and information sovereignty. National carriers are entrusted with a strategic role within the national information and communications technology (ICT) fabric. As activities and investments of a national carrier are sometimes driven by strategic national objectives rather than pure commercials, they are often the primary choice or have refusal rights in certain sectors. The purpose of such arrangements is not only sovereignty related, but also for ensuring the protection of state assets (copper wires, fiber links, switches, exchanges, etc.) and the information they carry, which are of critical significance in both peace and war times. Any future conflict between adversaries will have significant component of cyber warfare, therefore the security and resilience of national ICT infrastructure is entrusted to the national carrier PTCL.

Background

- Pakistan's national telecom career PTCL is owned 62% by the state, 26% by Etisalat (UAE) and 12% by the general public.
- PTCL currently has 4 international digital communication links via submarine cables, connecting Pakistan to Europe, USA, Middle East and Far East Asia.
- PTCL has the largest fiber optic infrastructure across Pakistan, and connects the country to India, Afghanistan, Iran and China (through partnership with SCO) over these links.
- PTCL also operates the nation's largest satellite ground/earth stations (Islamabad and Multan), comprising of large aperture dishes.
- PTCL is the dominant communication provider to banks, telecom operators, manufacturing companies, federal and provincial governments, and the armed forces (apart from their own connectivity infrastructure).
- PTCL is the largest Cloud services provider in Pakistan, providing cloud computing services to both the public and private sector.
- PTCL provides secure communication and interconnection facilities to various national level strategic organizations including Civil Aviation Authority, State Bank of Pakistan,

Pakistan Customs, etc.

- As the national carrier of Pakistan, numerous PTCL exchanges across, Pakistan built between 1970 and 2000, were constructed as strategic communications hub and were designed to withstand hostile actions (like grid failure).

National Policy Consideration

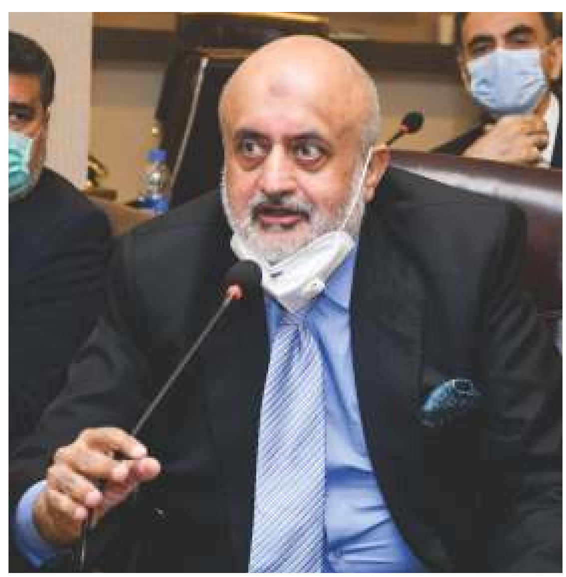
- As the majority shareholder, the Government must strategize to realize the potential of PTCL's commercial growth.
- The government should take ownership of the planning of PTCL while allowing the minority shareholders to manage PTCL's consumer-side product and services portfolio.
- PTCL personnel in strategic positions should be vetted through the security clearance process by relevant agencies, in order to safeguard the nation's digital assets and cyberspace sovereignty.
- The spare capacity and space at the Command and Control specification PTCL exchanges can be utilized for building indigenous Tier-3 and Tier-4 level datacenters. This will not only save on infrastructure costs but provide colocation facilities with existing fiber optic networks. In order to contain unnecessary strain on the budget, all government and semi-government departments should be encouraged to use the existing building facilities of PTCL rather than committing scarce financial resources on constructing new buildings.

8. Anticipatory Governance and Foresight

There is a dire need to shift from a responsive to proactive anticipation of governance related matters. Technology has enabled governments around the world to serve their citizenry and improve provision of services. Pakistan's Citizen Portal in this light is a case in point, further similar initiatives are required to improve the quality of life for citizens of Pakistan, while integrating the emerging tools such as AI, Machine Learning, IoT in a holistic policy framework. There is a dire need to shift from a responsive to proactive anticipation of governance related matters. Technology has enabled governments around the world to serve their citizenry and improve provision of services. Pakistan's Citizen Portal in this light is a case in point, further similar initiatives are required to improve the quality of life for citizens of Pakistan, while integrating the emerging tools such as AI, Machine Learning, IoT in a holistic policy framework.

Background

- Anticipatory Governance (AG) offers a systematic way to manage the challenges that are complex in nature and helps in strategic decision-making, strategic management and, crucial policy coherence.
- The idea that policymaking, and its subsequently developed solutions and models, should be data-driven is called foresight.
- Foresight research is increasingly becoming ever more ingrained in the mind of policymakers around the world. Many



governments have dedicated foresight teams in conventional planning divisions or even in strategy units at prime minister or president offices, which prepare researched reports on emerging trends and give policy recommendations.

- Anticipatory Governance and utilization of the foresight technique are now an integrated function in various governments across the globe including Australia, Canada, China, Finland, France, Germany, India, Japan, Netherlands, Japan, UK and the US.

National Policy Consideration

- Government of Pakistan should adopt anticipatory governance practices and actively promote digitization, data recording and open data platform to utilize as tools in undertaking anticipatory government practices. AG platform enhances the future thinking by gathering knowledge of experts in a systematic way, based on factual, multidimensional and indicators related data.

- Government of Pakistan should work towards enablement of its constituent ministries, departments and bodies to make informed decisions, starting with development and implementation of policy interventions based on this report. Utilization of foresight methodology will aid greatly in this endeavor, as it takes into account perceptions about how future events may change business-as-usual scenarios. It provides data, correlations and analyses based on indicators;

provides a platform where stakeholders can develop informed opinions and share insights about long-term developments, and thus aids decision makers to focus thinking towards areas that need attention and undertake the evidence-based decision making.

- Government of Pakistan should pilot the adoption of indigenous tools developed for the application and utilization of foresight / AG techniques, which provides access to socially organized research using methodologies such as forecasting, Delphi surveys, State of Future Index (SOFI) modeling, Trend Impact Analysis (TIA) modeling, etc. AG platform also provides predictive algorithms and machine learning using Artificial Intelligence tools to discover patterns and correlations, provides insights and causations, and aids in decision making towards assessing alternate futures; a comprehensive recipe for effective decision making and impactful outcomes.

- The Government should mandate strategic think tanks and relevant planning ministries / departments to pilot the application of AG / foresight techniques in focal sectors, gathering knowledge of experts in a systematic way, based on factual, multidimensional, indicators related data, and feeding the output back to decision makers for effective policy development.

PART III

NATIONAL ICT HUMAN RESOURCE AND INFRASTRUCTURE LANDSCAPE

National ICT Human Resource and Infrastructure Landscape

1. Human Resource Development

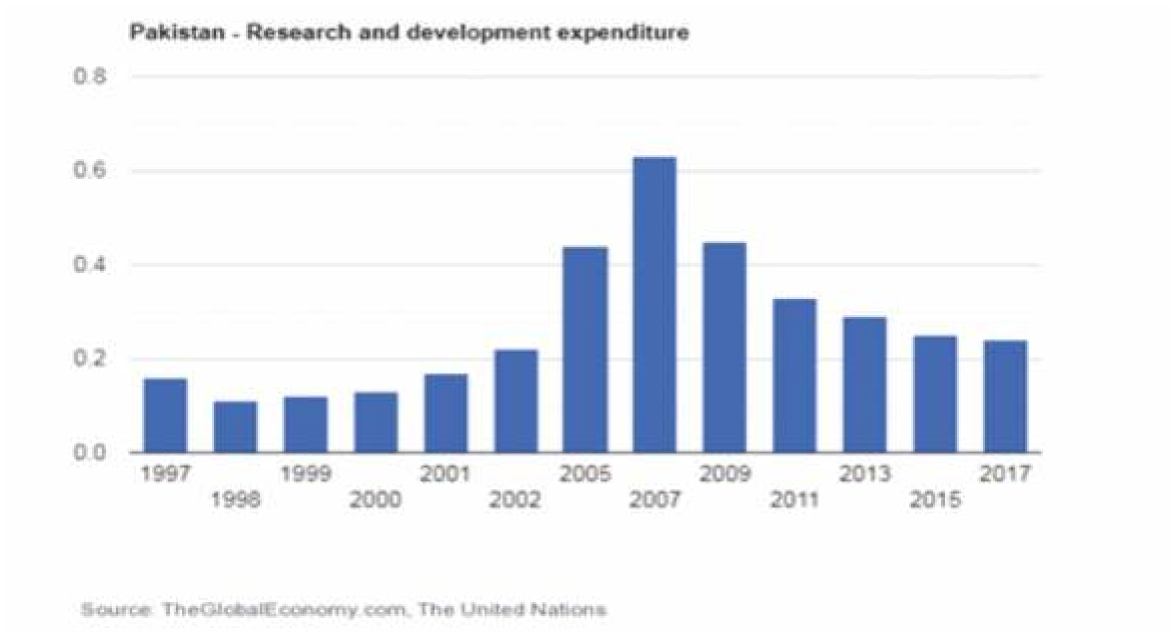
General

In Pakistan, Human Resource Development is influenced by lack of funds and qualified staff. The government of Pakistan allocates a relatively small amount of budget for Human Resource Development activities. According to UNDP, Pakistan's ranking on the Human Development Index (HDI) in 2019 was at 152nd position out of the total 189 countries, and it stands 13% below the average HDI of South Asia including Bangladesh and India. Low GDP growth, high population growth, high level of poverty, low per capita income, low literacy rate and unemployment has compounded the problems in this regard. Apart from distracted and perplexed policymaking, poor governance has remained a key issue and has had a negative impact on social service delivery. This has a direct impact on the services sector such as the ICT. The challenges to the HR development in the ICT sector have been listed below: -

- Lack of Investment in Innovation Focused Research and Development
- Unregulated Educational/Training Institutes
- Lack of Industry, Academia and Government Partnership
- Training of Teachers
- Lack of Knowledge

a. Lack of Investment in Innovation Focused Research and Development.

The lack of financial support and investment has been one of the major reasons for the quagmire we currently find ourselves in. As stated by the data provided by UNESCO Institute of Statistics (UIS), Pakistan spends only 0.3% of its GDP on



R&D (in comparison, India spends 0.8%) and has a meager 166 researchers per million inhabitants. In addition to this, gross domestic expenditure on R&D (GERD) has decreased from 0.4 (GERD as a % OF GDP) in 2005 to 0.2 (GERD as a % of GDP) in 2015 and remained the same in year 2017. The universities depend on state funding, primarily for R&D. However, government funding has proved inadequate to the rising needs of these institutions. Universities' income and expenditure analysis indicated excess of expenditure over income in all public universities and there was a building up of deficit between capital income and capital expenditure.

Challenges

- Human Resource Landscape in Pakistan is not equipped at present to satisfy the demand-side of the higher ICT value chain. We have 64% population under the age of 30, yet we lag in requisite skillsets to provide a steady supply of valuable ICT human resources. A closer look at our ICT resource mix in outsourcing work establishes domination of lower-value chain freelancers i.e. earners of up to $10/hr. It is imperative to understand the cycle of value-chain involved in producing ICT resources, and a clear roadmap is required to move up the chain. Furthermore, there are structural considerations to also take into account i.e. rapid increase in higher education influences finances and physical resources. The number of students in the universities outweighs the governments funding capacity.

- A secondary and higher education system centralized around passive learning and clogged by rote memorization, coupled with a complete absence of the promotion of research and independent inquiry culture, inadequate number of research institutes and diminutive investments in research and development sector are some of the reasons Pakistan still has to prove its mettle in the international scientific sphere. As per statistics, the government has earmarked Rs 77.262 billion for Education Affairs and Services in the federal budget for 2019-20 against the revised allocation of Rs 97.155 billion for the current fiscal year, showing a decrease of around 20.5%. The government has also reduced the budgetary allocation for higher education sector. Pakistan's public expenditure on education as a percentage of GDP is estimated at 2.4% in fiscal year 2018-19, which is the lowest in the region.

Recommendations

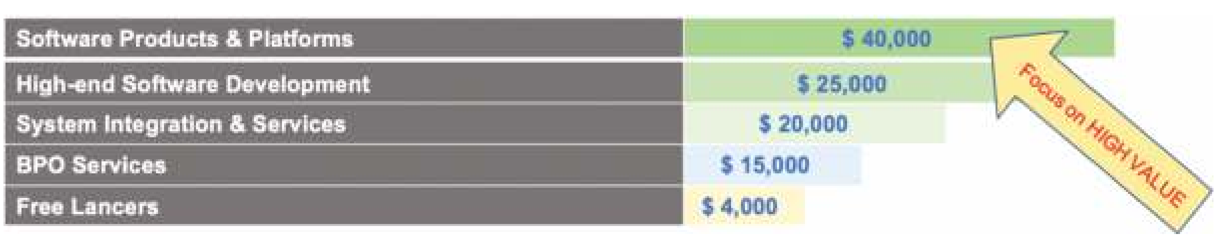
- There should be a national emphasis on improving the quality of human resource being produced in ICT sector. A closer Industry-Academia collaboration is required, under the supervision of government, to produce intellectual capital able to satisfy High Value ICT work. Furthermore, sufficient budgetary allocation for education in the national GDP will contribute to this effort. Incentives and facilities of the highest order should be provided to scientists and researchers, as it can help attract young students to a career in research. However, at the same time a rigorous qualitative assessment regime should also be put in place to assess the R&D output. Research in futuristic fields such as biotechnology, artificial intelligence, robotics and quantum computing could help put us on the forefront of global leaders of scientific community and promote a transfer / exchange of experts and technology between Pakistan and the leading global scientific institutes.

- Industry relevant ICT skills development programs for undergraduate students across Pakistani universities, run in cooperation with ICT industry; HEC mandated closer industry-university linkages, requiring lecturer / professor secondment to industry for skill refresh / industry relevance training; accredited learning (credit hours) for 3-6 months' placements of students in the private sector; Talent hunting and identification, followed by ICT scholarships program (undergraduate). A sufficient portion of annual budget should also be allocated to Higher Education Scholarships and for Research and Development (R&D). Encouraging R&D activities through accumulation of knowledge and human capital could help put Pakistan's technology manufacturing sector on the high growth path by alleviating the competitive strength of export-oriented industries in global markets.

- Schools from an early age should inculcate and develop independent thinking, analytical skills and some basic know-how of IT related aspects in the students for which the curriculum should be periodically updated and the teachers provided with requisite training.

- Creating a fund for R&D in new technologies for start-ups and entrepreneurs to enable innovation in cutting edge communications, 5G, software, digital content, cyber security and related technologies and applications; and commercialization of products and services through grants, scholarships, venture capital, etc.

- Promoting design led ICT equipment manufacturing in Pakistan by leveraging indigenous software/ R&D capabilities.



Category	2021	2022	2023	2024	2025	2026	2027
Employable Tier-1 Graduates	10,000	15,000	20,000	30,000	40,000	55,000	70,000
Current	*5,000*						
Re-Tarined Tier-2 Graduates	15,000	20,000	30,000	45,000	65,000	90,000	120,000
Current	*7,500*						
Re-Trainied Tier-3 Graduates	20,000	25,000	40,000	60,000	90,000	120,000	150,000
Current	*12,500*						

- The National ICT R&D Fund executed a comprehensive outreach scholarship program in 2007. This program called National ICT Scholarship Program (NICTSP) was executed by National ICT R&D Fund and targeted talented and deserving students from all provinces/regions of the country through screening and testing. To find best students having aptitude and interest towards IT sector, such programs should be reinvigorated.

- A National Talent Accelerator Program is proposed for improving digital literacy at all educational levels and moving up the value chain for developing technology and intellectual capital. It is further proposed improve existing mix of human capital from ICT sector by re-skilling and up-skilling. Also, it is proposed to incentivize closer industry-academia coordination for creating a sustainable pool of human resource trained on hi-tech technologies. Companies such as Microsoft, VMware, IBM, Amazon and others can be incentivized to invest in training resources and making multiple Global Service Support Centers in Pakistan.

b. Unregulated Educational/Training Institutes

Pakistan's private sector suffers from a lack of consistent and forward-thinking regulations, which seriously impacts the quality of teachers, education, tuition fees and the ratio of pupils to teacher. In its annual Global Education Monitoring Report (2017) by United Nations Educational, Scientific and Cultural Organization (UNESCO), there were as many as 80 students per teacher in private schools in Pakistan. These 'alternative educational and training providers' mostly do not have much in the way of risk assessment and control. The United Nations Committee on the Rights of the Child also recently echoed similar reservations stating, “The privatization of education in Pakistan comes with lack of measures to ensure the compliance of private schools with minimum educational standards”.

Challenges

- There are a significant number of training and educational institutes that are not registered in the government system and have no credible regulator or compliance check on them. These schools easily manipulate the curriculum and teaching strategies. There are also few cases where schools are adopting below-standard curriculum or teaching methods and are solely driven by the monetary benefits of running a business in a sector that is suffering from minimum oversight and regulation by the state.

- The minimum requirements to open a private educational or training institute are very low. Private institutions offering primary and secondary education do not require affiliation with a board, which means a school can be

registered without being accountable for suitable permanent premises, qualified faculty, a library, and other necessary facilities.

Recommendations

- The government should update the regulatory system and explore new ways for collaboration amongst public, private, and civil sectors.

- The government should immediately develop credible and efficient regulations and monitoring mechanisms while adhering to follow-up sanctions when standards are not met.

- The government should take necessary measures to create a homogenous educational system all across the country.

- A system of checks and balances for the private sector to oversee the issue of fees, school standards, and teachers' pay grades should be devised.

- A provincial regulatory framework with active operational guidelines to monitor private educational institutes should be formulated. The standards for the opening of private institutions should be raised to a certain minimum criterion.

- Utilize the training infrastructure available with telecom Public Sector Organizations for skill development (PTCL, Government Schools, etc.) and facilitate technical upgradation of Public Sector Organizations.

c. Industry-Academia-Government Partnership

There are examples of fruitful collaboration between universities, industry partners and start-ups. Many ideas from research in universities are put to use through collaboration between universities and firms. Others reach the market through licensing or start-up companies. Internationally, in the ICT sector, such partnership is fostering R&D and innovation by bringing together industry and university partners in pursuit of timely themes in applications and infrastructure, including AI and machine learning, hardware acceleration, operating systems, networking, Big Data, security, storage and data management. In Pakistan, relations between universities and businesses are far from being as large as they should be, despite the existence of engineering schools and schools of business and management, natural partners of companies; the presence of major public research organizations; and also the reciprocal mistrust that has long prevailed between academics and the business world, which has led to a slowed ICT growth in the country.

Challenges

- One of the major failings of the Pakistani higher education system is the discord between the curriculum and the needs of the industry. Most graduates that make their way into the Pakistani job market have no clue about what the employers expect of them or what are the skills needed to perform in a particular role. The education and skill gap in our youth has been widening for years, and on the job training to make young graduates skilled enough to work in a certain job role has been costing valuable resources to employers for long.

- Our graduates have good foundation knowledge but need significant polishing for tangible utilization in professional settings. The private sector IT industry estimates that only around 5000 to a maximum of 10,000 IT graduates, out of the 25000 graduating annually, are actually employable to fulfill the needs of the private sector.

Recommendations

- Universities should focus on creating an entrepreneurial and independent thinking culture among their graduates. This can be attained through the establishment of effective business incubation centers, encouraging partnerships between industry and academia and placing career counseling offices that should work on intellectual and professional development of the graduates during the course of their studies in order to prepare them today for the challenges of tomorrow. The results of already existing incubation centers should get more projection so that funds can be attained for the development of new centers.

- To reduce the gap between academia, research and job market, universities are needed to restructure their programs to prepare ICT professionals for today's market requirements and the needs of the future. To achieve this objective, teachers need to be trained periodically in order to keep them abreast with latest research and industrial demands. Visiting faculty from IT industry should be incorporated in IT departments of all universities and should impact the ranking / performance assessment of the universities by HEC.

- The institutions offering vocational courses should be required to integrate ICT education and skills in their teaching-learning process.

- Job oriented courses in ICT should be developed and established for students of the vocational stream at the higher secondary level by linking them with the need of ICT enabled industries/establishment in the neighborhood.

- The scope of these courses should be broad-based ICT literacy. It should not be limited to ICT based occupations, but should also inform and enhance productivities in a wide range of other occupations (for example, accounting, office automation, office communication, data handling and data processing,

desktop publishing, graphics and designing, music and video, etc.). This should also include courses on cyber security.

- The courses should be modular, and students should be provided a wide range of choices, catering to a variety of job options, hardware and software platforms, tools and resources. Students should not be limited to a fixed set of courses to qualify for a degree; flexible options should be provided by degree awarding institutes so that students can choose a professional and knowledge pathway suited to their particular interests.

- The courses should be frequently revised and updated in order to maintain relevancy to changing requirements of the job market and emerging trends in technology.

- Collaboration with foreign universities is required, focusing on adoption of research and entrepreneurship culture prevailing in foreign universities.

- Online courses from the world's leading universities and online certifications should also be included in the curriculum.

- Universities should make longer-duration internship and industry placements (e-g 3-6 months) mandatory for the acquisition of final degree, instead of the currently in vogue 1-2 months token internships.

- Leading universities should create a roadmap for developing skilled manpower with theoretical and applied knowledge in emerging technologies and their eventual utilization in the ICT industry, such as 5G, Artificial Intelligence, Big Data, Robotics, Internet of Things and Cloud Computing.

- Adopt the dual-use technology model, where defence sector may fund academia and work in collaboration with the industry for R&D leading to cutting-edge technology usable both for civilian purposes and military applications. This is especially relevant to bridge the technological gap between our armed forces and that of hostile nations'. Furthermore, US followed a Triple Helix Model to promote its ICT structure, i.e. collaboration amongst private, government and defence sector.

d. Training of Teachers

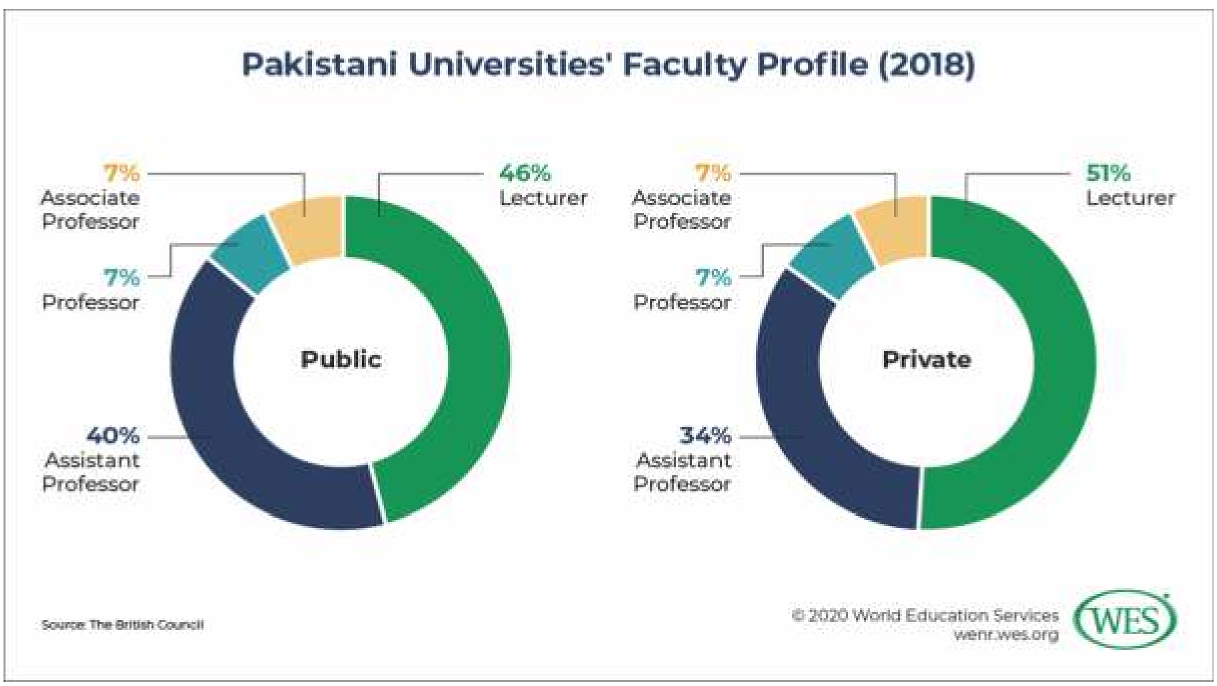
Pakistan's education system suffers from inequality in educational outcomes on a massive scale. There are significant variations in the quality of education provided from one child to the next. This is the pervasive issue of a lack of equity literacy. Among the most pressing shortcomings of Pakistani universities is a shortage of senior teaching staff. While assistant, associate and full professors must formally have a PhD, entry-level lecturers in most academic disciplines (except engineering, information technology, computer science, medical sciences, law, and studio arts and design) can teach at university level with just a Master's degree (18 years of total education). Since HEIs rely heavily on non-tenured lecturers, the percentage of teaching staff with PhDs is consequently low. According to HEC statistics, only 21% of full-time faculty at Pakistani universities held a PhD in 2015. Some universities did not have any professors who held doctoral qualifications.

Challenges

- There is lack of training opportunities for teachers in Pakistan. Although, there are various teacher training institutes in the country, these are either not very well resourced or being poorly run due to lack of fund and trained human resource such as trainers and administrators. There are no proper training standards in the available training institutes around the country. Most of the training institutes have been closed down due to lack of funds. The courses being run in the teacher education intuitions are outdated and very traditional which do not enhance the ICT skills, motivation and quality of teachers.

Recommendations

- The problem of quality teaching can be catered by initiating a stop gap arrangement. This would entail a varying cohort of teachers being imported from educational utopias, to not only work on the quality of teaching and education but also to provide invaluable policy inputs. These teachers and professors must be systematically placed at different levels of the education setup including primary, secondary, graduate and post-



graduate education levels.

- To modernize the research and development practices in Pakistani educational institutes and raise the qualifications profile of university faculty, the government should support doctoral programs with scholarship programs of considerable scale, considering Pakistan's fiscal constraints. HEC is already giving International Doctoral Scholarships on annual basis; however, the skills and knowledge of these PHD scholars on returning to Pakistan are not utilized properly. Therefore, we need to re-evaluate the system for optimal utilization of their skills.

- Teachers can also benefit from industrial placements sponsored jointly by the industry (e.g. with tax credits related incentives) and the teacher's employers (public or private sector). This will impart practical and industry relevant skills to the teaching faculty as well.

e. Lack of Knowledge

Challenge

Although there is huge adoption of mobile phones in Pakistan, a vast percentage of the population still does not own or have access to Internet-enabled phones. A major cause of this dichotomy (high mobile phone penetration but low Internet awareness) - other than a low overall literacy rate - is that there is limited localized content available on the internet (content in our local languages), which makes it difficult for our non-English speaking population to consume the pervasively available foreign content.

Recommendations

It is a universal fact, that education is considered as the most powerful instrument, eradicating poverty, gear-up socio-economic development and creating awareness in the society. It unlocks the door to awareness and helps individuals make informed choices. It gives people access to knowledge for improving lives but also for shaping a more informed, knowledge society. Teaching systems should now aim to increase ICT use in primary and secondary education. Measures need to be taken to promote creation and consumption of localized digital content, with focused efforts on native font's development, mandatory local/regional language publications (e.g. websites, magazines) of all public sector entities and policies to encourage digital publishing / marketing houses to create localized content and media.

Expected Impact of HR Development

Developing skilled human resource is key to unlocking Pakistan's ICT potential. The impacts include: -

- Significantly improving revenue per ICT resource
- Influx of foreign direct investments
- Availability of highly trained human resource
- Pakistan engaging in cutting-edge R&D

and reaping benefits

2. Infrastructure Development

General

We live in an age where digital citizenship shapes our history and place in this world. It is inexcusable that digital literacy remains an underutilized phenomenon within the country. Improving the human condition through technology should be viewed as an advancement of rights, not as a way to keep people uninformed to avoid democratic oversight. The Internet is an essential resource for today's world and there is simply no identity formulation without it. Digitization requires not only access but digital literacy and skills allow us to effectively use the Internet. The gaps in connectivity unsurprisingly are between rural to urban settlements and women. Therefore, in order to understand the problems with the development of the ICT sector, the following issues have been identified:

- Availability of broadband
- Right of Ways
- High Taxes
- Cost of Bandwidth
- Rising Gender Gap
- Availability of Uninterrupted and Affordable Power

a. Availability of Broadband in Pakistan

PTA (Pakistan Telecommunication Authority) maintains data of broadband penetration in Pakistan across all mobile and wired service providers. The latest numbers indicate that we have about 87 million Broadband subscribers. Although 75% of our population (150+ million) has access to basic voice telephony, broadband penetration is much lower. We have 41% Mobile Broadband Internet penetration which puts us at 75th when ranked globally. Only 1.7% of our Broadband subscriptions are connected via Wired/Fixed Broadband. Pakistan's rank for wired broadband penetration is 150. "The Inclusive Internet Index: Measuring Success 2020" ranks Pakistan as 76th on a global index of 100 countries. Our challenges with respect to broadband penetration in Pakistan are with Availability where our internet penetration stands at 32.4%. Only countries like Afghanistan, North Korea, East Timor & Turkmenistan have lower penetration than Pakistan.

Fiber Coverage in Pakistan

High speed and good quality digital services, that are now essential for internet enabled businesses, require massive amounts of internet bandwidth, particularly in backhaul and backbone networks. This is only possible

* Figures are updated as on August 2020

through optic fiber links.

Challenges

- There is a lack of wired broadband infrastructure in Pakistan. Wired Broadband Service providers offering high bandwidth solutions based on Telephone (DSL) and Cable media are challenged by the physics of copper infrastructure, limiting what they can offer to consumers. Fiber medium is a pre-requisite for business-grade Gigabit GPON solutions offering Voice, Data and High Definition video content.

- The existing fiber optic network through which Pakistan connects to the world has been developed by a consortium that has Indian companies either as partners or shareholders. This has to be viewed as a real and present security concern with respect to surveillance of our communications.

- There is no public sector spending on digital infrastructure in Pakistan other than by the state-owned National Telecommunication Corporation (NTC) for government's own needs (which are miniscule compared to the needs of a developing economy gearing towards ICT led export drive).

- The relatively infinite capacity of optic fiber cables means that they are what economists refer to as non-rival asset i.e. the use of the capacity by one operator in no way affects or impedes the use of it by another. On any modern fiber infrastructure there is enough room for all players using all the capacity they can use for the foreseeable future without encroaching upon each other. However, in Pakistan, the large data-carrying capacity of fiber optic cables never gets fully utilized, as most Internet Service Providers compete by laying their own fiber optic networks. Resultantly, wasted redundant investment worth billions lies buried in cities. In addition, there is the problem of inaccessibility to certain geographical areas due to which new cables cannot be laid.

Recommendations

- The developed economies treat the passive optic fiber networks as a utility (like water and gas pipelines, electric power, etc.). Governments or their national carriers commission the passive fiber option infrastructure, and then lease the fiber capacity to the private sector ISPs (Internet Service Providers), which then provide digital access to the end-users using the fiber optic network capacity.

- One of the best-known models, called "Stokab", originated in Sweden, a country that ranks first in the Network Readiness Index. Stokab, the cities own underground passive fiber networks.Fiber optic capacity is leased to the ISPs, who compete with each other in service provision. The Stokab model and its variations are used in several European countries. Several Stockholm-based tech companies, such as Skype, Spotify and Transmode, have gone on to become big players in their industries. For our smaller cities and rural towns, we could follow a similar approach to the Swedish Stokab. The ownership of the passive fiber networks in these cities could lie with the city (or provincial) government. The city or provincial governments could hire technical assistance of PTA-licensed telecom infrastructure providers (TIPs) to install and manage the fiber optic network on their behalf.

- If the Stokab model is adopted, private sector ISPs will not have to invest in fiber optic networks installation and will consequentially be able to provide lower cost services, which in turn will decrease the financial access barrier to internet services for a significant portion of our population. Low barrier to entry in the ISP sector will allow small new entrants into the market and the sector will have to compete on price and quality of service. Furthermore, cities and citizens will be saved from repeated road diggings for lying of fiber optic cables.

- Subsidized optic fiber connectivity to all unserved Union Councils (UCs), in a phased manner, connecting inter-alia towers of mobile broadband, rural schools, local government offices, health-care centers, Wi-Fi hotspots in the UCs.

- This challenge of wide ranging and far reaching fiber optic network deployment across Pakistan is something that cannot be met by the ICT industry alone. Close cooperation between Federal and Provincial Governments and the industry will be required to address significant issues that are obstacles in this sector. Federal subsidies, telecom tax breaks and policy initiatives will also be needed to make broadband projects attractive, feasible and sustainable.

- The increasing number of external fiber connections will help minimize disruptions in Internet connectivity and help deal with its impact on Pakistan's businesses, industry and security.

- The government should target to ensure connectivity to all uncovered areas, establish a national digital grid (e.g. under a new National Fiber Authority) providing universal broadband connectivity at 50Mbps to every citizen by 2025.

- Promoting collaboration models involving state, local bodies and private sector is necessary for provision of shared duct infrastructure in municipalities, rural areas and national highways.

- Building a fiber-to-the-tower program to enable optic fiber connectivity of at least 60% of telecom towers thereby, accelerating migration to 4G/5G.

- Extending incentives and exemptions for the construction of telecom towers and optic fiber connectivity.

- Encourage and facilitate sharing of active infrastructure by enhancing the scope of

Infrastructure Providers (IP) and promoting and incentivizing deployment of common sharable, passive as well as the active infrastructure.

b. Right of Ways

Right of Way (RoW) is "the legal right, established by usage or grant, to pass along a specific route through grounds or property belonging to another", or "a path or thoroughfare subject to such a right". The ICT industry faces a multitude of problems with respect to acquiring right of way for deploying fiber optic infrastructure.

Challenges

- Pakistan lacks effective tariff and policy controls on Right of Ways for laying fiber infrastructure. Service Providers have to negotiate with each city, jurisdiction, NHA, township that fall in the proposed fiber path. In addition to the delay and effort involved in the separate negotiations with each of such entities, fiber laying projects are severely impacted by the fact that there are no established market rates or upper bounds – allowing these entities to demand any rate from the service providers for acquiring the right of way. These authorities/entities could be Pakistan Railways, national/provincial highways, city development (like CDA), housing development (like DHAs), municipalities, cantonments, tehsils, etc.

- There are no uniform procedures for acquiring right of way (RoW), even in municipalities within the same province or district. If an investor has obtained RoW for the entire city, he still needs to get separate RoWs for any railway or highway crossings that come in the way. Some places are subject to multiple jurisdictions (e.g. a road along a canal is claimed by the city as well as by the Irrigation Department), therefore different rules apply.

- RoW charges are high but offer nothing in return except for permission to work i.e. intended as a pure rent-seeking enterprise. Other than official RoW charges, there are also unofficial charges, payable to public as well as private stakeholders. Otherwise, anyone (including wayside shop-owners) could stop the work midway.

Recommendations

- A national tariff control policy on Right of Way is a necessity for quicker development of ICT infrastructure, and thus services in the country. A number of countries in our region already have a National Right of Way policy. We must recognize fiber connections as a public utility conduit without which we cannot lay the foundation for a modern ICT infrastructure. Without such a policy, fiber projects will continue to be expensive and take much longer time to complete.

- The Government should constitute a consultancy committee, which shall study the best international practices and prepare the legal framework on RoW. This may include suggesting an independent corporate body to deal with RoW issues in Pakistan, an Authority or a Commission fully empowered and responsible for RoW in accordance with the laws, rules, and regulations in Pakistan.

- Create a Broadband Readiness Index for cities/Tehsils to attract investments and address RoW challenges.

c. High Taxes

Despite incentives the taxes on the sector are very high, which ultimately increase the overall cost of the services.

Recommendations

- For the Telecom sector to flourish, the heavy taxation levied on the sector needs to be eased. A number of countries globally have started 5G trials, with commercial deployments starting from 2019. A favorable tax treatment to incentivize investments in 5G infrastructure equipment and associated services can be offered conditionally to technology transfer.

- Encouraging investment in broadband infrastructure through fiscal incentives, including accelerated depreciation and tax incentives; and incentivizing fixed line broadband.

d. Cost of Bandwidth

Internet Service Providers Association of Pakistan (ISPAK), established in 1997, claims that the country has an Internet bandwidth capacity of more than 2500 Gbps with an installed bandwidth capacity of almost 3 terabits per second (Tbps) and loading capacity is at 2 Tbps from two authorized capacity suppliers; Pakistan Telecommunication Company Limited (PTCL) and Transworld with five undersea cables connecting the country to the world and four companies providing the domestic fiber backbones.

Challenges

- Bandwidth Tariffs are un-regulated. They should be regulated by PTA. PTCL's IPLC (International Private Leased Circuit) tariffs are not competitive when compared with regional countries.

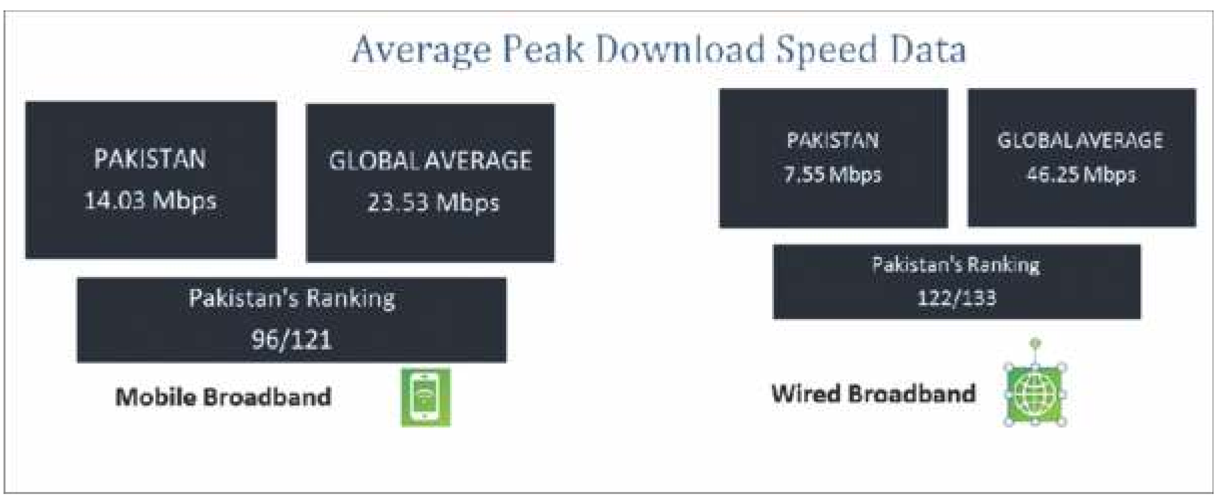
- Multiples of higher capacities of IPLC are inconsistent with international standards.

- Tariffs for higher capacities i.e. DS-3 & STM-1 are much higher when compared with regional countries.

- Charges of IP and IPLC are exorbitant as compared to Philippines, Argentina and India.

Recommendations

- Regulatory bodies throughout the world issue consultation papers for soliciting opinion of stakeholders before issuing final orders. PTA also followed the same practice. Industries demand a more transparent and inclusive consultation process. Every consultation of regulatory bodies with the industries should be made transparent and



easily accessible for public consumption.

- Improve international connectivity and reduce the cost of international bandwidth by facilitating setting up of International Cable Landing Stations, by rationalizing access charges, removing regulatory hurdles and by benchmarking the cost and quality of international bandwidth to global trends.

e. Rising Gender Gap

Challenge

A report by Bytes for All states, that only 21% of males and 12% of females in Pakistan are online with an equal disparity among those that use mobile phones. This is almost at par with recent global figures that suggest that more than 300 million fewer women access the Internet on a mobile device than men, and women are 8% less likely than men to own a mobile phone. This poses a major challenge towards Internet adoption in general.

Recommendations

- Raise awareness, and empower and encourage girls and young women to consider studies and careers in ICT.

- Governments should equip and prioritize education in ICT subjects.

f. Power in the ICT Sector

People tend to associate energy issues only with the energy used for transport, distribution and manufacturing. However, energy consumption related to ICT Sector is now attracting global attention. According to the World Bank, in its first comprehensive stock-taking of infrastructure services in Asia, that electricity access in Pakistan is in line with regional averages of 92.5%, the average interruption duration and frequency values are much higher. The average shortfall in the power sector is 4,000 megawatts (MW), and nearly two billion cubic feet per day (BCFD) in the natural gas sector. The shortfall in the power sector can rise to around 7,000MW or 32% of total demand for electricity. This has severely impacted the country's economy, especially sectors like the ICT.

Challenges

- Power outages have caused the losses of billions to the economy. While all sectors have been severely hit by the power outage, total industrial output loss is estimated to be at around 12-37%.

- Disruption in the supply of electricity lessens business sustainability, especially in the always-online IT and IT enabled Services sectors.

- The increased power generation costs, coupled with the high proportion of line losses, have led to very high electricity tariffs. The high cost of energy adds to the cost of doing business, making it difficult for start-ups to manage resources and establish business to sustain growth.

Recommendations

- The government should define ICT Industrial Zones/Special Technology Zones (STZ) and start-ups should be facilitated to set up their businesses in STZs. In these zones, an uninterrupted supply of energy should be ensured and subsidies on power should be provided to the ICT sector. The requirement for STZs in the ICT sector does not entirely relate to that of special industrial zones in the manufacturing sector. The primary drivers for STZs include alleviating the IT companies

from the burden to compete for limited and expensive office space in urban areas, traffic congestion, expensive utilities, competing for internet bandwidth from a limited capacity pool, and related factors that impact long terms business feasibility.

- Tariff differential subsidies should be phased out over the program period (i.e. three years) and tariffs should be brought to cost recovery levels. The country should develop indigenous industrial resources.

- Promoting and incentivizing deployment of solar and green energy for telecom towers.

- For any meaningful growth in ICT sector, Data Centers act as this sector's 'Center of Gravity'. In prevalent times, cost of energy to run and manage Data Centers is significantly high due to expensive commercial grid rates. Policy of Energy Wheeling via Solar Parks should be actively allowed to offset expensive grid energy via renewables. Doing so will not only reduce operational expenses and encourage clusters of data centers, but also improve national energy mix.

- Rationalizing of taxes and levies on the manufacture, production and import of such equipment for digital communication technologies.

Expected Impact of the Connectivity Development

ICT Infrastructure is the spine of the IT industry, and an exponential growth of the sector will require special attention to the infrastructure.

- Increase in internet penetration will lead to increased adoption and promotion of ICT.

- Simplifying RoW laws will lead to harmonized tariff and Policy Controls.

Energy Wheeling will result in Private Sector Investment and Networks of Data Centers.

PART IV

PROMOTION AND DEVELOPMENT OF ICT INDUSTRY

Promotion and Development of ICT Industry

General

Role of IT and telecommunication is vital in the development and economic growth of Pakistan. The ICT industry in Pakistan has been growing for the past 10-12 years in terms of its contribution to the economy, however it is severely constrained and underperforming with respect to the sector's achievable potential and in comparison, to regional players. This part will therefore focus on key areas which include: -

- IT Market Development & Support
- IT and Telecom Manufacturing, Convergence, Research and 0evelopment and De-regulation
- Software Exports and E-Commerce
- Incentivizing IT Investment and Technology Enabled Service Businesses

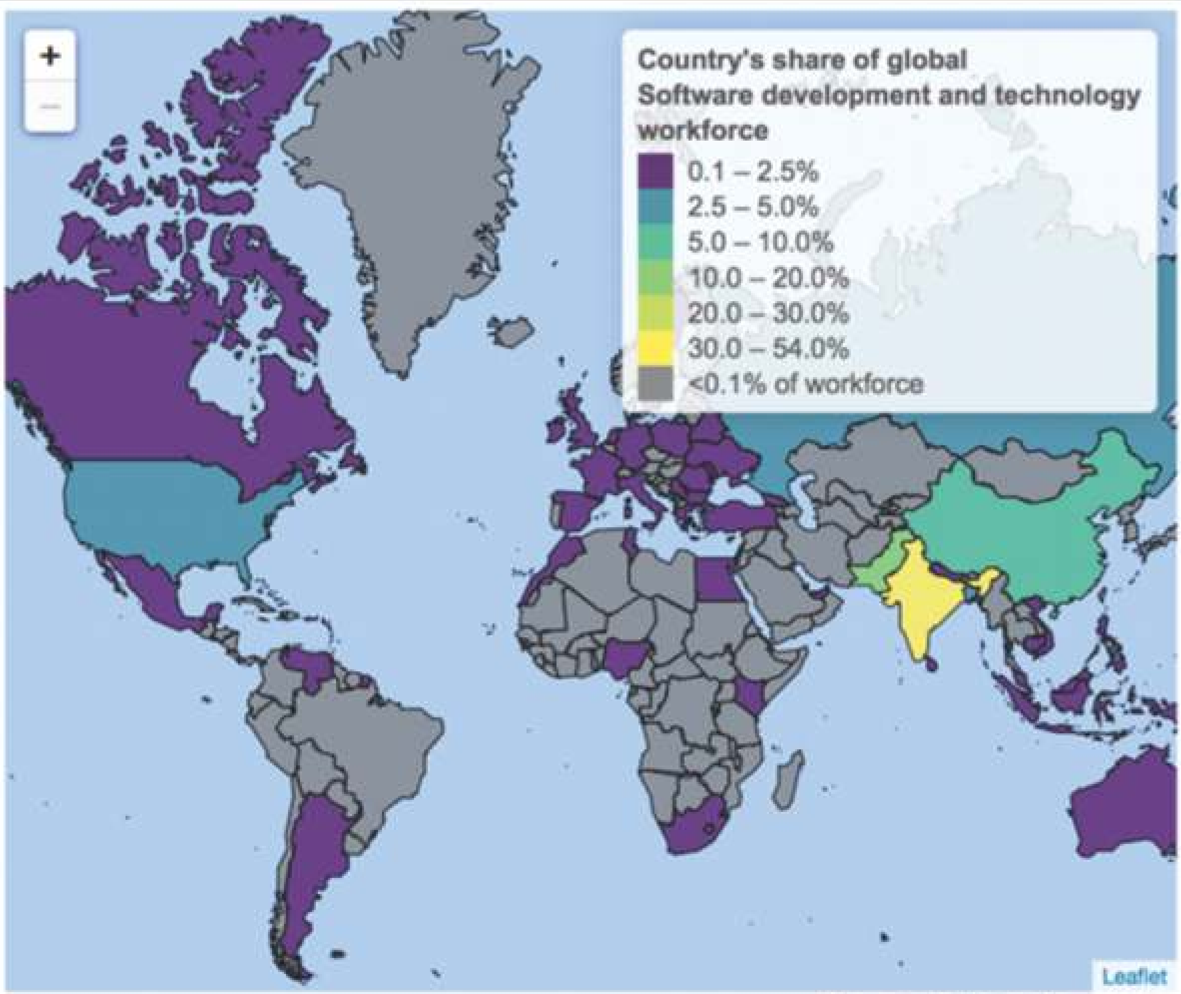
a. IT Market Development and Support

Pakistan's technology industry is shaping up. The country produces 25,000+ IT graduates each year, offers a domestic market of over 200 million USD, and has churned over 4,000 tech start-ups since 2010, of which close to 70% are still operational. The industry has the ability to provide a fundamental boost to the country's economy, especially in this time of fiscal restraint. Fresh university graduates and young entrepreneurs are gearing up to realize the next billion-dollar idea, and this conception is not far-fetched. A group of young Estonians developed Skype in 2003 which was eventually sold to Microsoft for US$8.5 billion in an all cash deal. In fact, all tech giants across the world today have had humble beginnings. WhatsApp was sold to Facebook for $19 billion, almost three times Pakistan's defense budget. Such is the scope and potential of this sector. With latest technology and access to faster internet, the tech industry is producing services and products, across sectors that are increasingly more dynamic and revolutionary. The industry's access to seed, private equity and venture capital funds is also improving, albeit with regulatory challenges that needs to be addressed immediately.

Patari, an online streaming application and a household name for music lovers in Pakistan, made headlines when it secured $200k in seed money in 2017. In 2015, Eatoye, a Pakistani online food delivery service, was acquired by one of the world's largest food portals (Food Panda) and continues to expand across Pakistan. More recently, Airlift nabbed $12 million in Pakistan's largest Series of funding. It is a ride-hailing startup which connects passengers with buses on a fixed-rate, operating in Pakistan's largest cities. These prominent app-based startups and many more cater to the domestic market, are part of the local economy and form an important element of the tech ecosystem. There is another major component of this sector which caters to the international market (through software development and business process outsourcing) and is deeply embedded into the global value chain. Rising exports and domestic success stories show the immense potential of this sector. Two fundamental constraints are limiting this potential; (i) low overall productivity and restricted supply of skilled labor in the ICT sector and (ii) lack of a supportive IT ecosystem.

Challenges

- The tech industry is highly skilled and knowledge intensive. It may be able to withstand disruptive energy supply, but it will



Source: Online Labour Index

not flourish without an adequate supply of skilled labor. Official statistics confirm that at least 10,000 IT graduates enter Pakistan's workforce each year. At the same time, Pakistan also ranks much better in cost than lower-middle-income countries group. The average annual cost of a software engineer in Pakistan is one fifth of the cost in USA and Europe. However, of the total graduates, just under a thousand graduates are products of Tier 1 universities and of these around half meet the skills requirement for specialized input needed by the industry.

- The tech industry relies on skills broadly of two kinds – technical / specialized skills to develop and design IT products and skills to develop innovative business models and marketing strategies. One without the other will continue to constrain Pakistan's access to a market for high value products.

- The academic path to becoming an IT professional is not well defined; though there are degrees that qualify graduates as IT graduates, the career pathways within the IT sector are numerous and our degrees do not prepare students for those pathways adequately. Product development relies on a workforce with more refined skill set, based on knowledge about product design, technology and marketing. Pakistan is not able to develop a niche in gaming (which is 80% of the revenue of Google and Apple Store) because its workforce lacks knowledge about game development and design.

- Moreover, it needs creative minds that are able to come up with innovative solutions to problems put forward by international clients. Basic software development only requires writing codes towards an end-goal already defined by the client and therefore, does not enable/require the workforce to become creative.

- Most companies of Pakistan cannot afford international sales cost. Medium-sized companies do not even have the training for international tenders.

- ICT sector has the largest number of job vacancies, although there are many job seekers in country but turnover of job in ICT is highest among other sectors.

- The country also lacks creativity in developing innovative business models, regardless of how technically sound a product is. Developing scalable business models is a first crucial step towards attracting large sums of money or venture capital funds.

- Government does not advertise digital marketing opportunities through PPRA website. Government's social media/digital advertising is not open to competitive bidding.

- The challenges in supply deter growth of IT companies and thus they have to struggle with numerous problems to achieve targets and win bigger projects. Lack of local projects for indigenous IT companies also constricts the market and creates a non-conducive environment for growth.

- The academic merit for enrollment into Software Engineering and Computer Science degrees is relatively lower at universities than other engineering disciplines; therefore, the intake of IT students at universities is also of a relatively lower standard. Due to lower merit, IT education is generally not a preferred choice of high achieving college graduates.

- The soft image of the country has been the most detrimental factor for the BPO and IT Call Centre businesses with respect to realizing business opportunities.

- Young Pakistani entrepreneurs struggle to develop their ideas from concept to products and services. At the same time, they are unaware of how to operate a business in the local market and how to attract foreign investors. Pakistan has a thriving freelance industry, which generally does not require a complete business ecosystem skillset. Globally it is ranked 3rd in terms of number of freelancers engaged in software development and technology. However, freelancing is a low hanging fruit with a limited growth potential.

- Lack of local language IT education facilities, books and digital material for skill development is also a major hindrance in progress of the IT sector, as it reduces the talent pool that could possibly enter the sector.

- Every year Pakistani universities produce a significant number of women graduates in IT with flying grades, but somehow their capabilities are not fully utilized in the IT workforce and their contributions are not reflected in IT industry due to social mindsets.

- Lack of affordable office space with quality infrastructure hinders the growth of IT companies and increases the cost of doing business.

- Hostile nations are actively and effectively using propaganda on a large scale to tarnish Pakistan's image globally. One such example is India's Srivastava Group, running a sophisticated network of 265 fake news websites out of 65 countries to disseminate propaganda against Pakistan. Pakistan on the other hand is neither countering such propaganda, nor exposing it, and also is not carrying out an effective and coordinated positive branding activities of its own.

Recommendations

- The role of the government should be to facilitate the promotion and growth of IT sector and not to regulate it. The red tape at Government level stifles the ability of the private sector to flourish. Thus, the govern-

ment needs to ease up controls on private sector and allow people to invest in Pakistan and grow. It is the job of the private sector to provide funding and commercial access. Focus on liberalizing the regulatory frameworks so the people from private sector come up and fulfill your needs.

- For the IT industry to grow, it is imperative that Government in general and the regulating bodies in particular understand the difference between industrial mindset and knowledge-economy mindset. There is a sheer need of a paradigm shift in the Government's approach, which must result in formation of favorable policies for the IT and ITeS sectors.

- International PR agencies should be hired by the Government for a comprehensive PR campaign to improve the country's soft image all over the world in respect to favorable IT investment and outsourcing opportunities. The government must focus on both, building a positive brand for Pakistan; and researching, exposing and countering anti-Pakistan propaganda being spread by adversaries.

- To protect the industry and employment it supports, the government must introduce business friendly policies and relaxed taxation.

- Support the creation of text to speech software for Urdu and regional/local languages that can be used to enhance the utility of basic mobile phone-based text messages as well as for normal computer usage.

- Pakistan must develop IT infrastructure, such as Special Technology Zones, ICT zones and Tech Parks for cluster-based IT ecosystem development.

b. IT & Telecom Manufacturing, Convergence, Research & Development and Deregulation

ICT plays a strong role not only in increasing productivity but also provides better living standard, rapid increase in supply, improved trade, advancement in infrastructure, low wastages of energy resources, minimizing cost, overcoming vicious circle of poverty, improving the quality of life etc. There is a pressure on developing countries to adopt appropriate technology which is based upon the need for providing employment according to the stage of development and within the prevailing economic policy framework of the country. Countries like USA, China, Malaysia and Japan have invested sufficiently in promoting emerging technologies over the past decade and are the ones that have developed successfully in this sector. India is also thriving in the technology industry and successfully established its version of Silicon Valley in Bangalore and provides special rebates and incentives, tax holidays and other facilities to their local industries related to technology. They have been striving hard for the last 20 years and invested in this sector of economy through R&D activities. In comparison, Pakistan is lagging behind in terms of investment and facilitation for the technology industry.

Serious prioritization by the government is needed to scale up new technologies.

Challenges

- Broadband penetration in Pakistan has increased in recent years but still, a large portion of the population is deprived of internet services, especially in remote and rural areas of Pakistan.
- Pakistan has only 13 technology parks and a few incubators. Even those that are available lack funding and adequate infrastructure. Furthermore, there is a dire need to develop forward and reverse linkages of the incubators with industry.
- There is a lack of a digital ecosystem and a data-oriented mindset, leading to dated practices, inefficiencies and missed capitalization on generation and utilization of data across sectors.
- Research and Development have been low priority areas in Pakistan, in both public and private sectors.
- Lack of timeliness in adopting next generation technology.
- Aversion to adoption and frequent banning of new technologies for fear of security concerns.

Recommendations

- Digitalization of governance and automation of public sector business processes to develop a digital ecosystem.
- Establish Pakistan's sovereign ownership over the data generated in Pakistan.
- Create of a legal and technological framework to put a statutory bar on cross border flow of data generated in Pakistan by internet users and from digital devices (e.g. IoT installed in public spaces).
- Allow the data collected by digital devices (IoT) to be used by local companies, agencies, institutions and non-profits for research and development, by establishing an open data portal/repository.
- Restrict transfer of data collected and processed in Pakistan for commercial use, to any third party outside Pakistan. Data required to be disclosed to government of another country shall be disclosed subject to prior permission of the Government of Pakistan.
- Make it mandatory to disclose data generated in Pakistan, but stored in another jurisdiction, as and when required by the Government of Pakistan.
- Allow sharing of community data with startups, especially social and creative enterprises for ventures initiated in public interest.
- Ensure availability of Internet access across Pakistan through effective implementation of 2015 Telecom Policy.
- Concerned ministries and departments must regulate decisions and policies that have a longer lifespan than the technology change curve for better governance.
- Ministries must initiate the regulation of ICT through natural capacity building for higher velocity and gauged IT experts working abroad for enhancing higher HR-led quality exports.
- Develop IT-led ecosystem in Pakistan through long term learning lifecycles that has to be more informed and inter-connected.
- A recommendation to improve the poor-quality internet service is by reducing barriers

to entry for as many ISPs to enter the market and let competition drive up the quality and lower prices. It is further recommended to Government to remove taxes on ISPs.

- Ensure timely adoption of 5G technologies by incentivizing investment in this sector, and avoid relatively delayed rollout as was the case with 3G and 4G in Pakistan.
- Timely capitalization of IoT by expediting frequency allocation.
- Adopt the European and American model of free IoT frequency to open up the market for IoT based solutions across industries.
- End the practice of restricting / banning new technology for fear of security implications, and focus on educating themselves on relevant security measures and safe / controlled adoption.

c. Software Export

General

The exports of IT and IT-related services increased to $1.090 billion in the financial year 2018-19 as compared to $1.065 billion recorded in the financial year 2017-18, showing a modest growth of 2.44%, according to data released by the State Bank of Pakistan. This is the third consecutive record of the IT industry for attaining an all-time high. The country also achieved the highest value of IT remittances during the financial year 2018-19. The value of IT exports is three times higher than the remittances reported by the central bank, which means the overall number crossed $3 billion in the financial year 2019. As for the sector's composition, export revenues of 35% or nearly $355 million of the total 3,228 ICT exporting entities came from computer software, including software consultancy services. Whereas, the rest had either

limited or no product orientation, as they generated revenues only from low value-added services (e.g. call centers), according to a study of SBP in 2019.

According to the industry experts, the dominance of low value-added services is not favorable for the country on a sustainable basis, particularly from foreign exchange generation point of view. The average receipts from software exports including software consultancy were more than double the average receipts from other ICT exports. Therefore, it is not surprising to see that only 56 firms had exports of $2 million and above on an annual basis, as an overwhelming majority of firms could not even fetch US$ 0.1 million receipts during the financial year. The majority of the IT-based exports are to the US market (60%). It is followed by European countries with a total of 38% share, and exports to the Middle Eastern countries stand at number three.

The Breakup of IT industry Exports of Services and Products

Heads of IT Exports	Financial Year 2017-18	Financial Year 2018-19
Call Center	$103.980 million	$107. 315 million
Telecommunication Services	$229.980 million	$186.355 million
Hardware Consultancy	$4.171 million	$2.366 million
Software Consultancy	$287.701 million	$355.945 million
Computer Repair/Maintenance	$1.761 million	$ 6.038 million
Export of Computer Software	$321.968 million	$277.512 million
News Agency Services	$1.023 million	$1.011 million
Information Services	$2.120 million	$2.380 million
Other Computer Services	$114.289 million	$152.179 million

According to the Pakistan Software Export Board, there are more than 3000 active IT/ITeS companies, which possess expertise in custom software development, enterprise resource planning (ERP), financial solutions, mobile content, document management, enterprise computing, and business process outsourcing (BPO).

Financial Year	Exports Value	Yearly Growth
2018-19	$ 1091 million	2.4%
2017-18	$ 1063 million	13%
2016-17	$ 938 million	19%
2015-16	$ 788 million	-0.4%
2014-15	$ 821 million	0.60 %
2013-14	$ 816 million	1.70 %
2012-13	$ 802 million	74.4 %
2011-12	$ 460 million	3.87 %
2010-11	$ 443 million	-0.05 %
2009-10	$ 443 million	16.6 %

Challenges

Although the potential is immense, more needs to be done and there is an immediate requirement for local companies to increase their capacity through collaboration and integration to develop core strengths at a national level.

Recommendations

- Events like ITCN Asia could prove to be a catalyst. There is a dire need for events that can steer intellectual discussions and help bring the entire ecosystem under one roof.
- Ease of doing business should be the top priority for the Government through policy making and relevant legislation.
- Sales tax waiver on local software products to promote local products/IP development and innovation.
- Creation of online complaint/support cell at relevant ministries, departments catering to the needs of the IT industry.

- PSEB should launch a program to subsidize companies directly for their participation in any events in their pre-approved list. For example, the subsidy could be 70% of the total cost and maybe capped at 10% of total reported exports earnings of the company.

d. Incentivizing IT Investment and Technology Enabled Businesses

Ease and Cost of Doing Business in ICT Domestic Market. (Annex K) Innovation is a major driver of economic transformation and development. Enabling and fostering innovation has long been considered a core strategic goal of economic policy in more advanced economies, and is receiving increasing attention in most developing countries. Startups are the building blocks of the knowledge economy. Pakistan has recently established some incubators across the major cities in the country, but tangible and economic contributions for these incubators will take time to materialize. Pakistan, home to more than 200 million people, is one of the fastest growing economies in Asia. As the country continues to develop, an additional 2.1 million middle-income households are expected to be established by 2025. Connectivity is also increasing with the number of 3G/4G subscribers rising four-fold in the last three years and demand for digital services clearly expanding the country's E-Commerce market is upbeat. Consequently, startup activity has surged as businesses emerge to satisfy unmet demand across the country. Many E-Commerce startups have come up over the years in Pakistan, disrupting the status quo, thanks to tech incubators across Pakistan such as the Nest I/O and IBA CED. However, what is lacking is a startup that increases E-Commerce exports. The government should create a tech incubator that solely focuses on creating cross-border E-

Commerce startups. There is a dire need for Pakistani venture capitalists and angel investors to invest in these cross-border E-Commerce exporting startups. Pakistan is cited as one of the top destinations for outsourcing business, but the country has not been able to attract foreign investors.

Challenges

- Entrepreneurial activities are on the rise in Pakistan, with an increasing trend in new organizations, funds and initiatives supporting entrepreneurs. The fundamental problem for the enabling environment is lack of successful exits, local investors not ready to exit and foreign investors are also not willing to come in.

- Due to a complex mix of image, legal, commercial and IP related issues, companies set up their primary offices offshore and undertake operational business activities in Pakistan.

- Companies usually face problems with visa applications, processes and approvals. Pakistani passport seriously limits the ability of management personnel to travel internationally.

- Internet black-out, partial application level restrictions and access blockage under security pretexts.

- There is a lack of an efficient taxation process which increases the time and resources spent by entrepreneurs and investors in undertaking non-core activities. Easy implementation of laws and ordinances is required (e.g. those related to cash reward/bonuses, foreign currency repatriation, and payroll taxes etc.)

- Taxation for IT business is different from province to province, and some taxes are levied both at Federal and Provincial level. Each province has its own revenue authority that administers sales tax on services and other provincial duties. The recent federal tax exemption for tech start-ups is only applicable at the federal level, many perceived it as an all-round exception.

- Start-ups are currently taxed on revenue rather than profits, which create a common misconception that start-ups do not qualify for corporate income tax because they are not profitable up until a certain point in their lifecycle.

- While Pakistan's digital start-up landscape has grown significantly in the recent years, the ecosystem has its share of challenges, particularly when it comes to regulations and access to early-stage capital.

- **Comparison with the Neighbors.** Over the past five years, (2015-19), there were a total of 101 venture capital deals of Pakistan-based companies' worth over $165 million which were raised by 82 companies. While this is encouraging, Pakistan still has a long way to go compared to its neighbors in South Asia. Based on a score given to the number of venture capital deals per year in 2019, Pakistan ranked 72, which was behind India (30) and Sri Lanka (45) but was higher than Bangladesh (73). While local venture capital funds are not incentivized to invest their funds inside Pakistan, foreign investors also need incentives to enter and invest in start-ups in the country. This, in addition to the stringency and complexity of the regulatory processes, poses a serious challenge to all stakeholders in the ecosystem.

- **Business Environment Needs to Be Improved.** Local venture capital funds are not incentivized to domicile their funds inside Pakistan. Foreign investors also need to be provided with further incentives to enter and invest in start-ups in the country. This, in addition to the stringency and complexity of the regulatory processes, poses a serious challenge to all stakeholders in the ecosystem. The result is a lack of access to capital for innovators and entrepreneurs.

- There is a critical lack of legal support, with respect to commercial, international and corporate law, available to local IT companies.
- At the procedural level, there is little in terms of automation of business processes and mostly business-related procedures are performed manually, which increase uncertainty in trade and investment operations.
- Government projects are mostly undertaken by government owned organizations or otherwise outsourced to the international companies. Local ecosystem is not trusted with large-scale projects, hence limiting their growth prospects.
- Government organizations such as the PRAL, Ufone etc. tend to compete with private IT companies in a bid to show self-reliance. Such a competition is really unfair and detrimental for private businesses. Public sector entities should be prohibited from bidding for private sector ICT projects.
- 3D printing technology has revolutionized global Product development industry. 3D printing is the future of Manufacturing Industry. It encompasses the industries like Medical, Bio-Technology, Sports, Jewelry, Auto parts, Aircraft, Dental, Industrial, Medicine, Architecture, Construction, Tool making, Arts and Education of aforementioned technologies. Unfortunately, in Pakistan, 3D printing technology has, since year 2013, been discouraged at the Government Policy level.
- In Pakistan, importing, selling and using a 3D Printer require NOC from Ministry of the Interior, Islamabad and Security Agencies. However, the NOC applications are almost always rejected.
- Our Defence Production industry and its vendors are also not exempted. The restriction on using 3D Printers is against the Progressive policy of the Government.

Recommendations

- Despite improvements on Ease of Doing Business (EODB) index, massive, costly and time-consuming business regulations at the federal, provincial and local level still appear to be the major stumbling block in the way of attracting the foreign direct investment (FDIs) and businesses to flourish. To achieve the substantial FDI inflows and helps thrive the businesses, especially the small enterprises, the government needs to rationalize the excessive business regulations.
- PSEB should invite and host international speakers/presenters for visit on different occasions, with focus on advising the local industry in increasing their share in the global IT export market. Also, it should organize events of international scope in which foreign companies can participate. This will lead to better country image, increased exports and more foreign investments in the country.
- Development of an online portal where the government should ensure the provision of inventory of all the regulations and laws at one place (sector wise), which can be easily accessible to businesses and investors.
- In consultation with stakeholders, the government should validate the relevance and

usefulness of all business regulation and eliminate unnecessary regulations, documentation and compliance requirements.

- There is a need to automate the compliance with business regulation and ensuring e-payments of all relevant charges.

- Need for research at sector level and what difficulties each sector faces in registration and licensing, and operations at provincial and local levels.

- Government should establish a venture capital firm to support, incubate, accelerate and fund start-ups and accelerate the mushrooming growth of big start-ups.

- Exemption, full or partial, from various taxes (WHT, GST, Corporate Income Tax, E-Commerce or Digital taxes) for a period of 5 years to provide an initial launch pad to the IT sector led economy expansion drive.

- Exemption of payroll taxes for employees who are working at a startup for a period of 3-5 years.

- Easier process by SECP for startups to offer stock options to employees.

- Exemption for startups from various regulatory compliances and audits for an initial period of 3 years – this would include Labor Department, EOBI, FBR, Social Security etc. with an additional 2-year exemption following a simple self-declaration or until the startup size grows to 30+ employees.

- Reduced Capital Gains tax from the proceeds of investments made in startups.

- Remove barriers to entry for venture capitals and angel investors.

- Tax exemption for angels and investors on funds dedicated for investment in startups either through incubators, accelerators or through venture and angel funds.

- Government should launch a credit guarantee scheme for startups, for collateral-free, fund and non-fund-based credit support for at least 10,000 startups in 5 years.

- Private sector should be encouraged to set up corporate incubators like HBL and UBL have set up innovation labs. Similarly, all telecom operators and Chambers of Commerce can do so as well.

- Government should set up a separate fund or leverage Ignite's fund for seed money to be given to incubators for investing in startups, partners like WB, DFID, SiDA or others can come on board to create multi donor fund as well. This fund should also help startups to file for international patents where the Government bears the cost for such IP filing.

- Policy of obtaining NOC for Import and sale of 3D Printer of any kind from The Ministry of Interior may be reconsidered and abolished.

- Instead of restricting import and sale of 3D printers, policy should be made to "Obtain NOC for making 3D Printed Firearm". (This is in vogue in many countries)

- 3D printing techniques be included in the syllabi of Middle to High Schools all over Pakistan. This will result in upbringing of better Engineers and Designers of future.

Inefficient Allocation of Resources / Domestic Spending for ICT Sector

Challenges

- Access to funding is a significant bottleneck. There is only \$0.06 per capita of venture capital money in Pakistan per year, while Bangladesh has \$0.07, Nigeria \$0.18 and India \$3. In 2017, only nine Pakistani startups received venture capital funding compared to 34 in Nigeria, 38 in the UAE and approximately 790 in India. Overall, Pakistan's tech startups raised under \$30 million in 2018 compared to countries such as Indonesia

(excluding unicorns) raised over $274 million in 2018.

- Regulations make it cumbersome to set up a fund inside Pakistan.
- Regulations make it hard to take invested money or profits out of the country.
- Global venture capital investors find the process of investing, having shares issued and registered riddled with red tape. Approvals are required from various government departments such as the Securities and Exchange Commission of Pakistan, Competition Commission of Pakistan and State Bank. This would put off anyone who has the option to invest elsewhere in the world. Due to over-regulation, investment funds choose to operate from outside of Pakistan.
- Foreign payments are heavily regulated and offered at unfavorable exchange rates. Pakistani startups prefer to route foreign funding using alternative means (such as register the company abroad) or keep the funds overseas.
- Lack of recognized international payment gateways especially impacts smaller businesses as larger players rely on banking channels for their transactions. Absence of recognized payment gateways such as PayPal also make it difficult for new clients to trust young entrepreneurs, whether individuals or companies.

Recommendations

- Steps to be taken by government departments for smooth approval of companies and ease of doing business in Pakistan to motivate start-ups.
- Initiatives by the Government to smooth the process of licensing of companies and tax regulations by FBR.
- The Digital Policy recently announced, must be supplemented with a plan of action, with short to medium to long term plans on how the core set of objectives can be achieved with assignment of responsibilities across various stakeholders.
- Initiatives for the promotion of incentivisation of tax payment must be strengthened.

Expected Impact of Development of ICT Industry

Overcoming the highlighted key challenges is imperative for a meaningful growth rate of Pakistan's ICT Industry.

- Establishment of Special Technology Zones will lead to private sector investments and encourage industry-academia collaboration.
- Digitalization of governance will increase efficiency, transparency and accountability, along with being corruption-resistant.
- Reduced barriers to entry for Venture Capitals and Angel Investors will increase FDI and facilitate the journey towards Pakistan-based Unicorns.

PART V

USE OF EMERGING ICT TOOLS IN SOCIO ECONOMIC SECTORS

Use of Emerging ICT Tools in Socio-Economic Sectors

General

ICTs are projected as dynamic solutions for socio-economic development and extensively utilized in the developed countries. ICTs are enabling pivotal transformations in Pakistan as well by becoming a key element in economic and social development. Modern ICTs enable socio-economic development through enhancing civic engagement, providing access to information, and knowledge in the development endeavors. This can help in boosting overall economic prospects by raising production and encouraging human capital development. Current political commitments also indicate that policymakers of Pakistan are realizing the potentials of ICTs and roles they play in advancing society. A strong desire for developing a vibrant ICT infrastructure to enable socio-economic development exists in Pakistan and in order to develop ICT-sensitive infrastructure and utilize it for advancing society, it is essential to have a set of policies and strategies that are socially rooted and contextually fit. In Pakistan ICT can contribute to income generation and poverty alleviation. It enables people and enterprises to capture economic

opportunities by increasing process efficiency, promoting participation in economic activities and networks, and creating more opportunities for employment and business.

a. E-Agriculture

Pakistan's agriculture accounts for about 19.5% the Gross Domestic Product (GDP) and employs about 43.5% of the labor force. Out of the 19.5% being contributed to the GDP, major crops contribute 26.19%, other crops 11.03%, livestock 58.33%, fisheries 2.12%, and forestry 2.33% to the agriculture's contribution to the GDP. Digitalization, automation and other IT led interventions provide many gains not within a given sector but across sectors and industries, in both social and economic aspects. Agriculture, being a key contributor to Pakistan's economy, has a lot to gain through sectoral digitalization and collaborations. ICT in Agriculture or Digital Agriculture focuses on the enhancement of agricultural and rural development through improved information and communication processes. Many ICT interventions have been developed and tested around the world, with varied degrees of success, to help agriculturists improve their livelihoods through increased agricultural productivity and incomes, and reduction in risks. Similarly, Pakistan is on the journey of digitalizing different aspects of sectoral value chains for delivering better services to the farmers and improving livelihoods.

Challenges

- **Water Wastages**. Water usage has been growing globally at more than twice the rate of population increase in last century, and an increasing number of regions are reaching the limit at which water services can be sustainably delivered, especially in arid regions according to UN Water Facts. On average, it takes one liter of water to satisfy one calorie consumption of food by a single human over one day. Pakistan, as an agrarian economy with more than 42.5% national workforce employed in the sector, has its water resources under tremendous stress and is on verge of becoming a water scarce country with accelerated depletion of ground water because of prevalent irrigation practices. More than 90% ground water resource is used for irrigation purpose in Pakistan. There is a very high dependency on groundwater to meet irrigation demands yet it is managed very poorly leading to extreme groundwater depletion in Pakistan.

- **Eco-system.** Currently, the agriculture sector landscape requires a change in mindset for both policy development and implementation. The governmental app-0roach doesn't fully utilize the potential of public private partnerships and the benefits of capacity building. The private companies haven't been able to fully lend their core competencies and agility to help support the public sector in the execution and scalability of different projects.

- **Lack of Efficient Farm Practices.** There is a lack of emphasis on high value agriculture and efficient farming techniques. The sector lacks focus on improving the profitability/yield for the farmer and changing the perception of the farmer for the role of various stake-

holders. Technologies such as IoT enabled groundwater / soil moisture / soil pH sensors, automated water pumping techniques, data analytics driven farming decision support systems are not being employed at scale in Pakistan's agriculture sector.

- **Farm Management.** Farm management and water wastages are a critical challenge for farmers. On average, it is estimated that 35% irrigation water is wasted. Poor water-use efficiency is primarily due to utilization of obsolete techniques like flood irrigation, which not only create waste but are unsuitable for various type of crops. Pakistan is becoming water scarce because of water wastage.

- **Failure to Ensure Scalability of Projects.** More than 60% of agriculture land is under the ownership of small-scale farmers. This is one of the reasons that developmental and yield improvement projects in this sector do not scale well, and remain just pilot projects, even if done under public private partnerships. Small-farmers require assistance in access to right technologies, advisories, capital support and government subsidiaries to experiment adoption of new ways to crop.

- **Lack of Database / Centralized System.** There is a lack of the connected systems where the farmers' profiles (through BISP/NRSP access) can be used for identification, provide input on soil fertility, scale of the owned land, and deliver climate data information. There is currently an information gap as farmers cannot be identified through digital means which leads to losing out on capturing the bigger picture. Geospatial imagery can help plan cropping zone better and aid educated estimations of total national production.

- **Inadequate Access to the Inputs and Marketplace.** Pakistan loses on selling to export markets due to the lack of the proper grading, testing, and packaging while produce itself is of international market quality. Pakistan's agricultural produce is often re-packaged and re-branded by the third parties and exported to western markets. Other issues including warehousing, logistics, ensuring standardized outputs and selling those outputs to connected markets also need to be looked into.

- **Credit and Financing.** There is a huge challenge of credit and financing to small farmers. The ever-fluctuating market prices and unpredictable weather and seasonal natural catastrophes often hamper the overall productivity and yield. Furthermore, access to capital is one of the most pressing challenges farmers face when choosing to adopt new technologies. In order to aid local agri-tech startups, government needs to bridge the go-to-market for Precision Farming startups by subsidizing farmers for adoption.

- **Lack of Awareness and Digital Literacy.** There is very limited awareness of digital agriculture technologies and their benefits in our farmers. Other than a handful of large scale land owners, there is no utilization of modern farming techniques and tools in Pakistan.

Recommendations

- Met Department should improve the weather forecasting and reporting by utilizing AI, which will help the farmers predict crop sowing, watering, fertilizing cycles in order to increase yields.

- Agriculture sector should be educated, facilitated and incentivized to utilize the modern farming techniques that are technology and data driven e.g. to monitor and identify the possible defects and nutrient deficiencies in the soil.

- Local agri-tech startups working on Precision Farming, saving water wastages and increasing crop yield should be supported.

- Encourage the adoption of modern tools, techniques and technologies for farming such as AI and IoT. When sufficiently pervasive, the agriculture sector will be well placed to benefit from advanced technological facilities such as drip irrigation, vertical farming, and hydroponics.

- Manual irrigation should be gradually replaced by automatic irrigation schedule techniques to ensure optimal use of water resources in irrigation.

- Prepare latest agriculture education and R&D material in local languages in order to improve its utility.

- Address the issue of power distortion created by the middlemen (referred to as the "aarhti") for transparent and efficient marketplaces.

- Use of a mobile (and online) portals to bring together farmers and traders for the purposes of buying and selling goods, tendering for services and bartering at the national and/or provincial levels.

- Support farmers through the use of IT in relevant areas such as digital mapping, land use, soil types, meteorology, ecology, oceanography (particularly off-shore fisheries exploitation), hydrology, agricultural records etc.

b. E-Health

E-health is an established field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. Availability of E-health facilities brings about benefits in improving access to healthcare, reducing patient wait times, reducing medical and related costs, improving clinical outcomes and results in a relatively healthy population.

Challenges

Following challenges are being faced related to adoption of E-Health in Pakistan: -

- In Pakistan, health problems are rooted in poor infrastructure, financial, economic, and environmental conditions. Individuals avoid using state-provided medical facilities because of their "poor quality" and "unreliability." A survey of Pakistani government hospitals suggested that the behavior of hospital administration, the irresponsible attitudes of healthcare professionals (HCPs), and the illiteracy as well as poverty of citizens deters the Pakistani people from using state and public hospitals for treatment.

- Health information management systems are not deployed in hospitals across Pakistan.

- Patients' electronic medical records (EMR) are not being maintained; even if some hospitals utilize EMR systems, the records are not easily available for patients or owned by the patients.

- Connectivity infrastructure is not available at majority of the hospitals and health units for utilizing E-Health tools.

Recommendations

- Mandate all hospitals to maintain Electronic Medical Records (EMR) of the patients, which is beneficial to the medical practitioners in treatment of diseases, improving clinical outcomes and the population's health in general.

- Monitor and report on developments and trends in digital innovation for public health to inform policy and practice in the country.

- Establish cloud-based telehealth centers, providing timely and easy access to healthcare professional in rural and remote regions.

- Electronic health records across Pakistani hospitals should be interlinked via an Electronic Health Exchange, allowing the patients to make their records available to any health facility he or she visits.

- Government to formulate suitable guidelines and code of practice for E-Health standardization.

- Encourage R&D and adoption of AI for healthcare and enhancement of telehealth services to reduce costs and improve service quality.

c. E-Energy

Pakistan's energy sector remains one of the main obstacles to industrial and economic growth. Although Pakistan has managed to increase power generation consistently since 2013 and mitigate power blackouts that plagued the country over the previous decade, expensive fuel sources, a reliance on imported energy products, chronic natural gas and electricity shortages, major debt in the power sector, and aging and insufficient transmission and distribution systems have prevented the sector from growing and modernizing. Pakistan's energy future remains challenging. According to National Electric Power Regulatory Authority's

(NEPRA) 2019 yearly report, Pakistan's total installed power generation capacity is 39000 MW, of which 66% of energy comes from thermal (fossil fuels), 24% from hydro, and 6% from renewable (wind, solar and bagasse) and 4% from nuclear. In the current scenario, renewable energy (RE) resources can play an important role in closing the deficit. With current government's tilt towards renewable energy, Ministry of Energy is also working on the development of a new 25-year energy policy. The policy reportedly seeks to have 20-30 percent of all energy derived from renewable energy sources by 2030 and would wean Pakistan's dependence on imported fuel products.

Challenges

- **Alternate Energy Solutions.** The world is undergoing an energy transformation, from a system based on fossil fuels to a system based on renewable energy, in order to reduce global greenhouse gas emissions and avoid the most serious impacts of a changing climate. However, Pakistan lags in terms of energy production through alternate, non-fossil fuel sources.

- **Electricity theft.** Power theft is one of the most prevalent issues which not only cause economic losses but also the irregular supply of electricity. It hampers the functioning of industries and factories, and also causes a shortage of power supply to the residential sector. It also leads to significant loss of revenue to the Government Ultimately it is the country's economy that suffers along with the country's political reputation.

- **Distributed power generation from centralized systems.** The distributed generation refers to a variety of technologies that generate electricity at or near where it will be used, such as solar panels and combined heat and power. However, in Pakistan, power generation is not greatly decentralized yet.

Recommendations

- Ensure decentralization and digitalization of the power grid, centrally collecting, aggregat-

ing and analyzing power generation and utilization statistics for running an efficient grid infrastructure.

- Removing the bureaucratic stumbling blocks in enabling 'Wheeling' of electricity. Private sector is willing to invest in clean and cheap energy by erecting Solar PV or Wind Plants, these infrastructural investments can minimize national reliance on expensive sources of utility scale energy.
- Smart home/office solutions and smart meters already exist but not yet widely deployed. Encourage and facilitate adoption of smart metering.
- Improve demand predictions to manage electricity distribution and consumption efficiently.
- Subsidy should be given on solar panels installations and operations to encourage greater adoption.
- Energy utilization assessment should be mandated across all multi-story commercial buildings to assess the buildings' energy efficiency and help reduce energy costs and carbon footprint.
- Investment is also needed in technology and programs that allow energy generation closer to energy consumption areas, reducing line losses improving the overall efficiency of the national grid infrastructure.
- Removing barriers for the large scale renewables adoption by ICT Industry.

d. E-Commerce/E-Banking

E-Commerce enables undertaking commerce activities, especially business transactions, via the internet. Studies show that Micro Small and Medium Enterprises (MSMEs) that use E-Commerce platforms are around five times more likely to export than those in the traditional economy. The rapid growth of E-Commerce is not confined to the developed countries; the developing countries are catching up fast in this race. The South Asian region displays the highest rate of growth in the E-Commerce industry. E-Commerce enables more dynamic relationships between producers and consumers. It extends the addressable market for goods and services, particularly in countries where many still lack access to savings, credit and insurance products. The B2C Global Retail E-Commerce is growing; as of 2020, the Global E-Commerce sales amount to US $4+ trillion. Globally, it is 15% of the total retail market. With respect to E-Commerce's share in a country's total retail market, India's E-Commerce holds a 2.2% share, USA's 9%, and China's 23.1%, whereas Pakistan E-Commerce share is only 0.5% of the total retail market. We have a huge opportunity to tap this opportunity space and grow this percentage to at least 15%. Recent indicators within the Pakistan E-Commerce market are encouraging; the number of registered E-Commerce merchants has risen by 2.6 times and E-Commerce payments have surged 2.3 times in a span of just twelve months. E-Commerce businesses such as daraz.pk, pakwheels.com and others are already achieving significant business in Pakistan, indicating a positive trend for a growing E-Commerce sector of Pakistan.

There are different E-Commerce models like B2B Market Place (Alibaba); B2B Procurement (Khareed); B2C Marketplace (Daraz, Foodpanda); B2C Multi-Brand Marketplace (Home Shopping, Shop hive); DTC E-Commerce Stores (e.g. those based on fishry.com).Pakistan's industry is emerging rapidly and has the potential to strengthen country's economy by creating

more job opportunities, linking remote areas to mainstream, development of small and medium enterprises and finally enhancing exports through online platforms. It is noteworthy that last year, Pakistan's E-Commerce growth in different areas has on average doubled e.g. Food and Personal Care 119%, Fashion and Beauty 122%, Electronics and Physical Media 97%, Furniture and Appliances 98%, Toys, DIY and Hobbies 86%, Travel (including accommodation) 8.5%, Digital Music 30% and Video games 23%. However, there is still a significant growth opportunity in the E-Commerce sector.

Challenges

- **Lack of Awareness and Accessibility.** There still exists a digital divide between those who are aware of modern technological usage of the Internet and then those who are not literate enough to utilize it, especially facilities related to the E-Commerce. The Government needs to encourage the use of E-Commerce amongst general public through awareness campaigns to promote a culture of E-Commerce in the country which supports electronic business transactions at national, regional and international levels.

- **Legal and Regulatory Environment.** Pakistan's basic laws concerning Information Technology (IT) extend legal recognition to transactions carried out in the digital environment and electronic payments. However, generally E-Commerce is regulated under the statutes concerning traditional commerce. This gives rise to various concerns for the industry and the concerned authorities. For addressing these issues, it is necessary to take measures for allowing re-export/re-shipment of goods, launch National Single Window (NSW) for speedy processing of issues related to E-Commerce, especially for export of the large volume of low-cost goods/items. To cater for the possible impact of import of digital goods in Pakistan, infrastructure and technical capacity should be developed to enable the government to impose customs duties on such products on their import. At present, there is no separate mechanism/registry for E-Commerce businesses.

- **Consumer Protection**. Consumer protection is perceived to be weak in Pakistan, with an impression that end buyers may have little recourse available in case of payment disputes or instances requiring return of goods/services acquired via E-Commerce channel. In particular, consumers tend to be hesitant when transacting using online channels, as they worry that their personal information (such as credit card number, bank account number, address, etc.) may be leaked or misused by unauthorized persons.

- **Lack of Trust.** The absence of trust in online platforms and inadequate implementation of consumer protection laws pertaining to E-Commerce, amid an already low digital literacy environment, become a deterrent to the rapid digitization envisioned by the policymakers and industry players. The efficacy of the online payment system gets diminished as many banks do not by default allow debit cards to be used for online transactions. Either the customers have to contact bank's helpline to activate the debit cards for E-Commerce for a set timeframe, or the debit cards simply cannot be used to transact online.

- **Card-Not-Present (CNP) transactions.** 1Link has enabled its system to allow E-Commerce transactions and is inviting banks to integrate the same at their end. This would allow customers in Pakistan to execute E-Commerce transactions through PayPak Cards. However, the same would not be viable for cross border transactions.

- **Digital Merchant.** On-boarding is not being offered by any bank in Pakistan. Availability of merchant digital on-boarding by banks with simplified Know Your Customer (KYC) requirements would provide an enabling environment for providing cost effective services to the merchants.

- **High Cost of Doing Business.** For businesses, upfront costs for developing an adequately secure and reliable infrastructure for payment processing, negotiating contracts with banks/PSO/PSPs, and stringent KYC requirements of banks for merchant on boarding prove to be the major deterrents.

- **Logistics Infrastructure and Delivery Services.** Poor logistics have traditionally been major hurdle. Local courier services lack scale and penetration; while major international courier services such as FedEx and DHL are too costly to be used by internet retailers. There are no automated systems for transportation/delivery at local third-party logistics' end, which may give online stores accurate visibility. Some marketplaces and retailers face inventory challenges, which result in non-availability of stock ordered on the website. These and other related problems arise due to manual synchronization between manufacturers/suppliers and online marketplaces and retailers. A likely result of this is long delays in delivery or even cancellation of orders. This erodes consumer's trust and confidence which are the two fundamental factors necessary for growth of retail B2C model of E-Commerce.

- **Taxation Structure.** Taxation of online marketplaces has always been a contentious issue between E-Commerce players and the revenue authorities all over the world. In Pakistan, taxation structure related to E-Commerce businesses requires certain reforms in the form of harmonization in sales tax rates, avoidance of double taxation and simplified procedures in filing of tax returns.

- **International Payment Gateways.** Payment processors like VISA and MasterCard operate in Pakistan, which facilitate the merchants for E-Commerce transactions, both national as well as international. However, there are a number popular International Payment Gateways that do not operate for transactions and payment routing in Pakistan, owing to a number of regulators issues.

- **ICT and Telecommunication.** ICT Infrastructure plays a vital role in enabling E-Banking, but the limited proliferation of ICT infrastructure across Pakistan is hindering the pervasive spread and utilization of e-banking as compared to foreign countries.

- **Ease of Access.** In Pakistan, there are many banks that provide the services of e-banking but they have not designed their web portals according to the need and demand of customers. They always focus on their own demands while they are designing the website for the purpose of e-banking, which is difficult to understand and use by non-IT-tuned consumers. Furthermore, other than fraud related warnings, no bank's online banking portal or app has a complete Urdu language version, which severely puts a large portion of the population at a disadvantage when it comes to utilizing E-banking.

Recommendations

- Establish secure technical infrastructure and facilitate payment service providers to operate in Pakistan in order to progress in the E-Commerce business.

- Implementation of the Trade Facilitation Agreement and operationalization of the National Single Window shall ensure facilitation of E-Commerce through simplified I&E forms, de minimis and expedited ship-ment provisions.

- International best practices shall be continuously reviewed and followed regarding imposition of levies, customs duties and other taxes on e-goods and FBR (Customs) shall develop the necessary infrastructure and technical capabilities.

- Online/E-Commerce businesses should be registered with SECP, irrespective of legal nature of the business entity, i.e. to allow partnership firms and single member comp-

anies doing online businesses to get registered. SECP shall add a separate category of E-Commerce and simplify the registration process by making necessary amendments in the Companies Act, 2017 and relevant rules and regulation.

- ·For foreign E-Commerce businesses, instead of SECP registration, requirement of registration of business shall be deemed to the extent of only liaison/ branch office registered with Board of Investment.

- The Schedule II (Distribution of Business among the Divisions) of the Rules of Business 1973 shall be suitably amended to allocate the subject of E-Commerce to the Commerce Division. Wherever the word commerce is used, it shall be accompanied by E-Commerce too.

- Promote financial inclusion and digitization, Cash on Delivery mode of E-Commerce shall be gradually discouraged through special incentives for consumers and merchants with an objective to use digital devices for payments.

- Establish a national E-Commerce gateway with the State Bank of Pakistan (SBP) with the support and coordination of relevant stakeholders to promote internet merchant accounts to facilitate B2B and other in-bound transactions.

- Promote the IT enabled logistic systems of Logistic Operators, especially the operations of Pakistan Post.

- Align SME policy in line with the growing opportunities in E-Commerce. Initiate Pak e-SME program to identify train, enable and connect 50,000 e-SMEs of remote areas of Pakistan to online market places for promoting E-Commerce.

- Creation of an E-Commerce business facilitation hub. TDAP to develop an E-Platform to bring together all players under one umbrella.

- Legal framework for consumer protection has to be improved proportionate to the increase in size of the E-Commerce market.

- Harmonized provincial sales tax regimes through application of uniform sales tax rates on services and in avoiding double taxation.

- State Bank of Pakistan to further facilitate accessibility to international payment gateway shall work on allowing an existing international service provider to offer services in Pakistan.

- Ensure continuous at the entire multilateral E-Commerce negotiation forums such as WTO, ITU, UNESCAP and UNCTAD to protect Pakistan's economic interest and global connectivity through market access and effective special and differential treatment.

- Use of credit cards can be promoted by lowering the bank's interest rates and easy repayment schedules.

- Banks need to re-focus on making the design and content of their E-Banking portals easier to use from a functional perspective.

- Take effective measures to further enhance the security and safety of online banking.

- Develop E-Banking and E-Commerce portals and apps in local languages

- Adopt and enforce Made in Pakistan technologies.

e. E-Justice

E-Justice is a specific field under the more

general umbrella of e-Government. In particular, it refers to the use of information and communication technologies aimed at improving access to justice, increasing cooperation between legal authorities, strengthening the justice system and improving legal institutions and the overall administration of law. ICT enabled justice functions could increase productivity and diminishes transaction costs within a system that is highly information intensive; reduces the duration of procedures, thus saving both time and money, and puts systems for document handling and processing within the reach of judges and courts; provide the best information available and a better understanding of both the way the courts work and the legal instruments that citizens have to ensure recognition of their rights; facilitate improved control over cases and allow a better qualitative and quantitative evaluation of outputs. As a consequence, e-Justice also increases beneficiaries' confidence and provides greater legitimacy of the judicial power. Judiciary in Pakistan urgently needs re-engineering with ICT and digitalization focus, modernize the use of its human resource and bring about change management by harnessing the potentiality of the available information and communication technology to its fullest extent.

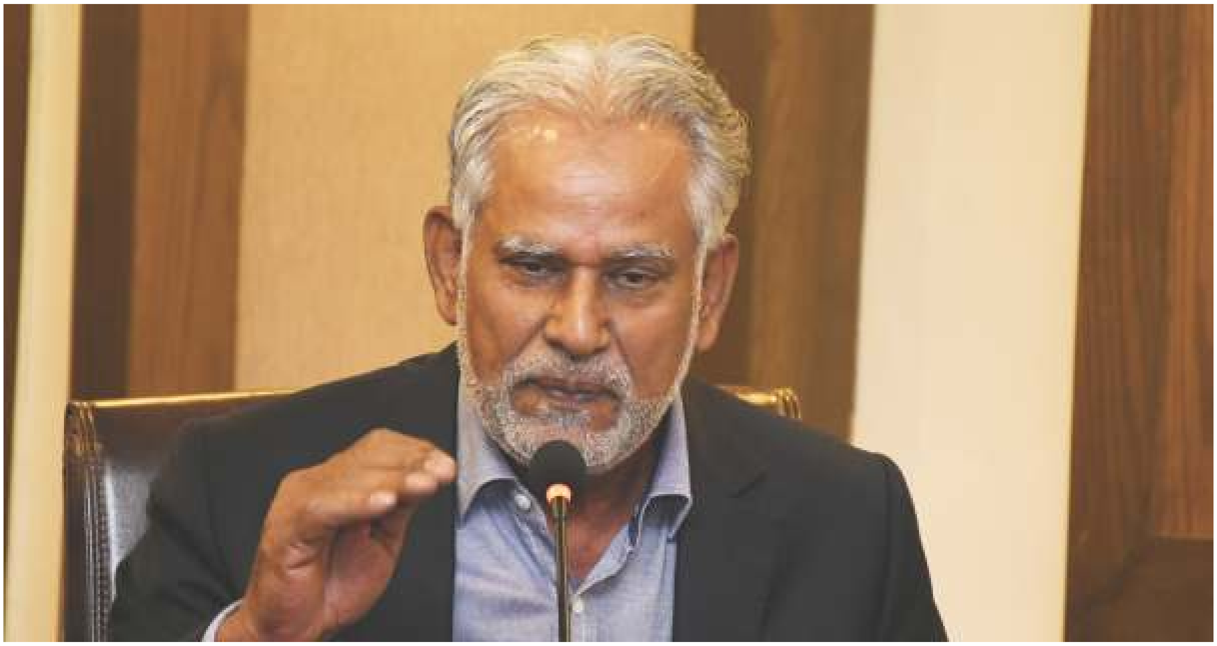
Challenges

- **Capacity Building / ICT Training.** By making efficient use of technology, courts and arbitral tribunals in Pakistan can offer expeditious and cost-effective access to justice. Most of the lawyers and judges are not tech-savvy and follow the traditional ways of justice system, rendering the few technical interventions in the justice system useless.

- **Infrastructure.** There are ongoing measures by the Government towards implementing an E-justice system in Pakistan e.g. there exists National Judicial Automation Committee, however a consistent and effective ICT enabled, digital E-Justice system has not been implemented in Pakistan.

Recommendations

- Implement the Digital Court and Case Management Systems across Pakistani courts, whereby the data used in the course of litigation is stored in automated registers and can be retrieved securely and automatically. Transition towards automation of judicial processes.



- Introduce Sentencing Information System, which aids judges in quick sentencing, easy access to relevant information about past sentencing of the court in similar cases, without placing any formal restrictions on the exercise of judicial discretion.

- Centralize the information organization and provisions with the highest courts, ministries of justice, and judicial councils.

- Introduce criminal justice interoperability platform that digitally links together crime reporting, investigation, prosecution, judicial and jail systems.

- Ministry of IT to assist in training and conducting regular workshops with certifications to the officers of all courts and tribunals.

f. Success of Property Technology (IT)

Prop-Tech (Property and Technology) is a small part of the wider digital transformation of the property industry. The real estate industry is, by its nature, quite a traditional industry, but it faces a number of challenges. As the sector is quite data-rich and open to exploring digital opportunities, this makes it particularly well-suited for leveraging digital and innovative property technologies as a means to address their myriad challenges e.g. using space more efficiently, improving tenant experience and satisfaction, and managing the carbon footprint of their assets.

Pakistan's construction industry amounts to over $50 billion, which makes up about 12-13% of the GDP, out of which the real estate sector contributes approximately one-third ($15 billion) of the total GDP. With the increase in availability of smartphones, reliable 3G, and 4G services in urban areas of Pakistan and the increased use of property related online portals, the Prop-Tech in Pakistan is growing. As more house/property buyers are logging in to find homes, traditional agents and developers have had to change their outreach channels from traditional to digital. While there is still a widespread use of traditional methods, one can observe a steady shift in processes towards the digital alternative. The technologies that are being used in Prop-Tech in Pakistan vary across many domains and are in the fields of smart online listing portals, drones, mobile-friendly websites, and apps, augmented reality

(AR) as well as virtual reality (VR) tours.

Challenges

- Market Research of Assets and Resources. Homebuyers spend the maximum amount of time seeking verified agents and clean properties with no legal litigations or disputes. In the Pakistani market, this activity is painstakingly difficult and time consuming.
- Lack of Data. A constant problem faced by the real estate sector is unavailability of digital land records. Some provinces have partially digitized their land records, but there is not only a significant portion of land record yet to be digitized, the private sector has no access (through APIs, subscriptions, open data portals, etc.) to this land record and thus cannot utilize it in Prop-Tech.
- National Need. It is estimated that 20 million new houses will be needed across by 2030.
- Regulation and Enforcement. There are 65 thousand housing societies in Pakistan, about half of which are not approved / planned.
- Trapped Investments. Many investments end up in dead and unplanned projects, reducing their potential economic benefit.
- Unregulated Transactions. Majority of real estate transactions continue to be unregulated, opaque and off-the-books, leading to continuing issues of trust and investor confidence.

Recommendations

- Introduce and implement national level policy and program to digitize all land records across all provinces in 3-5 years.
- Allow private sector access to digital land records for utilization in Prop-Tech
- Regulate and license property agents, devise and enforce a code of conduct, and maintain and publish a registry and track record of property agents' transactions.
- Digitize land parcels, using geospatial data, which can then be used for construction,

surveys, assessments, town planning, etc.

- Allow investors to use to land parcel planning and feasibility data to make informed decisions.
- Use technology, e.g. digital inventories backed by a legal framework to make transactions safe, secure and transparent.

g. Expected Impact of Use of ICT in Socio Economic Sectors

Encouraging new technologies in socioeconomic sectors will enable Pakistan's journey towards becoming a truly digital nation.

- IoT and AI-led Agri-tech solutions will save water wastages and increase crop yield
- Use of technology in healthcare, particularly EMRs and AI, will lead to predictive care, disease spread analytics, and accessible and improved healthcare.
- Large scale renewables adoption by ICT Industry will lead to improved national energy mix and reduced ICT operating expense.
- Improved Digital Payments infrastructure will result in an increased flow of commerce and currency.
- Digitalization and automation of judicial processes will empower courts and enable efficient law dispensing.
- Digital banks and an enabling infrastructure will lead to reduction in unregulated movement of capital and an improved digital environment for FDI.
- Effective use of prop-tech can significantly improve transparency and documentation of the real estate economy, allow efficient planning based on well-researched data repositories, enhance investment profile in the sector and generate snowball impact.

PART VI

RECOMMENDATIONS REQUIRING IMMEDIATE ACTIONS

Recommendations Requiring Immediate Actions

Immediate Impact Interventions

1. **Special Technology Zones (STZs**) with tailored facilities, essential infrastructure and customized incentives geared towards facilitating the ICT industry's ease of doing business and global competitiveness; supported by appropriate legislation/act and overseen by an Authority, in line with SEZ Act but customized to suit the requirements of the ICT industry; to be drafted in consultation with the ICT industry. Government to provide enabling environment (Land, power, banks, technical institutes to award requisite certificates and other basic facilities). Instead of Govt. borrowing money for the development of these STZs, private industry be encouraged to invest in infrastructure development as per their needs.

2. Announce one or two cities having hub of ICT training institutions for provision of skilled manpower as ICT cities (Islamabad and Karachi to start with).

3. Pakistan's Information Technology Agreement (ITA) Accession: It can play an important role in fostering economic growth, in part by integrating Pakistan into global value chains for the production of ICT goods and services.

4. Setting up an **empowered unit at PM Office on ICT and Innovation** to liaise with industry and monitor implementation of PM's vision on ICT. Removing regulatory barriers and revamping NITB for leading digitalization of Governance. Liaison with academic institutions and leading industry players for working on National **Strategies on IT, AI and Cyberspace**.

5. Appropriate legislation and easing-up of over-

regulation to **encourage foreign investment in ICT sector**; so that entrepreneurs don't have to establish holding companies abroad to utilize foreign investment. Removing barriers to move capital from Pakistan so that ICT industry is encouraged to bring more than just operational expenses into Pakistan. Avoiding tax revenue losses due to drop shipping of international software licenses in Pakistan without paying any local taxes, this practice is prevalent amongst leading MNCs operating in Pakistan, incurring losses to national exchequer.

6. **Current, accurate industry stats** and benchmarking study for ICT industry is required to assess the complete landscape and establish baseline. Stats such as Industry Size, Number of Companies, IT Graduates and their skill levels, Number of Professionals employed etc. are required to plan our priorities and our action plan.

7. **Incentivize ICT industry** via tax breaks/ holiday e.g. for startups and SMEs with revenues under a certain threshold or number of employees under a certain threshold, reducing rate of income tax on ICT sector workforce, etc. Easy tax-free import of equipment and technology required by startup companies such as laptops etc**. Exemption of payroll taxes** for employees who are working at a startup for 5 years.

8**. Encouraging/Incentivizing local ICT manufacturing** by reducing import/custom regime on plant, equipment, electrical components and machinery used in ICT industry.

9. **Subsidize employment of fresh graduates** working in the ICT sector by paying half of the salary for the first year of employment (e.g. average salary of fresh graduate = Rs 25,000 per month = Rs 300,000 per annum; 20,000 ICT graduates per year x Rs. 150,000 per annum (Govt. 50% share) = Rs. 3 Billion per annum). It will improve employability of fresh graduates and encourage private sector to hire more,

increasing not only employment numbers but also skills development.

10. Create **a level playing field** for indigenous companies that provide ICT services in Pakistan and compete with foreign companies providing similar services in Pakistan but are hosted/incorporated abroad i.e. by reducing direct and indirect taxation on ICT products /services that render Pakistani companies uncompetitive.

11. Restrict public sector entities to bid for public sector ICT related tenders. **Amendment of PPRA rules to make it easier for startups to qualify**.

12. Establish **ICT Export Development Fund** in line with Export Development Fund, under an autonomous Secretariat / Wing in MoITT or MoST.

13. Declare **fiber optic connectivity an essential utility**; formulate a National Right of Way Policy and **National Fiber Strategy**, harmonize right of way tariffs across juris-dictions, which is pivotal to address connectivity challenge. **A 10% increase in broadband infrastructure directly contri-butes to about 1.5% of GDP** in Emerging Markets. Expected impact of $4.5 billion generation via this activity.

14. While addressing the security concerns, restrictions on import of specialized IT equipment (3D printers, drones/UAVs) may be reviewed.

15. Ensure **adequate, stable and renewable power supply for the ICT sector**, at least in STZs catchment areas. Ease-up wheeling of energy for ICT sector to encourage private sector investment in renewables, while bringing down the operational costs of Data Centers.

16. **Incentivize digital payments** e.g. by reducing sales tax on domestic e-commerce. It will not only help increase consumer spending but also improve documented economy numbers (discourage cash on delivery); Facil-itate international payment service providers to operate in Pakistan; expedite digital banking adoption.

17. Simplification of process by **SECP for startups to offer stock options to employees** (ESOPs); Easy opening up of a Bank Account in

a day subject to providing a registration certificate. Exits (winding up of companies) for tech businesses should be made easy as well, even if there is a little debt.

18. For startups**, exemption from all regulatory compliances and audits for a period of 3 years** – this would include Labor Department, EOBI, FBR, Social Security etc. with an additional 2-year exemption following a simple self-declaration or until the startup size grows to 50+ employees; Exemption on startup from all corporate taxes including WHT, GST, Corporate Income Tax, E-Commerce or Digital taxes for 5 years.

19. **Tax exemption for Angels Investors and Venture Capitals** on funds dedicated for investment in startups; Reduce Capital Gains tax from the proceeds of investments made in startups (Example of Small Enterprise Investment Scheme (SEIS) in UK); Govt. backed credit guarantee scheme for startups, for collateral-free, fund and non-fund based credit support for at least 10,000 startups in 5 years.

20. **Industry relevant ICT skills development programs** for undergraduate students across Pakistani universities, run in cooperation with ICT industry; HEC mandated closer industry-university linkages, requiring lecturer/professor secondment to industry for skill refresh / industry relevance training; accredited learning (credit hours) for 3-6 months placements of students in the private sector; Talent hunting and identification through aptitude test at school level, followed by ICT scholarships program (undergraduate).

21. Revamp and enrich **skill-based curricula** for ICT sector universities, colleges and institutes. ICT skilled based advance **certifications** need to be launched at national level to meet international job market. Companies such as Microsoft, VMware, IBM can be incentivized to invest in training our human pool.

22. Special rules by SBP for transaction of forex by ICT Companies.

23. Introduction of PayPal and similar services in Pakistani Market.

24. Incentives for return of Pakistani origin IT Professionals (both to employee and employer).

25. Provision of legal and professional advice to software houses.

26. ICT industry leaders to meet regularly through MoITT, PSEB, PASHA or any other ICT related governing body for bridging the gap between Government and private sector.

__Medium Term Impact Interventions__

27. **Expand domestic ICT sector market size** by adopting *'Made in Pakistan'* policy for all public sector ICT related projects. ICT sector tenders/RFPs to mandate 70% budget to be spent on Made in Pakistan software products /services; Mandate that at least 30% *'Made in Pakistan'* technologies to be used in Telecommunication industry, to encourage local manufacturing.

28. Focused and sustained attention of relevant ministries towards **improving Pakistan's annual rankings in global indicators pertaining to ICT**. Assign lead role and responsibility to MoITT for ICT sector indicators monitoring and improvements.

29. Addition of **new STZs in all provincial capitals.** Also convert all provincial capitals as **ICT Cities.**

30. **National ICT Policy/Digital Pakistan Policy 2021 to be formulated afresh**, with industry input, accompanied by sector-wise strategy documents that set targets, specify implementation mechanisms and assign responsibility to Ministries/Departments, e.g. **National AI Strategy**, National Broadband Strategy, National ICT Skills Development Strategy, etc. Public sector ICT projects and funding (e.g. IGNITE, HEC, etc.) to be linked to National IT Policy and sector-wise Strategies.

31. **Access to capital for start-ups and SMEs** is a real problem. Establish a government backed VC Fund for investment in ICT startups directly or provide local business the leverage to invest in startups (shared risk).

32. **Increased Government spending on R&D innovation** to spur labor productivity and integration of ICT with broader economy.

33. Accelerated adoption of rapidly developing technologies such as **Robotic Process Automation, AI, Machine Learning, IoT**, and 5G

technologies.

34. Mandate **Electronic Health Records to be maintained** and telemedicine facilities provided at all public and private hospitals.

35. Special courts with requisite ICT sector knowledge to expedite dispensing justice and resolving any disputes related to ICT sector.

36. Promoting Agri-tech startups and innovation, promoting **Precision Farming adoption to reduce water wastage** in Pakistan's agriculture sector and **increase in crop yield**, education of farmers on precision farming techniques, access to knowledgebase, training and tools to practice precision farming.

37. **Resolve IoT Spectrum allocation** matter for transition of urban centers into smart cities.

<u>Long Term Impact Interventions</u>

38. Addition of new STZs in other major cities across Pakistan.

39. Decide and define Pakistan's stance on **cyberspace sovereignty**; specify policy and legislate laws on the subject; thereby enforcing legislated regulations upon foreign content and service providers.

40. Reset and redefine **fiber/terrestrial broadband penetration targets**; adopt aggressive targets; maximize broadband penetration by incentivizing investment on fiber optic connectivity infrastructure (bring best in the region OFC penetration in next three years).

41. **Incentivize additional submarine cables to land in Pakistan** (Pakistan has 6, India has 20, Oman has 13). Incentives should include tax holiday on setting up Submarine landing station and relaxation in import duties for equipment that is not manufactured locally.

42. **Incentivize establishment of domestic data centers**; remove prohibition of Govt. services/content to be hosted at NTC; allow non-sensitive content to be hosted by private entities e.g. PTCL, other private sector providers.

43. Direct **all government functions to be digitalized and automated** (not just e-office, but rather all internal and citizen facing functions); target a truly digital governance

model in the long run.

44. **Regulate and license property agents**, digitize land parcels.

45. **Steady inclusion of renewable sources** in power infrastructure, reducing lines losses and infrastructure inefficiencies, bring power tariffs to regionally competitive levels.

46. Improve **brand image of Pakistan**, utilizing embassies and foreign missions to promote the Pakistan's ICT sector. Visa regime assistance also required for the ease of shuttling of ICT resources.

47. Enabling **access to risk capital** for encouraging innovation and entrepreneurship. Govt. should set up a large fund or leverage Ignite's fund for seed money to be given to the Incubators for investing in startups. This fund should also help startups to file for the international patents where the Government bears the cost for such IP filing.

ANNEXES

Annex A

Program

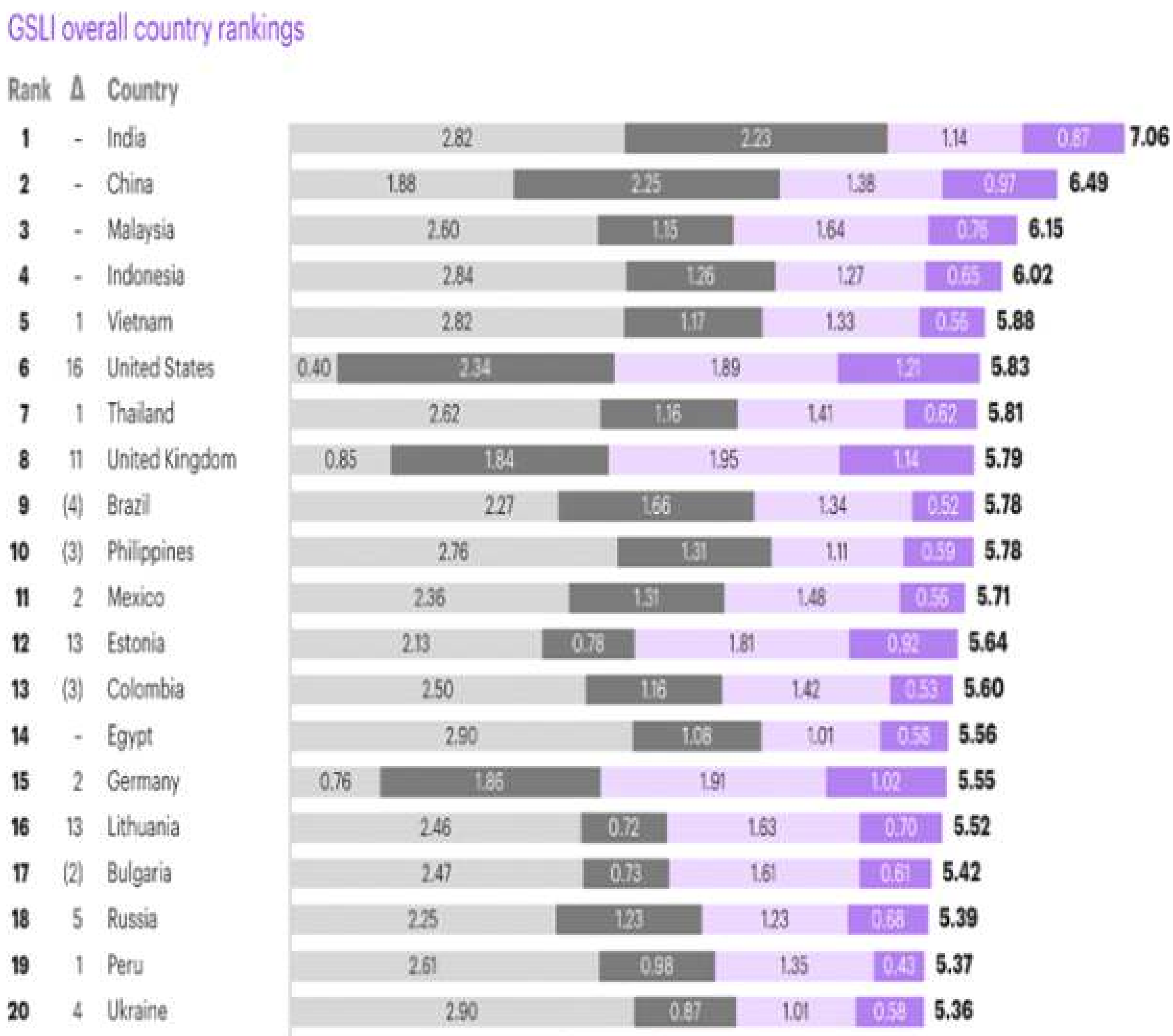
7th October 2020

Time (Hrs)	Activity	Remarks
0915-0945	Arrival of Participants/Registration	Javed Sultan (JS) Hall, ISSRA
1000	Arrival of Guest of Honour	VIP Reception NDU
1000-1015	Discussion of Guest of Honour with President NDU and DG ISSRA	President NDU Office
1015	Arrival of Guest of Honour	JS Hall, ISSRA
1015-1020	Recitation of Holy Quran	‘’
1020-1100	Interactive Session	‘’
1105	Arrival of Chief Guest	‘’
1105-1115	Welcome Remarks by President NDU	‘’
1115-1145	Presentation by NDU (Maj Gen Asif Ali, HI (M), DG ISSRA): Findings/Recommendations on the Subject (30 Mins)	‘’
1145-1200	Address by Chief Guest	Chief Guest Departs at 1200
1200-1230	Tea Break	ISSRA Lounge
1230	Departure	-

Annex B

Top Global Outsourcing Destinations

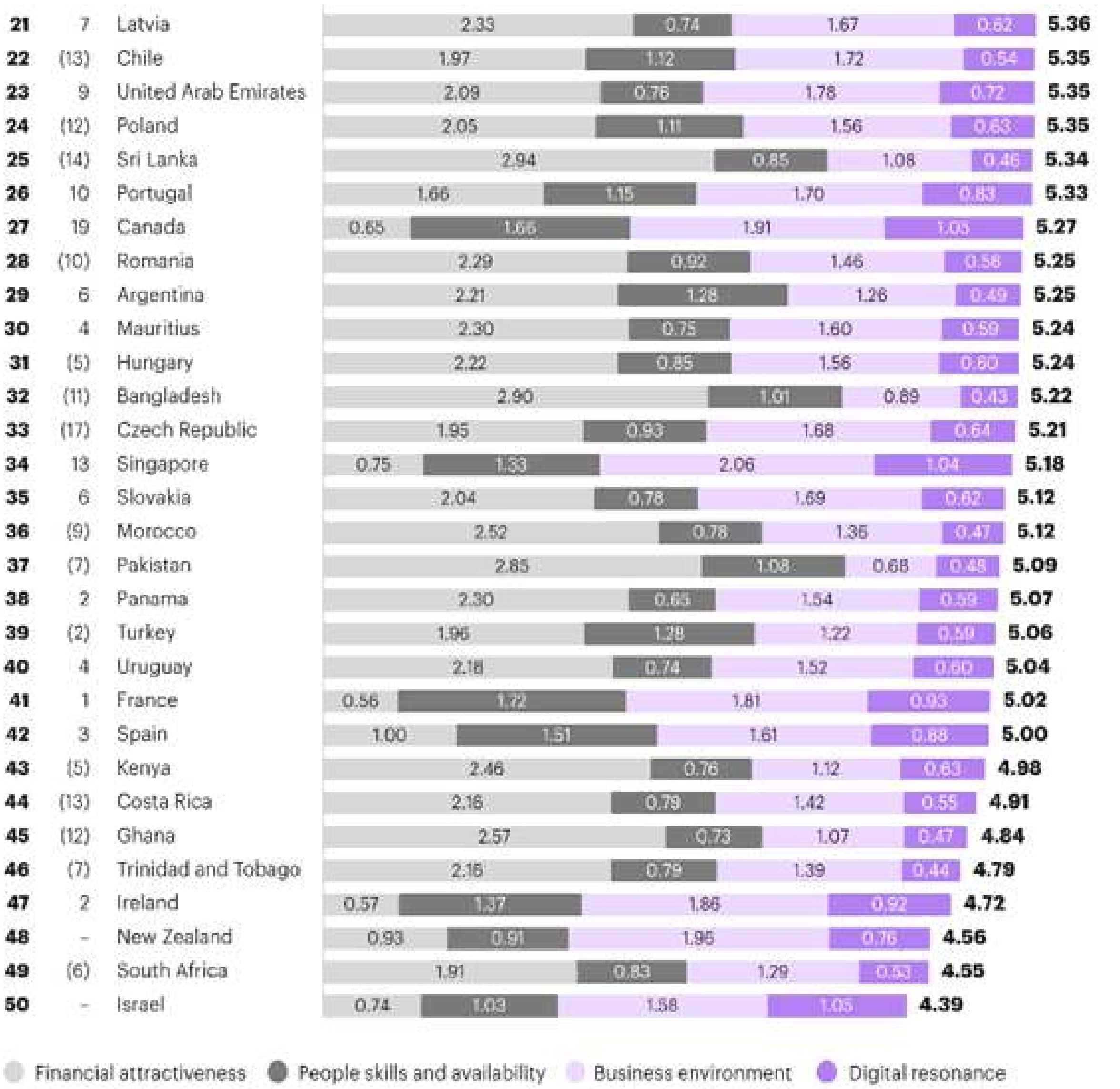
Factors: Financial Attractiveness, People Skills and Availability, Business Environment and “Digital Resonance”



Annex C

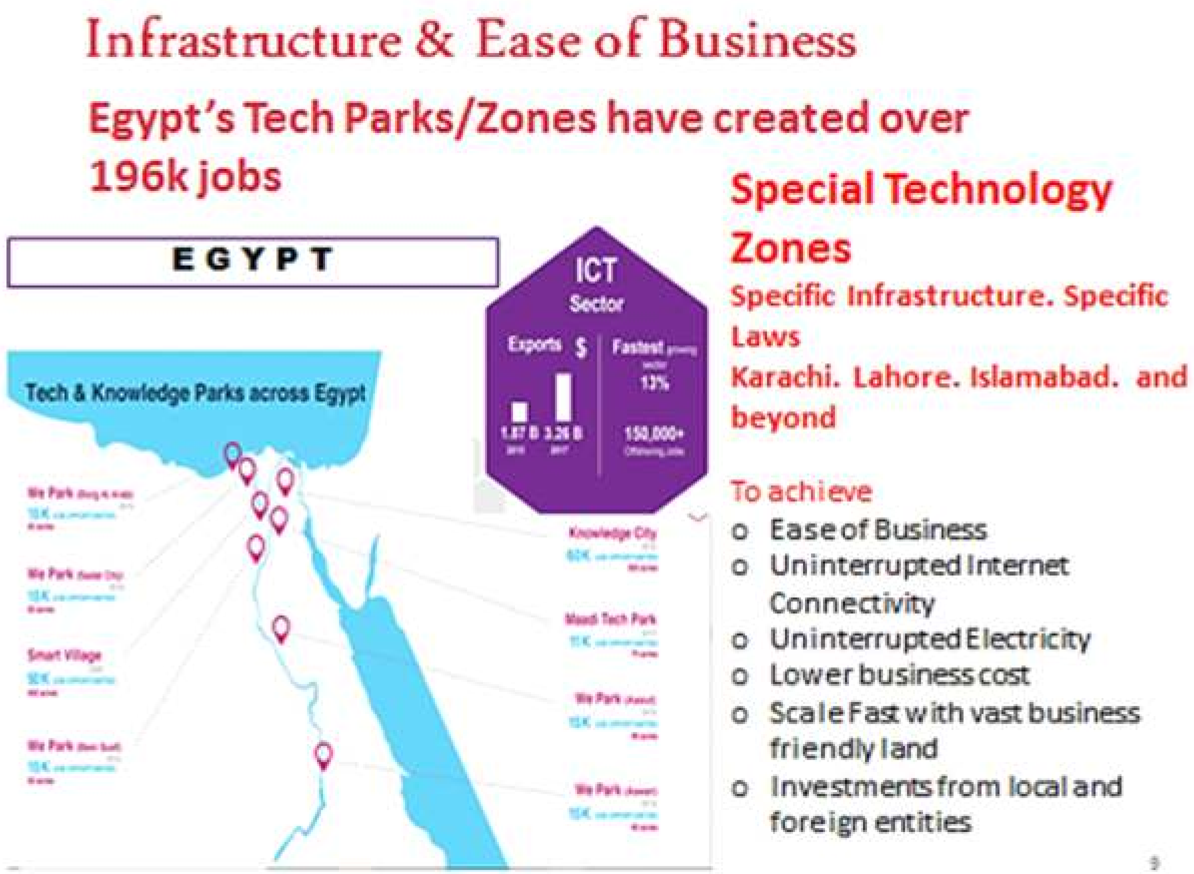
Top Global Outsourcing Destinations

Factors: Financial Attractiveness, People Skills and Availability, Business Environment and “Digital Resonance”



Notes: For France, Germany, the United Kingdom, and the United States, Tier II locations are assessed. Numbers may not resolve due to rounding.
Source: Kearney GSLI 2019

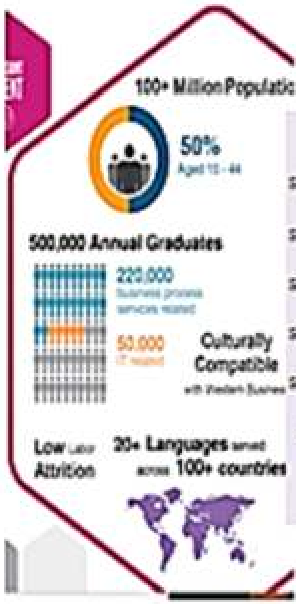
Annex D

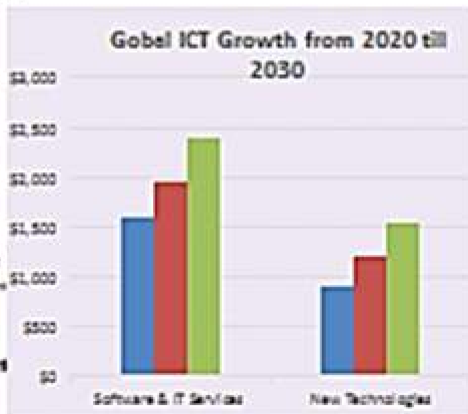

Infrastructure & Ease of Business
Egypt's Tech Parks/Zones have created over 196k jobs
EGYPT
Tech & Knowledge Parks across Egypt
ICT
Sector
Exports $
Fastest
13%
1.87 B
3.26 B
150,000+
Knowledge City
Maadi Tech Park
Smart Village
We Park
Special Technology Zones
Specific Infrastructure. Specific Laws
Karachi. Lahore. Islamabad. and beyond
To achieve
o Ease of Business
o Uninterrupted Internet Connectivity
o Uninterrupted Electricity
o Lower business cost
o Scale Fast with vast business friendly land
o Investments from local and foreign entities
9

Annex E

Human Capital

Egypt has 50,000 IT graduates per year; Pakistan has 25,000





IT Growth is directly linked to Talent Pool

50,000 persons needed to grow per $1bn.
Current Employable IT grads per year: 5,000

- Finishing Schools (like India, etc) to improve employability of graduates
- Skilled workforce without degrees (increase talent pool quickly)
- Invest in Emerging Technologies skilling
- Promotion of IT; improve awareness among masses
- Other Skill Development Programs
- More aligned programs in universities

10

Annex F

BPO is promising

Philippines BPO exports over $30bn annually and employ over 1.2mn

Forecasted Growth (2020-2024): $105.49bn*

Pakistan's exports from BPO: 26% with world's 3rd largest English speaking country

Emerging Trends in BPO

- Robotic Processing Automation
- Social Media as Customer Service Channel
- Cloud Computing (SAAS/PAAS/IAAS)
- Tailored Outsourcing
- Upskilling

To achieve

- Employ diverse skill set, from low to high tech
- Scale fast
- Investments from local and foreign entities

11

Annex G

Internet Speed of Peer Group Countries

Country	Terrestrial Broad band	Mobile Broadband
Pakistan	9.02 Mbps	13.55 Mbps
Bangladesh	22.13 Mbps	10.23 Mbps
Vietnam	38.64 Mbps	24.60 Mbps
Nepal	20.38 Mbps	10.70 Mbps
Laos	19.27 Mbps	27.18 Mbps
Indonesia	19.09 Mbps	11.77 Mbps
India	30.74 Mbps	10.63 Mbps
Singapore	191.93 Mbps	50.43 Mbps
Taiwan	151.75 Mbps	43.66 Mbps
South Korea	156.18 Mbps	97.44 Mbps

The terrestrial broadband is generally faster and cheaper than mobile broadband.

Source: Speed test Global Index (July 2020)

Annex H

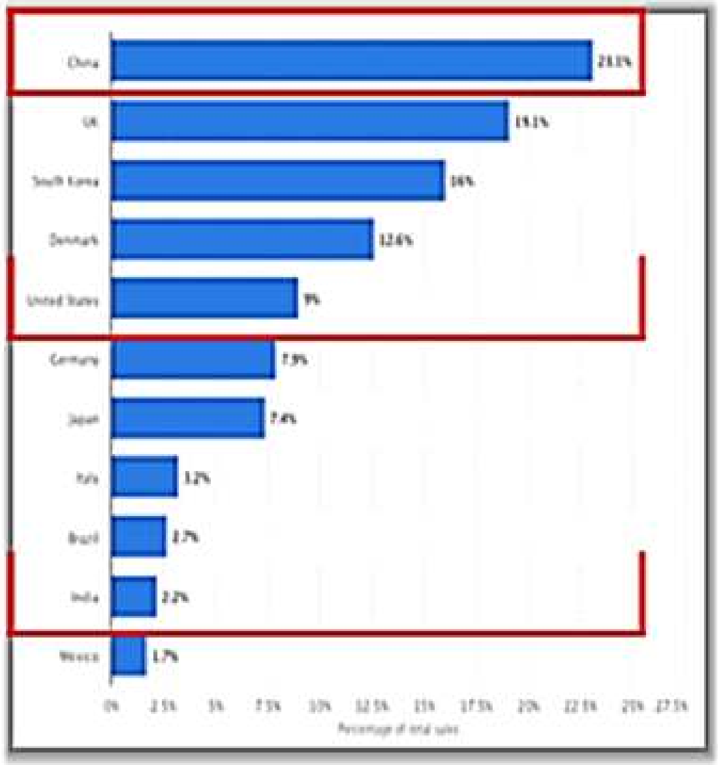
Low E-commerce to Retail Ratio

Pakistan's e-commerce as %age of Retail is very low:

<0.5%

Compared to:

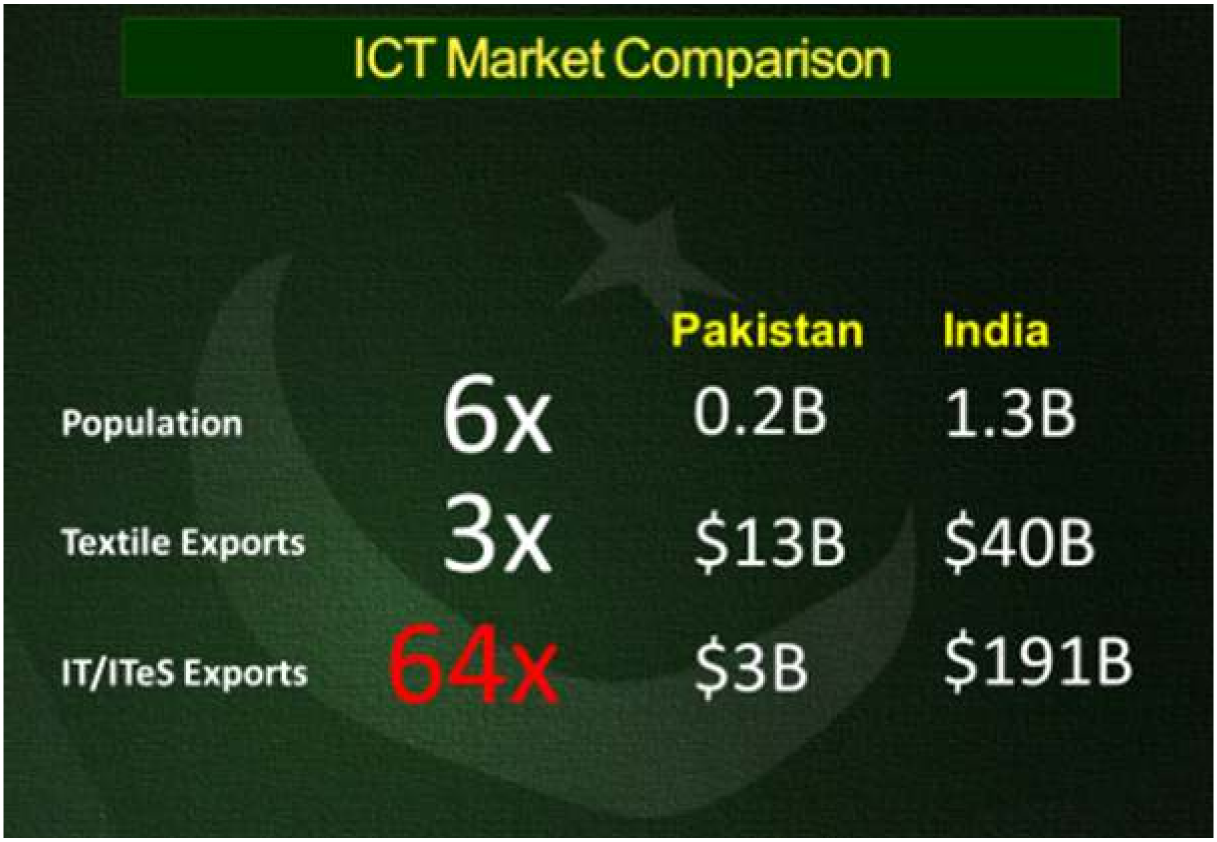
India: 2.2%
USA: 9%
China: 23.1%



Pakistan net retail sales in 2017 were US $155bn compared to e-commerce sales of US $700m. Source: Global Retail Sales (Statista)

14

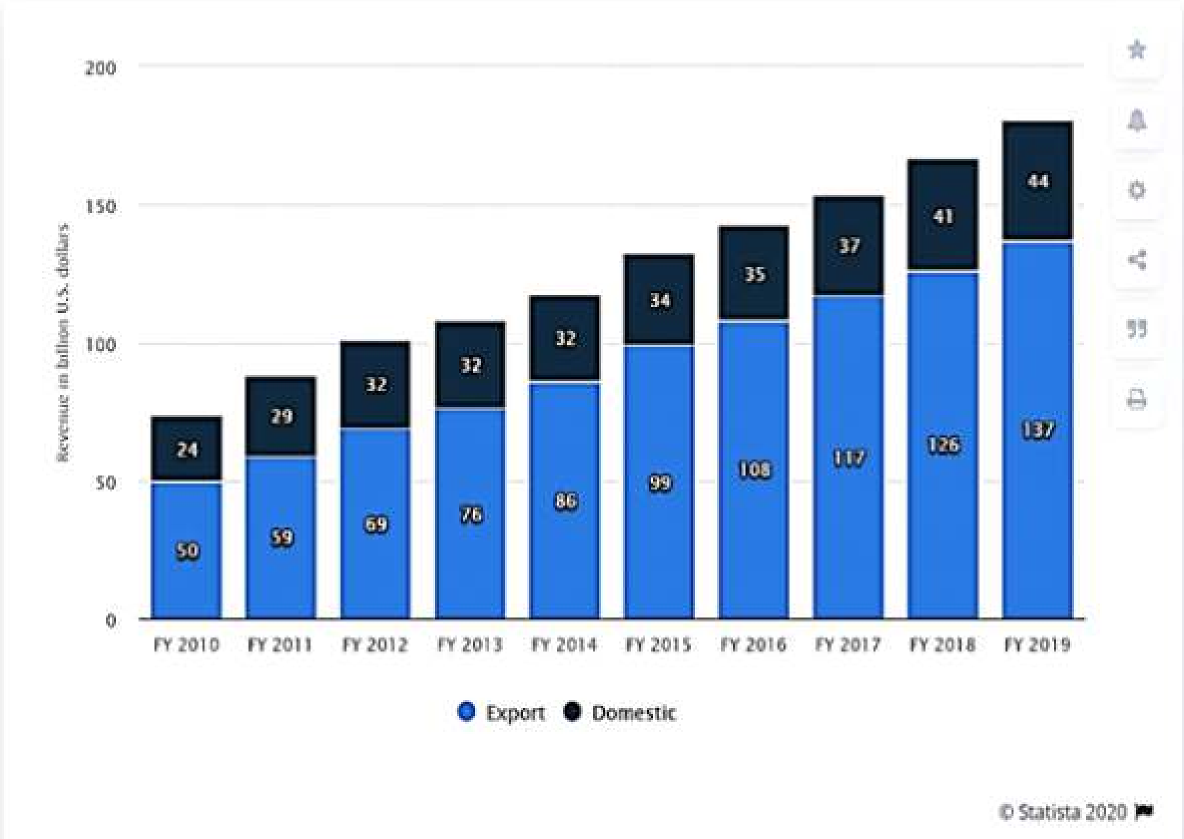
Annex I



ICT Market Comparison
Pakistan
India
Population
6x
0.2B
1.3B
Textile Exports
3x
$13B
$40B
IT/ITeS Exports
64x
$3B
$191B

Annex J

Domestic Capacity Building



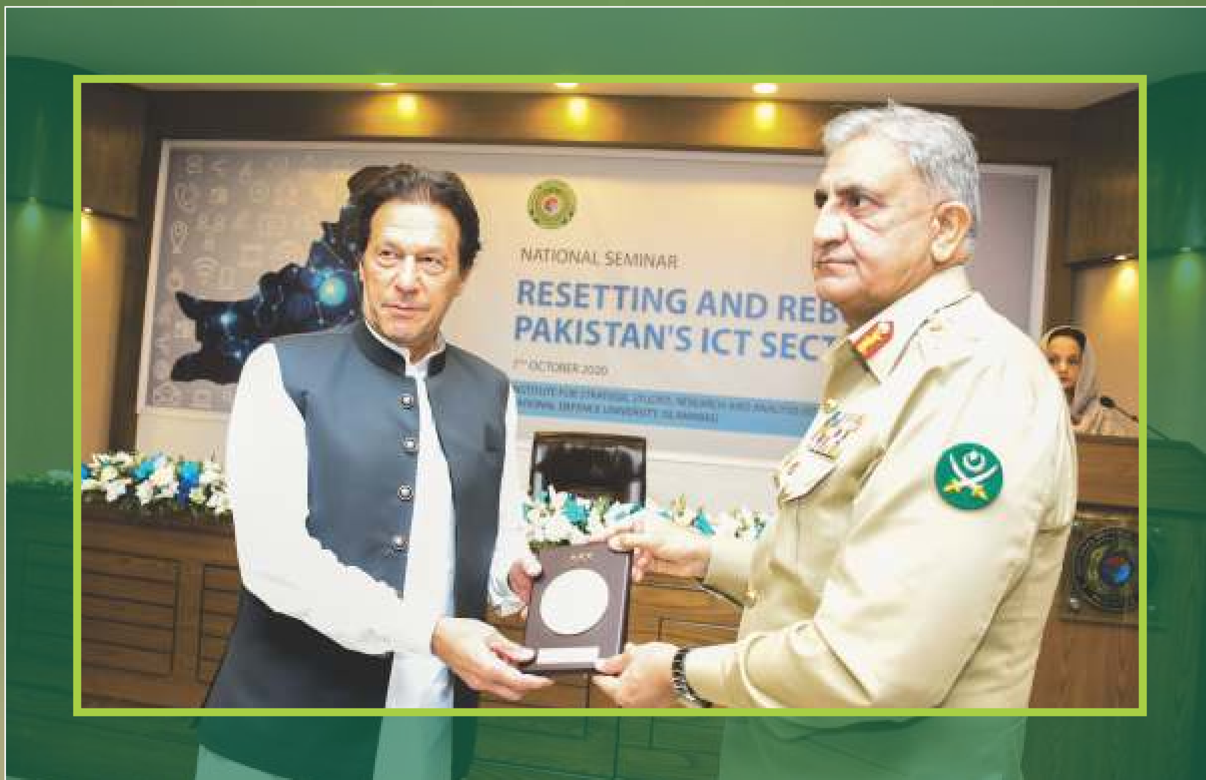
Domestic Revenues & Exports are co-related

$1bn Domestic: $3bn Exports

Because Domestic Supports Capacity Building:

- Exports Capacity
- Import Substitution
- Employment Creation
- Skill Development
- Build Profile/Brand
- Product Development & Local Innovation

PICTURE GALLERY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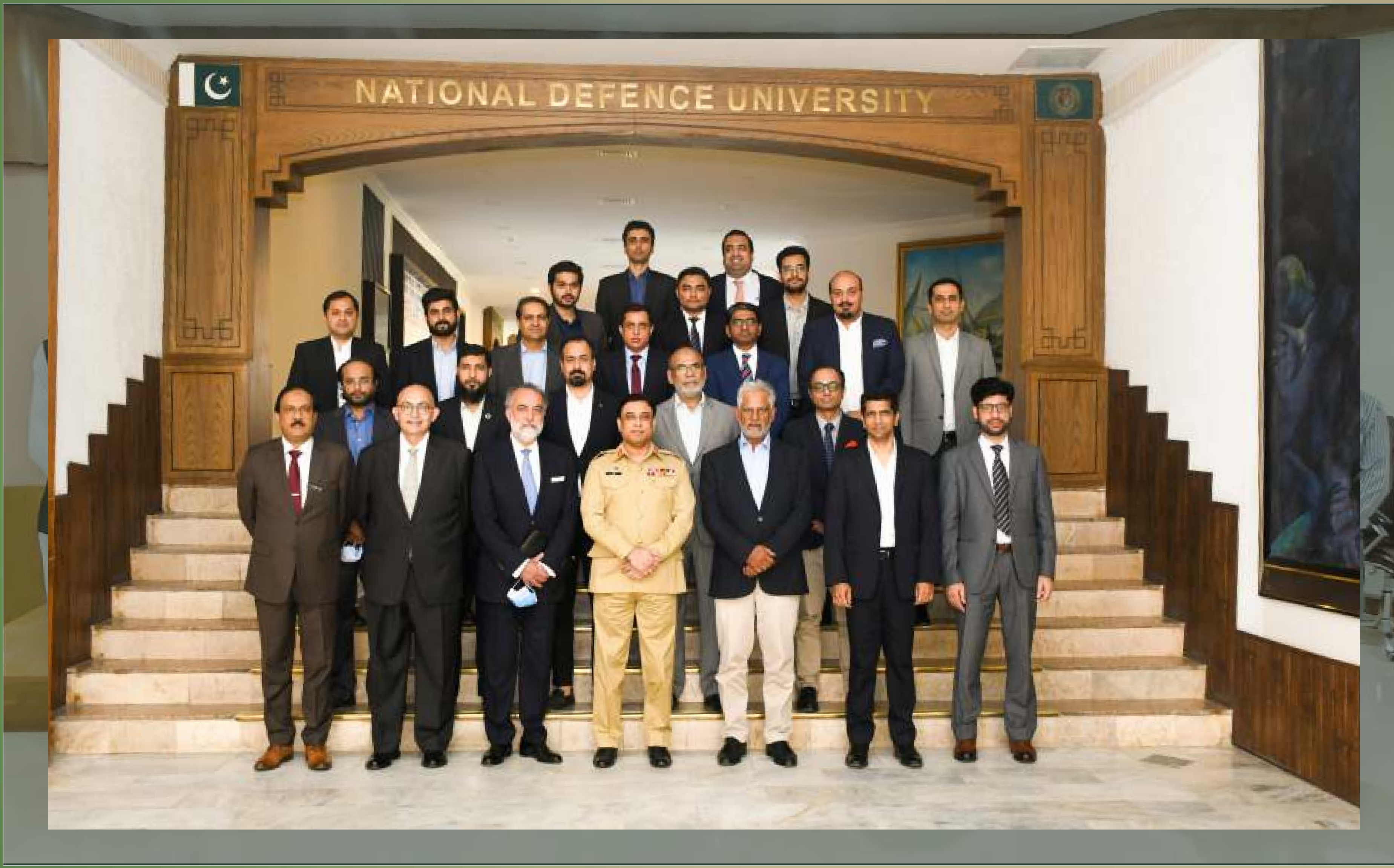
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PAKISTAN'S ICT SECTOR

National Defence University
Islamabad-Pakistan