DEVELOPMENT ADVOCATE
PAKISTAN

LEVERAGING TECHNOLOGY FOR DEVELOPMENT

DEVELOPMENT ADVOCATE
PAKISTAN

UNDP
Pakistan

Development Advocate Pakistan provides a platform for the exchange of ideas on key development issues and challenges in Pakistan. Focusing on a specific development theme in each edition, this quarterly publication fosters public discourse and presents varying perspectives from civil society, academia, government and development partners. The publication makes an explicit effort to include the voices of women and youth in the ongoing discourse. A combination of analysis and public opinion articles promote and inform debate on development ideas while presenting up-to-date information.

Editorial Board

Mr. Ignacio Artaza
UNDP Country Director

Mr. Hamid Raza Afridi
Policy Advisor
Embassy of Switzerland

Mr. Shakeel Ahmad
Assistant Country Director/Chief
Development Policy Unit

Mr. Aadil Mansoor
Assistant Country Director/Chief
Crisis Prevention and Recovery Unit

Mr. Kaiser Ishaque
Assistant Country Director/Chief
Democratic Governance Unit

Mr. Amanullah Khan
Assistant Country Director/Chief
Environment and Climate Change Unit

Ms. Fatimah Inayet
Communications Analyst

DEVELOPMENT ADVOCATE
PAKISTAN

March 2018
CONTENTS

© UNDP Pakistan

Technology for Social Good

The 2030 Agenda for Sustainable Development puts forward an integrated, broad and ambitious plan for global action on sustainable development. With such zealous targets, the need for innovative and disruptive solutions is critical. These solutions will largely sprout from technology, thanks to to the innovations introduced through the Fourth Industrial Revolution. The Revolution has already transformed how we live. It has reshaped government, commerce, healthcare, mobility, education and livelihoods.

Along with the potential to provide disruptive solutions on a large scale, new technologies bring their own sets of challenges and opportunities. What impact will these technologies have upon inequalities, poverty, jobs and wellbeing? How can these innovations aid in overcoming our development challenges? With commercial goals, how can we combine the social impact of new technologies? These are all important questions to consider and address with the increasing infusion of technology.

Technological innovations have allowed access to information for people around the world. Those in the most remote and inaccessible areas are now joined by invisible lines of connection, over radio waves and satellite signals, which give them a voice and a means to communicate across the planet. Wearable and implantable technologies are helping enhance people's "digital presence"; pocket-sized supercomputers are providing for an infinite amount of storage space; smaller, cheaper and smarter sensors are being introduced – in homes, clothes and accessories, cities, transport and energy networks; the advent of artificial intelligence (AI) and robotics is reshaping livelihoods and decision making; 3-D printing is allowing to open an entire world of better health opportunities…and the list is endless! These are some of the fascinating possibilities that technology is helping to achieve.

Already experimenting with big data, AI, machine learning and 3D printing, Pakistan's startup community are actively using new technologies for commercial and impact use. Investments by the government, private sector and UN agencies need to be made in this ecosystem. These startups are largely led by Pakistan's young men and women. With appropriate training and opportunities, these young women and men can become both the drivers and the beneficiaries of a massive global shift. Institutions such as Ignite Fund and National Incubation Centres set up by government, are hubs focused on harnessing this very ecosystem and new technologies.

These changes encompass developed and developing countries alike. In Pakistan, for instance, technology has opened up easier ways of doing things. For many urban consumers, organizations such as Careem and Uber are revolutionizing mobility. Online education platforms such as that of the Virtual IT University, are improving access to education in every corner of the country. In the elections, voters will be able to navigate to their designated polling stations using their phones and exercise their democratic right. A dengue app monitors new cases and informs local government response, while online platforms coordinate the national struggle to eradicate polio.

The innovative potential of microfinance has also been a vehicle for leveraging technology. Mobile technology, the internet, and globalization are powerful tools in eradicating poverty through microfinance loans, which have funded half a billion people and counting.

Automation has also revolutionized gender parity in employment. Advances in technology have allowed more women to work in executive and senior level roles, from the confines of their homes, or remotely otherwise, or have created opportunites to co-share a job. An example of this is 'telemedicine', which has empowered female doctors. The Karachi based health startup, 'Sehat Kahani', is an example of one such platform.

However, new technologies also bring challenges. As automation continues to replace manufacturing or blue collar jobs, artificial intelligence will subsequently do the same for skilled, white collar jobs in banking, law or medicine. While it is true that technological leaps have often eliminated older, human-powered methods of doing things, advances in technology also have the potential to create new jobs, most of which we cannot even dream of today.

According to the World Economic Forum Global Risks Report 2017, *"the Fourth Industrial Revolution has the potential to raise income levels and improve the quality of life for all people. But today, the economic benefits of the Fourth Industrial Revolution are becoming more concentrated among a small group. This increasing inequality can lead to political polarization, social fragmentation, and lack of trust in institutions. To address these challenges, leaders in the public and private sectors need to have a deeper commitment to more inclusive development and equitable growth that lifts up all people."*

It is essential to harness the benefits of science and technology for all. Being inclusive in how we innovate, engaging vulnerable communities in the process of innovation, and developing solutions that are accessible to people living in poverty, will be critical to ensure that no one is left behind. For this to happen, foremost, there needs to be leadership to define a vision, and effective institutions to implement that vision of a sustainable future powered by technology. Making available thorugh various means the financial and technical resources, along with incentives for investment, are prerequisites for a successful transformation. By building on the vision at the heart of the SDGs – to leave no one behind – global and regional partnerships can take the world towards a technologically unified global village.

Development and Technology: A Revolutionary Paradigm

At the end of 2015, the Sustainable Development Goals (SDGs), meant to guide the advancement of humankind for the next 15 years, were adopted by the United Nations General Assembly. Known as the 2030 Agenda, the agreement called upon all countries to advance the welfare of their citizens in a sustainable manner to ensure the long-term viability of development and growth. A key means of implementation of these Sustainable Development Goals (SDGs) is the effective use of science, technology and innovation (STI).

The relationship between development and technology is possible yet complicated.

Too often, the concept of 'technology-boosters' creates unrealistic targets and unachievable notions. Expensive, inappropriate technology fixes that take no account of development realities, often sprout about every now and then. For instance, believing that there is a technological silver bullet that can 'solve' illiteracy, poor health or economic failure, reflects a poor understanding of real poverty. Likewise, a region's sensitivities and needs have to be kept in focus whilst designing and implementing technological solutions and innovations. In developing countries, for instance, technology can be utilized to create easier cheaper solutions

and build new resources. Au contraire' in developed countries, technology serves to augment and complement existing resources and interventions.

Au contraire', in technology lie several development solutions. If the development community turns its back on the explosion of technological innovation in food, medicine and information, it risks marginalizing itself and denying developing countries opportunities that, if harnessed effectively, could transform the lives of poor people and offer breakthrough development opportunities to poor countries.

Figure 1: Science, Technology and Innovation for the SDGs[1]
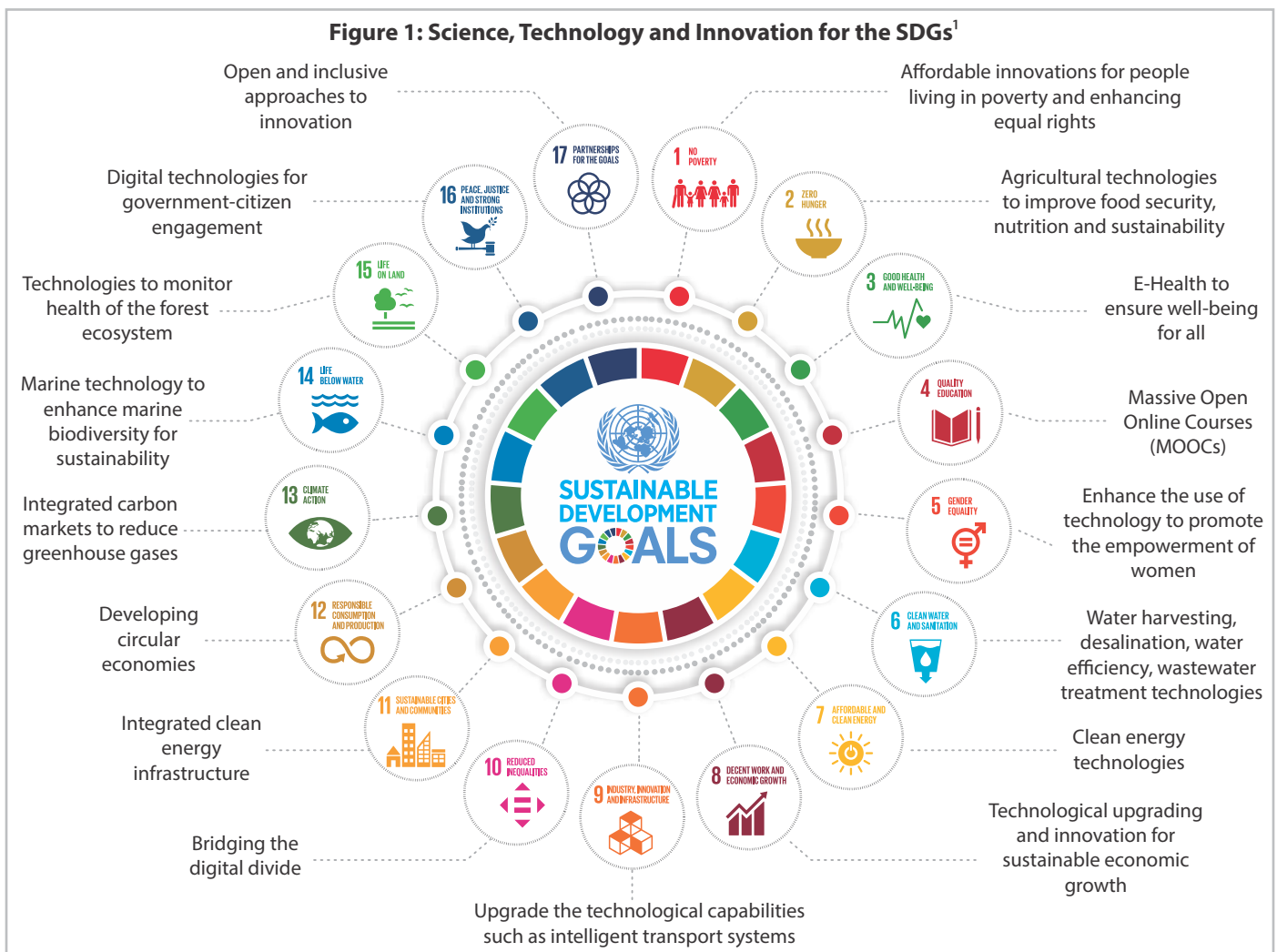
1. UNESCAP (2016). "Harnessing Science, Technology and Innovation for Inclusive and Sustainable Development in Asia and the Pacific." Available at http://www.unescap.org/publications/harnessing-science-technology-and-innovation-inclusive-and-sustainable-development-asia

In essence, technology should serve to complement development. It is important that the potential benefits of technology are rooted in a pro-poor development strategy. Hence, technology should not be the means to an end, rather, it should be the means to the beginning of providing people and governments with the opportunity to empower themselves and allow them to create more meaningful choices.

Technology has become a driver of economic growth. Through the revolution of the internet, isolated rural villages now yield the power of connectivity. This connectivity allows critical information to be accessed, shared and monitored. This helps create strategies for improved future planning in all socio-economic indicators.

With the recent rise in entrepreneurship, tech-startups have also started emerging as powerful tools to aid the development discourse. These tech startups are efficient hubs of technological advancement as they utilize existing tech resources to power new ideas. Something as simple as using mobile applications to connect people to employment opportunities, to discharging full-fledge campaigns such as distance-learning through virtual platforms, these tech startups are unleashing the power of Information Communication Technologies (ICT), like never before.

Our lives have been profoundly impacted by the stunning advances in various fields of science and technology. These advances have penetrated into almost every sphere of activity and have transformed into new products or processes that have flooded world markets. Entire nations have transformed and achieved economic benefits owing to their transition into digital economies through their vision to make science and technology the cornerstone of their development programmes.

Nevertheless, development is something that needs to be fed continuously in order for it to translate into economic gain. For this, the first focus must be on education. Unless children are taught from an early age to inhibit critical thinking, they will not be able to develop a 'futuristic' approach towards development. The challenge many developing countries face is the translation of resource into wealth. In order to unleash their creativity, these countries must expose their youth to a challenging educational environment that teaches them to think and find novel solutions to difficult problems.

Another important pillar in climbing the ladder of development, is the domain of research and development (R&D). The lack of proper research and analysis, is synonymous to a bridge that has no connections to the roads that exist on either end. In essence, R&D are the connecting points that support the entire structure of development.

Figure 2: Tech Startups by Plan9

Source: Punjab Information Technology Board, Plan9.[3]

Last but not the least, the third very important pillar in enabling technology for development, is the support of the government. The government must not only support in letter and spirit, but also create incentives for additional investment by other stakeholders. Incentives can include tax holidays, provision of risk capital by venture capital companies, protection of intellectual property rights, rationalisation of import duty structures, banning of smuggling to protect local industry, and creation of investor confidence through stable and long-term policies.

Pakistan's Technological Landscape
Pakistan is experiencing an ever-changing landscape. As a developing country with changing dynamics, the space to welcome new and diverse opportunities is increasing. According to the Global Innovation Index 2017[2], Pakistan's rank improved from 119 out of 128 countries in 2016, to 113 out of 127 in 2017. By utilizing its robust youth bulge, the country can accelerate on the path towards innovation-based technologies and breakthroughs, provided supporting mechanisms are available/provided.

Technology in Pakistan has enormous potential for growth. In this day and age, tech incubators and startups offer a lot of promise. But teething problems, especially a lack of funds and encouragement for

2.   Cornell University, INSEAD, and WIPO (2017). "The Global Innovation Index 2017: Innovation Feeding the World." Ithaca, Fontainebleau, and Geneva. Available at https://www.globalinnovationindex.org
3.   PITB, Plan 9. "Our Startups". Available at http://plan9.pitb.gov.pk/startups/
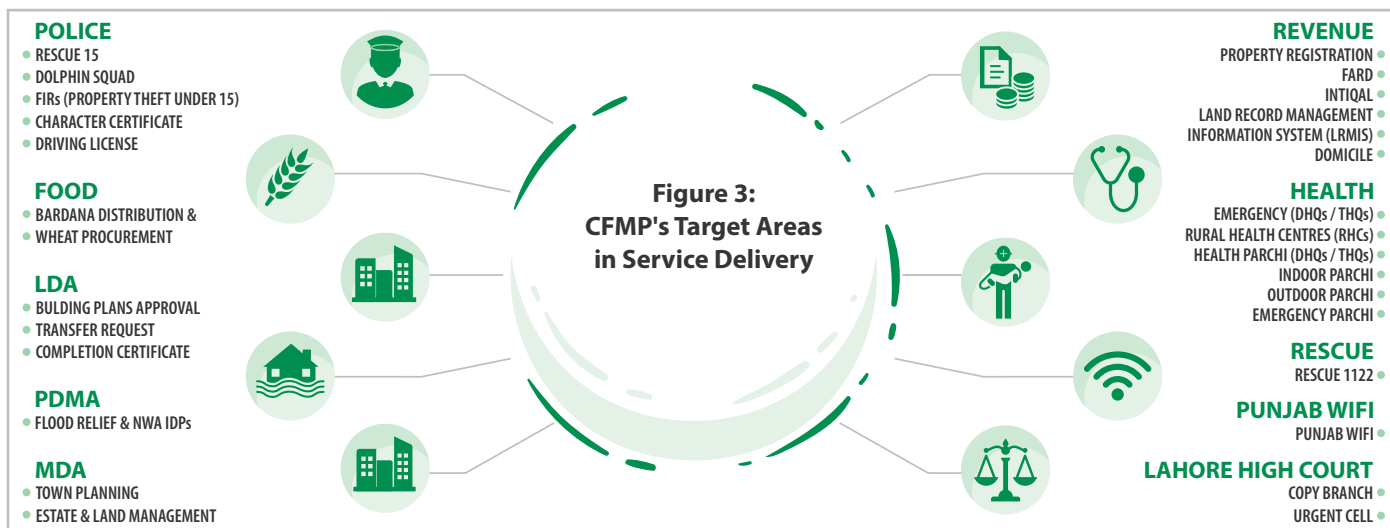
product development, have deterred start-ups from moving forward with disruptive innovations or technologies. There are, however, several examples that delineate the growing shift to becoming more digital. In the public realm, initiatives of the Punjab government, for instance, display immense potential for leveraging technology for development. Through its tech incubators, PlanX, Plan9 etc, the space to kick start entrepreneurial initiatives using

impacted the direction needed to thrust individuals on a critical thinking path and thereby establish university-economy links.

Despite all of that, Pakistan has managed to remain an active player in the technology discourse. A national roadmap to launch a knowledge-based economy by integrating science and technology with economic development programmes, was created. Since June 2000, the government has

several trainings have been created for students and professionals alike. A very exciting venture is that of the Virtual I.T. University. The university pioneered high-quality TV programmes and digital channels in an effort to reach as many households as possible.

All these efforts of the government represent a genuine turning point in the development of science and technology in

POLICE
- RESCUE 15
- DOLPHIN SQUAD
- FIRs (PROPERTY THEFT UNDER 15)
- CHARACTER CERTIFICATE
- DRIVING LICENSE

FOOD
- BARDANA DISTRIBUTION &
- WHEAT PROCUREMENT

LDA
- BULDING PLANS APPROVAL
- TRANSFER REQUEST
- COMPLETION CERTIFICATE

PDMA
- FLOOD RELIEF & NWA IDPs

MDA
- TOWN PLANNING
- ESTATE & LAND MANAGEMENT

**Figure 3:
CFMP's Target Areas
in Service Delivery**

REVENUE
- PROPERTY REGISTRATION
- FARD
- INTIQAL
- LAND RECORD MANAGEMENT
- INFORMATION SYSTEM (LRMIS)
- DOMICILE

HEALTH
- EMERGENCY (DHQs / THQs)
- RURAL HEALTH CENTRES (RHCs)
- HEALTH PARCHI (DHQs / THQs)
- INDOOR PARCHI
- OUTDOOR PARCHI
- EMERGENCY PARCHI

RESCUE
- RESCUE 1122

PUNJAB WIFI
- PUNJAB WIFI

LAHORE HIGH COURT
- COPY BRANCH
- URGENT CELL

Source: Punjab Information Technology Board, "Citizen Feedback Monitoring Program."

technology, is well on its way. Several successful tech-based startups running through mobile apps have been created via these platforms (Figure 2). These target health, education and other development imperatives. There are also numerous case studies in the private sector that have in a short while, become household names. These include the transport service Careem which initiated in 2012. Using a simple mobile application that controls all its services, Careem now spans across 13+ countries and has 20+ million users. Daraz, a leader in e-commerce, also completely runs via a website and a mobile application. These initiatives are addressing development challenges in the country, but there are several avenues yet to be explored. For instance, with electricity and energy becoming more expensive and scarce, smart automated lighting that switches on and off via sensors, just might be the solution for electricity conservation. Such is the power of technology.

The development of sci-tech has always been on a backburner in Pakistan. Lack of interest coupled with a faulty vision, never allowed this industry to bloom to its full potential. The core of the industry, the research and development (R&D) domain, was unable to produce any worthy research that was required to identify gaps and opportunities, in a bid to set the foundations for a plan of action. Even in schools and universities, a lack of proper facilities and issues in the curriculum,

launched over 260 development projects worth a total budget of about PKR 18 billion in various fields.

A very interesting initiative that was launched was the Science and Technology for Economic Development (STED) Programme. This programme allowed a link between the public and private sector industries for technology-based production of high-value-added goods. The programme was characterized by research and development initiatives that bordered along the lines of the application of existing technologies for agricultural or industrial development. So far, 28+ projects have been initiated under this programme in different sectors including biotechnology, pharmaceuticals, chemicals, IT, energy, and health, under public-private collaboration. The STED programme is expected to strengthen the industrial and technological base of the country and set the trend for commercially viable high-value-added products and processes. To facilitate software development, the government has also set up a chain of well-equipped technology parks in major cities.

Education is the cornerstone of any socio-economic development. A total of 12 dedicated I.T universities have been established in the country, and all others house the disciplines of science and technology. Internships and scholarships have been offered in various fields of I.T. and

Pakistan and should provide a much-needed injection of funds and scientific expertise into centres of knowledge, ultimately leading to the country's socio-economic development. Public policy plays a pivotal role in making an environment conducive to any transition and policies on paper can only be successful if translated into action.

Big Data and Technological Innovations
Big data refers to large volumes of data that are analysed and their results are utilized across a wide range of areas. Big data has revolutionzed the growth paradigm owing to the astounding opportunities it offers governments, institutions, corporations and organizations to assess trends in order to create solutions. Big-data analytics combines tools and processes to enable individuals to examine massive data sets by unearthing hidden patterns, trends, citizen preferences, previously unknown correlations, and other useful actionable knowledge.

Recent years has seen a rise in big data being utilized to implore development benefits. The UN Global Pulse, an initiative launched by the UN Secretary General in 2009, has been a leader in this regard. Under this initiative, internet based data was used in Argentina in 2013 to estimate consumer price index and poverty rate. In Rio de Janerio, satellite imagery was used to forecast weather patterns.[4] China also employed big data through using

4. Treinish, Lloyd (2014), "'Operational Forecasting of Severe Flooding Events in Rio de Janeiro." Available at https://hepex.irstea.fr/operational-forecasting-of-severe-flooding-events-in-rio-de-janeiro/

alternative sources of data outside official statistics that allowed it to analyse and compare poverty at different levels and regions within China. They created the Living Standards Index, whereby indicators were measured using a combination of conventional as well as big data sources. These sources included census results, online dashboards, satellite information etc.[5]

Another example of big data in Pakistan is the stock exchange, that routinely handles huge chunks of data but owing to the sensitivity of information, it can only be accessed and maintained by brokers.

A realm where Pakistan can greatly benefit from big data is the political realm. While political parties have been actively using social media and other tools of engagement towards voters, yet there

media monitoring can help identify problem areas and develop better counter strategies, for instance. Simultaneously, no heed is being paid to the analytics of people's engagement in the entire process.

The use of technology in electoral processes also has the potential to improve coordination and organization. A computer is hard to bribe, biometric data seems objective and spreadsheets rarely make
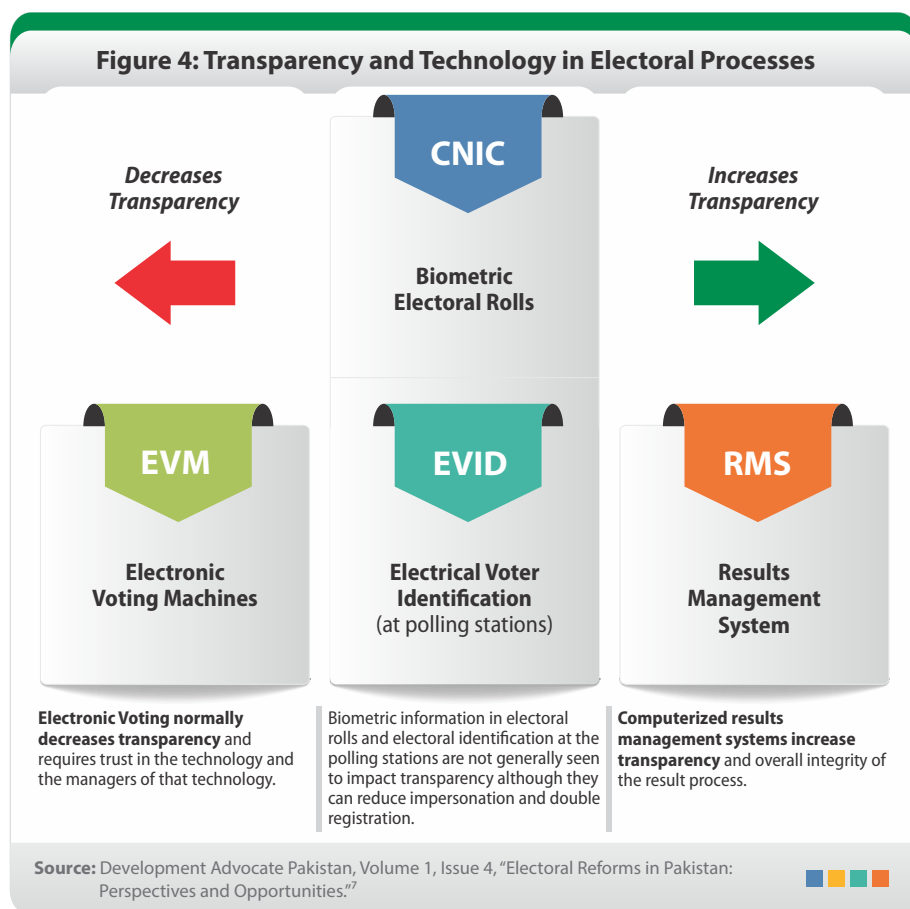
Table 1: Key Electoral Technologies

CNIC Biometric Electoral Rolls	EVID Electrical Voter Identification (Fingereprint scanning at polling stations)	EVM Electronic Voting Machines	RMS Results Management System
Voter lists and biometric data in databases. (NADRA/ CNIC)	Voters are asked to scan their fingerprint at the polling station before voting.	Computerized balloting and counting.	Computerized system to aggregate results.
Can reduce duplicate registration.	Can reduce multiple voting and voter impersonation.	Can reduce invalid ballots and improve integrity of court.	Can provide more accurate results and improved transparency
Examples	Examples	Examples	Examples
Pakistan, Ghana, Democratic Republic of Congo	Pakistan, Ghana, Democratic Republic of Congo	India, Brazil, Venezuela, Philippines, USA	Pakistan, Brazil, Venezuela, Philippines, USA, Kenya, Zambia

Source: Development Advocate Pakistan, Volume 1, Issue 4, "Electoral Reforms in Pakistan: Perspectives and Opportunities."[6]

In Pakistan, the use of big data is still in its infancy. Several reasons such as a lack of the availability of data, lack of research, lack of incentives, lack of rules and laws, lack of an understanding of the sector, and limited technological development exist in the backdrop. The flip side however, is that big data is being used by several large companies in Pakistan. The government is also actively trying to encourage the use of big data and big data analytics. One such example is the Punjab Information Technology Board (PITB) whereby 80 percent to 90 percent of its work is based on big data.

An example of the use of big data in PITB's work is through its Citizen Feedback Monitoring Program (CFMP). It aims to identify problematic areas, curb petty corruption in service delivery and facilitate government officials in taking evidence-based corrective measures. For achieving its aims, CFMP analyses citizen feedback to identify trends and patterns in service delivery, through large chunks of data. Other similar programs, such as the Punjab government's polio vaccination programme, dengue monitoring programme etc all work on the concept of big data. They accumulate large amounts of data from a diverse demographic area and the data is subsequently analysed to create solutions and chalk areas of intervention (Figure 3).

Figure 4: Transparency and Technology in Electoral Processes

Decreases Transparency

CNIC

Biometric Electoral Rolls

Increases Transparency

EVM

Electronic Voting Machines

EVID

Electrical Voter Identification (at polling stations)

RMS

Results Management System

Electronic Voting normally decreases transparency and requires trust in the technology and the managers of that technology.

Biometric information in electoral rolls and electoral identification at the polling stations are not generally seen to impact transparency although they can reduce impersonation and double registration.

Computerized results management systems increase transparency and overall integrity of the result process.

Source: Development Advocate Pakistan, Volume 1, Issue 4, "Electoral Reforms in Pakistan: Perspectives and Opportunities."[7]

remains tremendous potential for further utilization. The analytics derived from social

mistakes in simple math. Many countries have adopted technology for their electoral

5. UNDP China (2016), "The Living Standards Dimension of the Human Development Index: Measuring Poverty with Big Data in China." Available at http://www.cn.undp.org/content/china/en/home/library/poverty/the-living-standards-dimension-of-the-human-development-index--m.html
6. Development Advocate Pakistan, Volume 1, Issue 4, "Electoral Reforms in Pakistan: Perspectives and Opportunities." Available at http://www.pk.undp.org/content/pakistan/en/home/library/hiv_aids/development-advocate-issue-4-english.html
7. Ibid

processes. The Election Commission of Pakistan (ECP) also took measures of introducing the Result Management System (RMS) in the 2013 elections. Yet, the system was not properly utilized by the Returning Officers in many constituencies, as reported by ECP. Not just results, even delimitation maps were not available in Pakistan. Table 1 presents a snapshot of four key electoral technologies that are being used in electoral processes. For the 2018

Even if the data is available, a major issue remains is the technical capacities required to interpret that data. Hence, the need for personnel trainings, both in the public and private domain, is required if technology is to be leveraged for development.

Pakistan now has a National Center in Big Data and Cloud Computing (NCBC) that brings together 12 laboratories across 11 leading universities of the country working

Technology in Remote Settings

With the internet sprawl, the world has become a global village. In the age of this global connectivity at ones fingertips, no area has remained inaccessible. The internet, if used correctly, can serve as a very meaningful development tool for fragile areas that have limited access and exposure.

In the area of social uplift, distance learning can increase the number of opportunities for all, irrespective of any age group, class or gender. Education plays a vital role in the development paradigm and can open doors of economic and livelihood opportunity. The concept of Massive Open Online Courses (MOOC) enables education to reach millions. For example edX—a nonprofit founded by Harvard University and MIT in 2012 is today, a leading online learning destination and MOOCs (Massive Open Online Courses) provider with more than 7 million learners from all over the world.[9] In Pakistan, almost 90,000 learners benefit from this platform. With a nominal fee of PKR 5000 to 10,000, edx offers courses from some of the best universities and corporations in the world. There are also platforms that offer free online courses ranging from several disciplines, such as Khan Academy or Coursera. Such technological innovations enable the furthest of areas to access quality education at a single click.

Rule of Law has also often posed a menacing problem in areas that have been sensitive. In such cases, technology has once again come to the rescue. Forensic labs across the country have aided in combating violent extremism in areas. The National Forensic Science Laboratory, for example, has developed a fingerprint and DNA database with records of more than 200,000 criminals, and has helped solve 2,540 cases of terrorism so far. These forensic labs established throughout the country are equipped with state of the art technology, including triple-quadrupole mass spectrometer, gas chromatograph with mass-spectrometry, liquid chromatography-mass spectrometry, gas chromatograph with flame ionization detector, gas chromatograph with NPD, and enzyme-linked immunosorbent assay, FTIR spectrometry, ultraviolet-visible spectrophotometry, gas chromatograph with mass spectrometry, and gas chromatograph with flame ionization detector.[10]

While forensics is one way to combat violent activities in fragile areas,

---

NADRA: A Case Study in Leveraging Technology and Big Data

The National Database and Registration Authority (NADRA) was established in the year 2000, in an aim to digitize citizen registrations through harnessing data and subsequently utilizing it. NADRA databases house complete citizen information. Beginning from printing electronically generated, secure, and modern identification (ID) cards, NADRA has come a long way into transforming itself as a leading implementer of IT driven solutions in the government sector, not only in Pakistan but also across the region.

Today, NADRA serves as a single, authentic point of reference for citizens as well as planning authorities. This means that once a citizen's record has been verified and entered in the data warehouse, the individual becomes eligible for facilities like passport, identity card, motor vehicle registration, driving license, arms license, and domicile certificate, etc.

NADRA has the potential to use currently available data and supplement it by additional sources of data from other government departments engaged in planning and service delivery. This will enable the different planning and development arms of the government to conduct detailed analysis and project future trends to determine the specific needs of citizens. These may be in areas like education, healthcare, housing, finance, population planning, disaster management, infrastructure development, and manpower development.

The analytical insights that NADRA can develop using big data could facilitate improved citizen engagement, operational efficiency in various government functions, cost savings, new revenue opportunities, and effective methods of ensuring compliance with government rules and regulations.

Source: MIT Technology Review Pakistan (2016), Rahat, Khurram, "Big Data: A New Way to Govern." Available at http://www.technologyreview.pk/big-data-new-way-govern/

---

elections, the ECP has decided not to use Electronic Voting Machines.[8]

However, data analytics can only be useful if data itself is available and released. The data with the ECP can be utilized to understand issues of voters' turn-out, women and minority aspects, and targeting improvements for future elections accordingly. Since the right to information has become a constitutional right in Pakistan, institutions like ECP and NADRA should be proactively putting out essential data and information in public domain. Legislation is necessary to ensure that the data is available to the general public and subsequently informed decisions can be made by the policy makers.

in fields ranging from medicine and agriculture, to energy management and distribution. PKR 1.5 billion has been earmarked for the center and will be used to fund research in fields ranging from medicine and agriculture, to energy management and distribution. This will enable Pakistan to position itself as a knowledge-based economy driven by data.

There is a lot of scope to work on big data in Pakistan. The key is to plan in advance and then equip institutions with the technical knowhow required to analyse data. Big data has the capacity to not only resolve current challenges, but also provide easier and reliable solutions to government and citizens alike.

---

8. Express Tribune (2017), "ECP won't use electronic voting machines in 2018 elections." Available at https://tribune.com.pk/story/1566597/1-ecp-wont-use-electronic-voting-machines-2018-elections/

9. MIT Technology Review Pakistan (2016). "MOOCs on edX: A World of Unlimited Learning Opportunities." Available at http://www.technologyreview.pk/mooc-s-on-edx-a-world-of-unlimited-learning-opportunities/

10. MIT Technology Review (2017), Sharif, Shafiq, "Assessing Forensic Science Landscape in Pakistan." Available at http://www.technologyreview.pk/assessing-forensic-science-landscape-pakistan/

technology can also help in the dispensation of justice. The KP police, for instance, is utilizing technology massively to improve efficiency. Their digitization measures include FIR digitization, crime tracking and analysis via geo-tracking technology, Automated Fingerprint Identification System (AFIS), rented buildings database, computerization of driving licenses and so on and so forth.[11]

Hence, technology has massive potential for use in fragile areas. It can not only help in improving the social and subsequently, economic conditions of families and households, but also aid in improving the overall peace and security situation in such regions.

International Models
Pakistan is gradually making steady progress on becoming increasingly digitized. There are models and lessons that provinces can learn from each other. For instance, the implementation of the Safe City Project in Islamabad, whereby intelligence video surveillance and vehicle management system cameras with automatic number plate recognition facility, were installed in order to aid in criminal investigations and traffic management, received immense applaud and success. 1,890 cameras are already functional and have been installed in various areas of the city, with 104 cameras yet to be installed. Around 1,150 crimes of various nature, have been solved thanks to the surveillance cameras installed throughout Islamabad under this Project.[12] Following its success in Islamabad, it was subsequently also replicated and launched in Lahore in May 2016.

There are several other countries who can be studied for their expansion in digitization. One such country sharing a border with Pakistan, is China. China has a dynamic and rapidly expanding digital ecosystem. It has the largest e-commerce market in the world, accounting for over 40 percent of worldwide e-commerce transactions.[13] Moreover, China is also becoming a leader in developing and using cutting-edge technologies, including 3D printing, artificial intelligence (AI), robotics, automated vehicles and drones. By using big data analytics, China is also moving towards offering remote diagnostic solutions for patients with chronic diseases, for example. A big factor attributing to the increasing rate of China's digitizing

economy, is the support of its government. The government is an active consumer of, and investor in, digital technologies, and is aiming explicitly for an AI applications market of more than USD 15 billion in creating the world's largest 5G mobile network.[14]

Another country employing technology to transform itself in the realm of public services, is Singapore. The creation of the Government Technology Agency of Singapore (GovTech) earlier last year, aims to bolster the digital transformation of the public sector and deliver more anticipatory services to the public. By using data analytics to crowdsource demands for transportation routes and matching them with private bus operators who will decide which routes are commercially viable to service via the 'Beeline digital mobility platform', GovTech has drastically improved the commuting experience of Singaporean residents. Beeline has garnered more than 45,000 app downloads, with more than 37,000 successful matches made. Such international examples area case studies for Pakistan to learn from in its race towards development through technology.

Way Forward
From being a global village, the world appears to be transforming into a technology park. While Pakistan has a steady pace in this regard, visionary leadership and national ownership are important factors required to steer the ship towards a digital economy. In order to implement and achieve the Sustainable Development Goals, the government will need to develop integrated and visionary science, technology and innovation policies and incentivize businesses and investors to support the three dimensions of sustainable development-economic, social and environmental. These policies and strategies need to be bound by the principles of inclusivity, openness and collaboration. Engaging vulnerable communities in the process of innovation and developing innovations that are accessible and affordable to people living in poverty, will be critical to ensure that no one is left behind. It will be essential to engage all actors in the innovation system to ensure plans incorporate the economic, social and environmental dimensions of sustainable development. With the government owning up to the adoption of the SDGs and bringing it in line with national development priorities, a clear

roadmap weaving in technological innovations that can further drive the fight towards the country's socio-economic development, is the need of the hour. This roadmap should be revisited and re-analyzed based on changing development contexts and adopted accordingly. Implementation is key: the roadmap should aim on infusing each sector with the possibilities that technology can offer. This would require a complete paradigm shift. For instance, only if children are taught from an early age to develop critical thinking, will they go on to develop an 'out-of-the-box' approach and attempt each problem with a futuristic solution. And the future, is technology.

Financial and technical resources, along with incentives for investment, are of course pre-requisites to fuel a successful transformation. The youth of Pakistan-60 percent at the moment-can be a big force in a gear shift aimed towards a digital economy. In order to ensure the sustainability of science and technology backed development, it is important to nurture and channelize the most important source: the citizens. Governments need to recognize and support under-represented communities, including women, as significant sources of talent and innovative ideas. Governments also need to nurture a workforce for the future and enable life-long learning by supporting the development of digital and innovation skills, and nurturing problem solvers with adaptive, flexible and innovative minds. By supporting and training the local population, governments can generate and make fit for purpose all available human capital through the stages of economic and social disruption that often accompany new technologies or innovative processes.

Finally, there is ample scope for regional and global collaboration. The world is home to some of the most dynamic, pioneering and innovative countries, but, at the same time, to some of the most technologically deprived as well. The challenge is to develop concrete and sustainable innovation and technology sharing opportunities to help bridge this gap, and enable countries at all levels of development to take advantage of available technologies and develop a robust culture of innovation backed by science and technology.

11. Government of Khyber Pakhtunkhwa. "Achievements of KP Police." Available at http://police.kp.gov.pk/page/introduction

12. ProPakistani (2018), "Safe City Project Helped Solve More Than 1000 Crimes in Islamabad: Police." Available at https://propakistani.pk/2018/01/31/safe-city-project-helped-solve-1000-crimes-islamabad-police/

13. Mckinsey Global Institute (2014). "China's Digital Transformation." Available at https://www.mckinsey.com/~/media/McKinsey/Industries/High%20Tech/Our%20Insights/Chinas%20digital%20transformation/MGI%20China%20digital%20Full%20report.ashx

14. Ibid

E-Governance and Development

Sajid Latif

Director General E-Governance
Punjab Information Technology Board

Governance through IT is one of the fastest growing tool used by governments, especially in developing nations, for service delivery. Easier said than done, it entails a comprehensive list of challenges which include, skillset, cultural change, and personal and professional insecurities. There are very few economies/governments in developing nations who have gainfully employed technology to empower their systems, over the course of time and efforts.

In Pakistan, technology has been employed by provincial governments time and again to aid service delivery and improve performance in sectors such as police, health, transport, education etc. One such example of a platform that provides technology-based initiatives for digitization, monitoring and evaluation, process optimization, all with a prime objective to improve efficient service delivery to serve citizens better, is the Punjab Information Technology Board (PITB). 'Smart monitoring' was deployed to address several well-known challenges of service delivery. Leveraging the 76 percent mobile-phone penetration and fast growing smartphone usage, PITB developed a cellular phone-based technological framework that helps public departments monitor their own work by proactively reaching out to citizens for feedback on the quality of service delivery. All of these led to a digital revolution in government operations and services where field work is paperless, monitoring and decision making is done in real time, performance and progress is publically available and most importantly, government to citizen engagement is high.

PITB is also playing a significant role in enhancing the performance of government departments with its flagship program, the Punjab Public Management Reforms Program (PPMRP). The project is also known as the 'I.T Centric Smart Monitoring Program' and covers technological interventions in seven key departments: Agriculture, Livestock and Dairy Development, School Education, Health, Excise and Taxation, Irrigation and the Board of Revenue. PITB has launched several key technological initiatives under PPMRP along with the first ever Citizen Contact Centre. Currently managing 30 critical campaigns with 75 agents that are available 24/7 round the year, approximately 2.5 million calls for enquiries, complaints and suggestions have been answered with an average talk time of 3 minutes. More than 4 million virtual calls were made to gauge citizen satisfaction on services rendered. PPMRP is also managing a growing portfolio of 216 district services for performance management. In addition to this, more than 81 organizations, under PPMRP, are disclosing information publically on its operations, contacts and performance.

Rule of law is an integral component of governance. Incorporating technological solutions can expedite rule of law processes, limit chances of error and corruption, and improve accountability and delivery. In the province of Khyber Pakhtunkhwa, for instance, several technological innovations have shaped policing in the area. These include for instance, the 'Vehicle Verification System'-a system enabling the field staff to nab stolen vehicles by verifying the credentials of any vehicle registered anywhere in the country through a mobile click; the 'Digitization of Criminal Record system'–a system aimed at digitizing the credentials of every reported crime and criminal/proclaimed offender thereby enabling the police force to run a background check of any person via a simple mobile click; the 'Geo-Tagging of Crime and Criminals plan'–an ambitious plan aimed at mapping and picturing the scenes of crime/terrorism and the known abodes of criminals/suspects on google maps in order to enable police personnel to perform their duties efficiently and systematically through improved supervision, and so on and so forth. Automating police station records is another area where technology can and is being applied to enhance transparency.

Good governance is also a by-product of ensuring that the social needs-such as education, health etc-of the citizens are met. Technology can help create bridges to foster innovation in these sectors. An example is the 'eLearn' initiative in Punjab. It is an open online and offline repository of digital content for Grades 6 through 12. It includes thousands of topic-based, grade-relevant animations, simulations, videos, audios and self-assessment exercises. Textbooks for Grades 6 to 10 have been digitized, augmented with thousands of interactive multimedia components including 1,830 animations, 592 simulations, 13,047 videos and 2,000 minutes of audio recording. The platform also offers topic based video lectures recorded with the help of experienced instructors, in local language.

Social media is increasingly becoming an extension of people's lives in the digital domain and accounts for a significant portion of our daily time. While it currently remains largely a forum for networking and media consumption, it is a fertile ground for germination of initiatives such as spreading awareness about governance schemes and gauging public reaction through instant feedback. Geo-tagging by users on the basis of self-diagnosis or automated diagnosis at healthcare centers and time-stamp based monitoring, can be used on social media to quantify and check the spread of epidemics by enabling effective deployment of medical teams, for instance.

Good governance can never be truly optimal unless corruption and other unhealthy practices are reduced to the minimum. A successful example of this is the 'e-Stamping' initiative. Collection of Stamp duty is one of the major source of revenue for the Government of Punjab. Out of this, high value Stamp Papers (PKR 1000

and above) constitute ninety-five percent. The 'E-stamping' initiative addressed process issues, fraudulent practices and revenue losses. However, it also added value into the system with digitizing transaction records for verification and record purposes. Available across Punjab, 2.7 million stamp papers worth PKR 72 billion were issued since May 2017. In addition to this, approximately 4.7 million unique visitors have visited the E-Stamping website. The highest revenue recorded in a single day is PKR 316 million.

The smooth internal functioning of government institutions is also requisite in order to ensure elimination of external bottlenecks. The setting up of biometric systems, for instance, is a step in that direction. Technical trainings are also equally important in this regard. All provinces conduct specialized I.T trainings in order to equip their employees with improved ICT skills, thus enabling them to foster innovative thinking.

Governance is like a living organism-constantly adapting and evolving. We have to sow the seed of change today for reaping benefits in the future which needs good leadership to bring about reforms, relevant institutional support and a people-centric approach. Developing countries like Pakistan face a daunting challenge of limited human and financial resources. At the same time, however, there is a pressing need for effective use of existing resources by preventing corrupt practices and leveraging technology for their efficient allocation. The introduction of IT-based initiatives can help achieve these tasks. More importantly, the dividends of these initiatives in terms of institutional capacity building and improved service delivery are significantly large to offset their nominal cost to the public exchequer.

Opinion

Enhancing Agriculture Outputs Through Technology

Dr. Yousaf Zafar

Chairman
Pakistan Agricultural Research Council
(PARC)

Despite the fact that the contribution of the agriculture sector to national GDP slid down from 21.7 percent in 2010-11, to 19.5 percent in 2016-17,[1] the sector plays a central role in national development, food security and poverty reduction.The performance of the sector is significantly dependent upon the vagaries of nature - recent years has seen a fluctuating growth rate owing to changing hydro-climatic conditions. Use of technologies in agriculture is a potential way to counter-balance or cope with the adverse effects of natural variances and ensure sustained agricultural growth. Technological innovations are the key to significant improvements in agricultural productivity and sustainable economic growth in agrarian economies.

Water is an indispensable input along with other inputs of production, such as improved seeds and fertilizer. However, fresh water is the most limiting resource when it comes to agriculture development in Pakistan, owing to increased demands from other competing sectors (e.g. domestic, industrial and environment). In addition, the challenges posed by the rapidly increasing population and changing climate, have put additional stress on the availability and distribution of fresh water. Hence, agriculture is very likely to face frequent and significant water shortages during coming years. In order to sustain food security for a rapidly growing population, efficient agricultural practices are essential to increase agricultural productivity. Thus, irrigation technologies play a vital role in improving water use efficiency at the farm level, resulting in reduced demands for irrigation water. Some promising technological innovations include:

Effecient Water Use Technologies

a. Furrow-bed Irrigation

The furrow-bed (raised-bed) irrigation system permits growing of crops on beds with water applied only in furrows. This technique has been tested for various crops and has proved quite successful for cotton, wheat and maize. Among surface irrigation methods, the raised bed technique permits more efficient use of irrigation water as compared to basin or border irrigation.[2] This technique reduces deep percolation losses, increases crop production and is appropriate for soils having low permeability, seasonal water logging, salinity and shortage of water supply.[3] Plants are grown on raised beds which not only utilize irrigation water more efficiently, but also ensure better crop growth under heavy rains.[4] Experiments conducted on water productivity improvement through furrow-bed irrigation system delineated that the water productivity of wheat and maize improved by 10 to 20 percent, and 20 to 40 percent under the large furrow bed system, respectively[5,6]. Ridge and furrow-bed irrigation innovations are being adopted for cotton, maize and vegetable crops. However, mechanization is important for upscaling and out scaling these initiatives.

b. Low Pressure Trickle Irrigation System

Trickle (drip) irrigation systems harness the ability to deliver water and fertilizer to the 'root zone' of plants more efficiently than other forms of irrigation. Trickle irrigation is a means of increasing the efficiency of irrigation water by reducing deep percolation. These are important goals for irrigated agriculture, which faces pressure to reduce environmental impacts. Drip irrigation delivers water and fertilizer directly to the roots of plants, thereby improving soil moisture conditions. This has resulted in yield gains of up to 100 percent, water savings of up to 40 to 80 percent, and associated fertilizer, pesticide, and labor savings over conventional irrigation systems.[7] Trickle irrigation systems are generally permanent, have low

Figure 1: Drip Irrigation System in Plastic Tunnels

1.   Ministry of Finance (2017), "Economic Survey of Pakistan 2016-17, Chapter 2: Agriculture." Available at http://www.finance.gov.pk/survey/chapters_17/02-Agriculture.pdf

2.   Hassan I, Z Hussain and G Akbar. Effect of permanent raised bedss on water productivity for irrigated maize-Wheat cropping system. Australian Centre for International Agriculture Research Proceeding 121, of a workshop on "Evaluation and performance of permanent raised beds cropping systems in Asia, Australia and Mexico". 1-3 March, 2005. Grifith, NSW, Australia (2005).

3.   Qureshi R H, and E G Barrett-Lennard. Saline agriculture for irrigated land in Pakistan: A handbook of ACIAR (1998).

4.   Berkhout M. Farmers' used of basin and beds and furrow irrigation systems and the possibilities for traditional farmers to adopt the beds and furrow irrigation method. International Irrigation Management Institute. Report No. R-33 (1997).

5.   Mahmood, N, K Hussain and M Saeed. Irrigation techniques for efficient used of irrigation water in Wheat and cotton. Journal of Drainage and Water Management 3(182): 22-27 (1999).

6.   Yasin, M., M.M. Ahmad, A.A. Bhatti, Q. Hussain, A.G. Mangrio. Water productivity improvement through furrow-bed irrigation system. In a book titled "Sustainable Water Management in Developing Countries – Challenges and Opportunities". F.A. Memon, A.K. Ansari, M.I. Bhangar, R.B. Mehar and M. Memon (eds) ISBN: 0-9539 140-4-6. The Print Masters, Karachi, Sindh, pp: 213-218 (2010).

7.   Moyo R, Love D, Mul M, Mupangwa W, Twomlow S. Impact and sustainability of low-head drip irrigation kits, in the semi-arid Gwanda and Beitbridge Districts, Mzingwane Catchment, Limpopo Basin, Zimbabwe. Phys Chem Earth A,B,C 31:885–892 (2006).

labor requirements and lower energy requirements as compared to sprinkler systems because of lower operating pressure requirements.[8] They have the potential to use scarce water resource more efficiently if designed properly.

c. Sprinkler Irrigation Systems

This water effecient system uses sprinklers operating at pressures ranging from 70 to 700 kPa (10 to over 100 psi), to form and distribute 'rainlike' droplets over the land surface. Sprinkle irrigation uses a spray or jet created by expelling water from a nozzle. These innovative systems are designed to apply water at rates that do not exceed the soil's rate of infiltration to prevent surface runoff. Sprinkle systems are often a practical alternative for sloped or shallow soils. The uniformity of application is dependant upon the position and placement of the sprinkler/s. These systems are affected by wind and uniform distribution may be limited. Sprinkle

systems have high initial cost and maintenance requirements. They also use high operating pressures, which is a large energy requirement. These 'raingun' sprinkler irrigation systems have been installed in various parts of Pakistan for demonstration and introduction of the technology. In rainfed areas, these systems are being used for supplemental and life-saving irrigations to fruits, vegetables and field crops. Timely application of irrigation water through these raingun sprinkler systems, at the critical growth stage, is known to double crop yields.[9] The pre-sowing irrigation (rouni) is also being applied with this system to sow various crops. Fodders, wheat, sunflower, groundnut and chickpeas have been successfully irrigated with raingun sprinkler irrigation systems. A new technnology, the centre pivot sprinkler system, is also being introduced in Pakistan. This system is good for large and progressive famers. Sprinkler irrigation systems are capital intensive and

need to be adapted for major crops in new command areas[10] of small dams and other lands under development outside the Indus Basin.

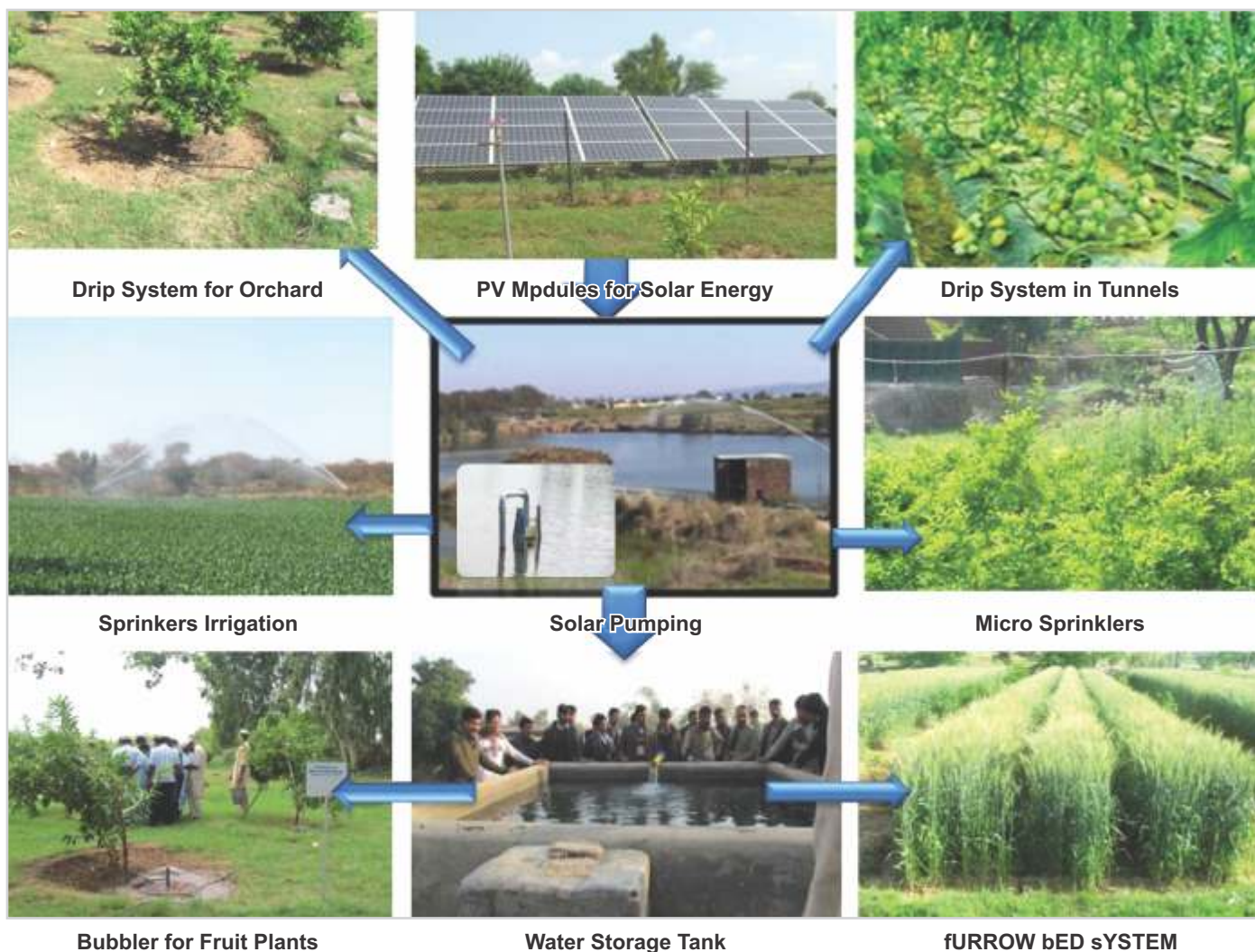### Figure 2: Raingun Sprinkler System for Cereal Crops

Solar Powered Technology

a. Solar Photovoltic Energy Use

The annual potential of solar energy lies at 1,575–49,837 exajoules (EJ).[11] This is several times larger than the total world energy consumption. In 2011, the International Energy Agency said that "The development of affordable, inexhaustible and clean solar

Figure 3: Mini-dam's command area development through integration of solar pump, irrigation techniques and high-value crops (fruits and vegetables)

Drip System for Orchard — **PV Mpdules for Solar Energy** — **Drip System in Tunnels**

Sprinkers Irrigation — **Solar Pumping** — **Micro Sprinklers**

Bubbler for Fruit Plants — **Water Storage Tank** — **fURROW bED sYSTEM**

---

8. James, Larry G. Principles of farm irrigation system design. John Wiley and Sons, Inc, New York (1993).
9. Ahmad S, M Yasin, A A Bhatti, M Aslam. Benefits of supplemental irrigation of wheat crop under rainfed farming systems. Pakistan Journal of Biological Sciences, 2(1):167-173 (1999).
10. The area which can be irrigated from a scheme and is fit for cultivation
11. UNDP, UNDESA and World Energy Council (2000), "World Energy Assessment." Available at http://www.undp.org/content/dam/aplaws/publication/en/publications/environment-energy/www-ee-library/sustainable-energy/world-energy-assessment-energy-and-the-challenge-of-sustainability/World%20Energy%20Assessment-2000.pdf

energy technologies will have huge longer-term benefits. It will increase countries' energy security through reliance on an indigenous, inexhaustible and mostly import-independent resource, enhance sustainability, reduce pollution, lower the costs of mitigating global warming, and keep fossil fuel prices lower than otherwise. These advantages are global. Hence the additional costs of the incentives for early deployment should be considered learning investments; they must be wisely spent and need to be widely shared." [12]

Adoption of solar powered pumps and irrigation systems is basically a climate change mitigation strategy. PARC however, has strived for its integration with micro-irrigation and high-value agriculture as an adaptation strategy to the changing climate. This intervention is not only saving water and energy, but improving livelihoods of poor farmers. The Climate Energy and Water Resources Institute (CEWRI) of PARC developed on-farm integration of irrigation technolgies and solar photovltic pumping systems. Its on-farm piloting in various ecologies, especially to develop minidam command areas of the Potohar region, is gaining popularity among farming communities. Moreover, the commnad area of dugwels and prenial nullahs (small canals) are also being developed through this intervention. Punjab and Sindh Governments are adapting high efficient irrigation systems on an area of 120,000 and 110,000 acres, respectively. Moreover, the Punjab government is adapting solar-powered drip irrigation on an area of 20,000 acres. PARC has developed research cum demonstration sites in various ecologies related to solar powered high efficient irrigation systems, since 2010. The model farm sites at Fatehjang and Chakri have been used as demonstration and training sites for farmers and extension workers. The fatehjang site uses a DC powered solar pump of 5 HP integrated with high-efficiency micro irrigation to address the issue of energy and water shortages. This helps irrigate the entire command area of the minidam through highly efficient irrigation systems; fixed and portable sprinkler irrigation systems for cereal crops, drip system for fruit crops, integrated drip lines for vegetable in plastic tunnels, bubblers for fruit plants, micro sprinklers for vegetable/nurseries and furrow bed irrigation for cereal crops which are integrated with the solar pump (Figure 3).

Evaluation of solar pumping systems and irrigation technolgies delineate, that previously, the daily average dicharge rate of the pumping systems was 5.23 liters per hour (Ips). However, the average discharge rate from the solar pumping system was 5.73 lps over 06 hours (peak time), while during off peak the corresponding discharge rate was 4.07 lps, which was about 29 percent lesser than the peak rate and about 22 percent lesser than whole day average (5.23 lps). High reliability levels for both peak and off peak times demonstrated the effectiveness of the solar pumping system.

Each irrigation technology has different irrigation efficacies, therefore, the corresponding command area is impacted by the choice of irrigation technology, along with the cropping pattern. Moreover, results show that solar utility for agricultural purposes was heavily dependent upon the choice of irrigation technology selected for integration. Water smart technologies like drip, sprinkler, bed/ridge–furrow, and supplemental irrigation can not only significantly enhance command areas, but can also offer significant water based crops diversification on-farm. PARC, through its Climate Energy and Water Resources Institute (CEWRI), piloted the technolgies in various regions and they are now being upscaled by Punjab and Sindh governments for an area of more than 100,000 acres along the integration of these high effciency irrigation systems like solar drip. However, challenges of high initial capital investment, lack of technical and skilled manpower, service providers, marketing of products and other socio-economic factors, exist. Therefore, the appropriate irrigation technology is essentially required to best utilize the expensive solar photovoltic pumping system. Without this prerequisite, only suboptimal returns can be expected from capital intensive pumping systems. Thus, to optimize land and water use efficiency and to address climate change adaptation and mitigation actions, there is a need to integrate solar water pumping systems and irrigation technologies for command area development of minidams/farm ponds in each region of Pakistan.

The potential areas of this intervention are:
• Potohar region (2 mha); 1300 mini/small dams, 2000 ponds
• Main Indus Basin with less than 12 acre farmlands, preferably in areas with shallow and good quality groundwater
• Riverine areas (in all four provinces)
• Revitalizing desert farming (Thal and Thar)
• Sindh and Coastal areas for drainage purposes
• In Balochistan where rainwater harvesting has been done (100 small dams project; 45 completed) and more than 10 MAF potential exist
• Lands beside banks of nullahs/rivers in hill ecologies

Enhancing Data Collection through Technology

Geographic Information Systems (GIS) and Remote Sensing (RS) technologies provide useful instruments for data capturing and processing that can be helpful in communication within agriculture planning and management processes. PARC has taken several initiatives and is involved in undertaking projects related to climate change and its adaptation through CEWRI, keeping in view the future implications of climate change in the country. Satellite remote sensing data of LANDSAT ETM+, SPOT, Aster etc. can be analyzed in GIS for identification, classification and characterization of resources.

Some GIS based local accomplishments include:
➢ Landuse mapping was conducted at provincial and country level and vegetation zonation was performed using GIS and remote sensing techniques;
➢ The cropping pattern of the country was mapped district wise of Rabi and Kharif crops;
➢ Spate irrigation region of Pakistan was delineated and inventory of rod-kohi units was developed.[13] Overall water resource potential of about 10.4 BCM was identified in the rod-kohi region of Pakistan, which can be utilized to bring approximately 1.0 million ha of land under irrigation; and,
➢ The wheat crop acreage was assessed through RS analysis at the National Agricultural Research Council (NARC) research station.

The Past and the Future

Agriculture is a backbone of Pakistan's economy. There are vast gaps between the acquired and actual output of produce, which suffers due to a lack of appropriate technological interventions. The cost of production also remains a big challenge for growers in Pakistan. The need is to explore possibilities as to how technology could be used to overcome this and further channelize the inherent potential of the industry through investments and incentives.

The year 2015-16 saw dismal performance of the agriculture sector when it registered negative growth of 0.19 percent against 2.53 percent of the same period in the last fiscal year. In order to keep the economy

12. International Energy Agency (2011). For further reading, please visit https://www.iea.org/Textbase/npsum/solar2011SUM.pdf
13. Ashraf, A.; Mustafa, N.; Iqbal, M.B. 2015. Composite Analysis of Landuse and Groundwater Resources of Rod-Kohi Region of Pakistan using Geoinformatics. Mehran Univ. Res. Jour of Engg & Tech. 34(1): 9-17.

thriving and the sector flourishing, new funding programmes that are focused on technological interventions for the development of the agricultural sector, should be developed. Measures to achieve this would include the use of technology to achieve ultimate boost for the benefit of all.
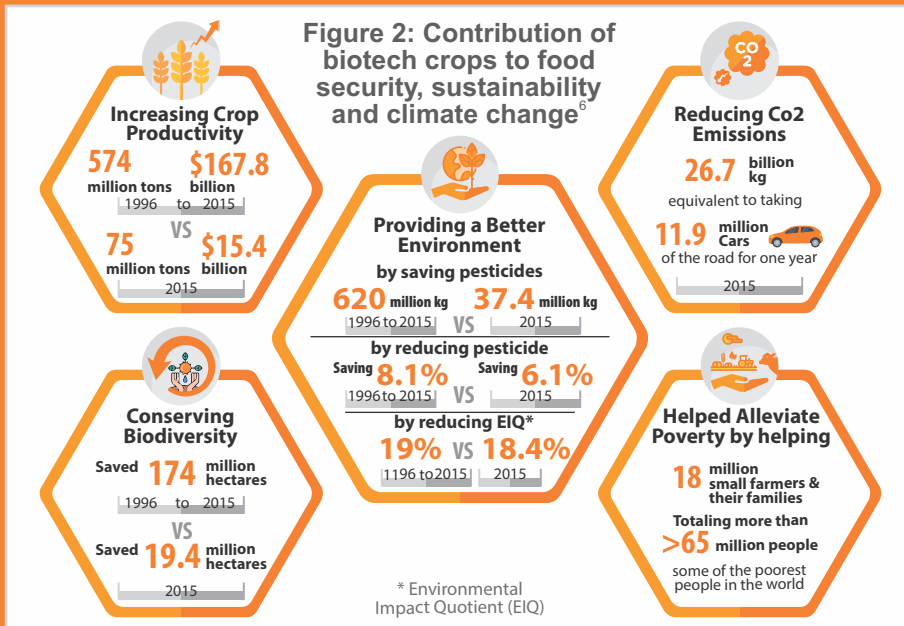
Genetically Modified (GM) Technology for Quicker Yields

By: Shaukat Ali

Principal Scientific Officer, National Institute for Genomics and Advanced Biotechnology National Agricultural Research Centre (NARC)

This year marks the 22nd anniversary of the commercialization of Genetically Modified (GM) crops. Between 1996 and 2017, the global area under GM crops increased to 185.1 million hectares, thereby speaking volumes regarding the worth and credibility of this modern science technology. GM technology has till date, been incorporated into 12 crops, and successfully commercialized in 26 countries (Figure 1). Soybean has been the leading GM crop, over the last few years, covering a global area of 50 percent.[1]

Globally, Pakistan ranks 7th in terms of area covered under GM crops. Despite acquiring the capacity to produce transgenic plants, transgenic cotton is the sole commercial GM crop so far in the country, granted approval for commercial release in the year 2010, though cases of a number of other crops are in the process of commercialization. Pakistan is a signatory to the World Trade Organization, Convention on Biological Diversity (CBD) and Cartagena Protocol on Bio Safety (BPB). National Biosafety Guidelines were promulgated in April 2005 under which a
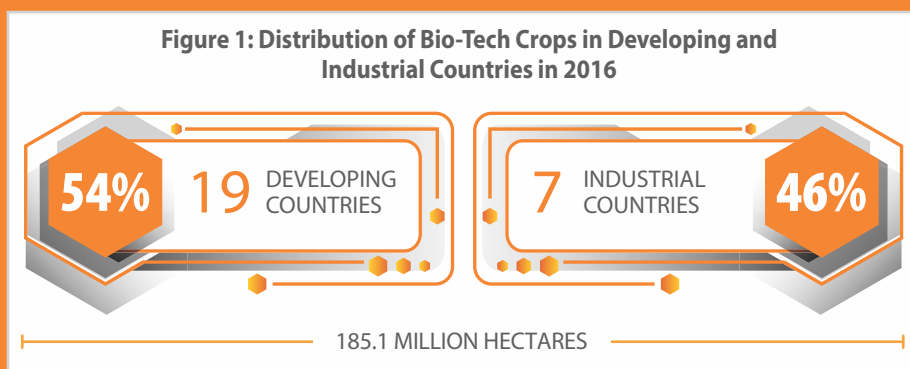

Figure 2: Contribution of biotech crops to food security, sustainability and climate change[6]

Increasing Crop Productivity
574 million tons 1996 to 2015 — $167.8 billion
VS
75 million tons 2015 — $15.4 billion

Providing a Better Environment
by saving pesticides
620 million kg 1996 to 2015 VS 37.4 million kg 2015
by reducing pesticide
Saving 8.1% 1996 to 2015 VS Saving 6.1% 2015
by reducing EIQ*
19% 1196 to 2015 VS 18.4% 2015

Reducing Co2 Emissions
26.7 billion kg
equivalent to taking
11.9 million Cars
of the road for one year
2015

Conserving Biodiversity
Saved 174 million hectares 1996 to 2015
VS
Saved 19.4 million hectares 2015

Helped Alleviate Poverty by helping
18 million small farmers & their families
Totaling more than
>65 million people
some of the poorest people in the world

* Environmental Impact Quotient (EIQ)

Source: ISAAA (2016), "Global Status of Commercialized Biotech/GM Crops: 2016." ISAAA Brief No. 52. ISAAA: Ithaca, NY. Available at http://www.isaaa.org/resources/publications/briefs/52/executivesummary/pdf/B52-ExecSum-English.pdf

three body regulatory system has been established. The National Biosafety Centre has been set up for the implementation of National Biosafety guidelines. 42 Bt cotton[2] varieties and three GM events[3] have been approved for commercial cultivation so far.

Contribution of GM Crops to Food Security

GM biotechnology has the potential to enhance food production by 5-6 percent, through breaking specific and generic barriers, required to move genes. It also provides tolerance for biotic[4] and abiotic stresses[5] for which there are no natural sources of variation. For example, it helps to mitigate the effects of climate change. Water saving and high yielding per unit land crops, will ensure the food security of

Figure 1: Distribution of Bio-Tech Crops in Developing and Industrial Countries in 2016

54% 19 DEVELOPING COUNTRIES

7 INDUSTRIAL COUNTRIES 46%

185.1 MILLION HECTARES

1. ISAAA. 2016. Global Status of Commercialized Biotech/GM Crops: 2016. "Biotech Crop Highlights in 2016." ISAAA Brief No. 52. ISAAA: Ithaca, NY. Available at http://www.isaaa.org/resources/publications/pocketk/document/Doc-Pocket%20K16-2017.pdf

2. Bt cotton is a crop that has been genetically modified by the insertion of one or more genes from a common soil bacterium, Bacillus thuringiensis.

3. A genetically modified organism (GMO) and all subsequent identical clones resulting from a transformation process are collectively called a transformation event.

4. Biotic stress is stress that occurs as a result of damage done to an organism by other living organisms, such as bacteria, viruses, fungi, parasites, beneficial and harmful insects, weeds, and cultivated or native plants.

5. Abiotic stress is defined as the negative impact of non-living factors on living organisms in a specific environment.

6. Source: ISAAA (2016), "Global Status of Commercialized Biotech/GM Crops: 2016." ISAAA Brief No. 52. ISAAA: Ithaca, NY. Available at http://www.isaaa.org/resources/publications/briefs/52/executivesummary/pdf/B52-ExecSum-English.pdf

Additional Sources Consulted

• Ahmad M M, M Yasin, Z Hussain, G Akbar, Z Khan Application uniformity and pressure variation in locally developed trickle irrigation systems. Journal/Procc. of the Pakistan Academy of Sciences 40(2):151-158 (2003).

• Mangrio A G, Z H Dahri, M Z Ikram, B Ahmad. Hydraulic characterization of locally manufactured drip emitters. Pak. J. Sci. Ind. Res. 50 (3): 218-222 (2007).

• Nayak P, Bhattacharjee P R. Agricultural Growth and Price Fluctuation Luctuations: A Case Study of Production and Prices of Potato in Tripura, General Economics and Teaching 0509010, Econ WPA (2005).

• Nayak P, Bhattacharjee P R. Agricultural Growth and Price Fluctuation Luctuations: A Case Study of Production and Prices of Potato in Tripura, General Economics and Teaching 0509010, Econ WPA (2005).

• PARC Final Report of the Project "Water productivity improvement through high efficiency irrigation systems". Natural resource division, Pakistan agricultural research council (PARC) (2010).

the country. An important step, which is needed at this stage, is the formulation of a National Biotechnology Policy in the country. Crops and incorporated traits must be prioritized according to the capability potential of national research institutes and universities. Public-private partnership should be strengthened to disseminate benefits of modern biotechnology.

Thus, biotech crops can contribute to a

Future of GM Technology- A Game Changer

National biotechnology research institutes of Pakistan have been trying to achieve food security goals while manipulating genes from diverse and exotic sources. Despite the diverse and widespread beneficial applications of biotechnology products, there remains a critical challenge of strict regulatory issues at national and international levels, which is thereby

improvement of agricultural crops through precise manipulation of plant genomes.

As biotech crops enter the third decade of planting/commercialization, game changing innovations are projected to revolutionize development of new biotech crops and traits. The first generation of biotech crops targeted input traits of herbicide tolerance, insect resistance and virus resistance, where farmers and food

Global Map of Biotech Crop Countries and Mega-Countries in 2016

#1 USA*
72.9 Million Has.
Maize, Soybean, Cotton, Canola, Sugar beet, Alfalfa, Papaya, Squash, Potato

#4 Canada*
11.6 Million Has.
Canola, Maize, Soybean, Sugar beet, Alfalfa

#22 Portugal
<0.05 Million Has.
Maize

#15 Spain*
0.1 Million Has.
Maize

#26 Czech Republic
<0.05 Million Has.
Maize

#25 Slovakia
<0.05 Million Has.
Maize

#7 Pakistan*
2.9 Million Has.
Cotton

#23 Bangladesh
<0.05 Million Has.
Brinjal/Eggplant

#8 China*
2.8 Million Has.
Cotton, Papaya, Poplar

#17 Mexico*
0.1 Million Has.
Cotton, Soybean

#19 Vietnam
<0.05 Million Has.
Maize

#20 Honduras
<0.05 Million Has.
Maize

#24 Costa Rica
<0.05 Million Has.
Cotton, Soybean, Pineapple

#11 Bolivia*
1.2 Million Has.
Soybean

#5 India*
10.8 Million Has.
Cotton

#18 Colombia*
0.1 Million Has.
Cotton, Maize

#14 Myanmar*
0.3 Million Has.
Cotton

#21 Chile
<0.05 Million Has.
Maize

#9 South Africa*
2.7 Million Has.
Maize, Soybean, Cotton

#13 Philippines*
0.8 Million Has.
Maize

#3 Argentina*
23.8 Million Has.
Soybean, Maize, Cotton

#16 Sudan*
0.1 Million Has.
Cotton

#12 Australia*
0.9 Million Has.
Cotton, Canola

#2 Brazil*
49.1 Million Has.
Soybean, Maize, Cotton

#6 Paraguay*
3.6 Million Has.
Soybean, Maize, Cotton

#10 Uruguay*
1.3 Million Has.
Soybean, Maize

*18 biotech mega-countries growing 50,000 hectares, or more, of biotech crops.

'sustainable intensification' strategy, allowing production to be increased on the current 1.5 billion hectares of global crop land, thereby saving forests and contributing to food security, sustainability and climate change (Figure 2).

hindering the use of transgenic plant biotechnology, considering public concerns.

Gene editing has also emerged as a powerful biotechnology tool for functional genomics research in plants and genetic

producers benefited with economic gains worth 574 million tons valued at USD 167.8 billion in 1996-2015. These benefits also provided accessible food and nutrition for the 7.4 billion global population. The second generation biotech crops included stacks of these traits, as well as drought

tolerance-one of the problems related to climate change. Third generation biotech crops focused more on output traits for improved quality and composition, geared towards consumer preference and nutrition. These include the various health-improving products of soybean for humans and animals (eg. omega-3 fatty acids), modified starch/sugar (potato), non-browning potatoes which are already available; non-browning apples etc. Acceptance of such biotech crops can contribute in the reduction of food waste due to browning and easy spoilage of products.

Innovative molecular biology tools are continuously being developed and tapped to discover new genes that would make food available, accessible and nutritious. Staple crops such as rice, banana, potato, wheat, ryegrass, Indian mustard, chickpea, pigeon pea and sugarcane, among others, were improved to contain new traits for insect and disease resistance, drought and stress tolerance, improved nutritional content, and yield and biomass, among others.

The encouraging outlook is that technology, in conjunction with conducive policies, can double food production.

However, the doubling of food production cannot be realized by society unless it ensures that regulation of GM crops is science/evidence-based, fit for purpose, and to the extent possible, harmonized globally. Failure by global society to ensure timely and appropriate regulation on food production will have dire consequences. On one hand, the world will suffer because of inadequate food supplies, while on the other, the power of science and technology to produce a safe, adequate and assured supply of food for all mankind, will be rejected because of the dominant ideological voices of the opponents of the new biotechnologies.

Tech Startups and their Impact on Socio-Economic Development

Jehan Ara

President
Pakistan Software Houses Association
(P@SHA) & The Nest I/O

Jazeb ul Haq

Content Head
The Nest I/O

Tucked away on the third floor of an office building in Karachi, is the launch site for the next generation of Pakistani tech startups. Over the last three years, The Nest I/O, a Google for Entrepreneurs Partner, has helped over 130 startups take flight. Of our first six cohorts, 88 percent of startups are still operational, while 27 percent have secured varying degrees of funding. The Nest I/O is just one member of the larger tech community of Pakistan, in which government and non-government entities are playing their part in seeing our young tech startups flourish. Speaking from experience, the desire to invest resources into tech startups comes from the unwavering belief that technology can help accelerate the slow-turning wheels of development. Tech startups, with their ability to sidestep bureaucratic quagmires and come up with innovative and scalable solutions to the unique challenges found in the less developed world, have a key role to play in charting a sustainable future for Pakistan's economy.

29 percent of Pakistan is between the ages of 15 and 29, with 64 percent of the total population being below the age of 30.[1] Pakistan will have to add 1-1.5 million new jobs every year for the next 20 years to satiate this 'youth bulge'. By opening up new avenues of employment and creating new jobs in the market, startups will help shape the future of our workforce.

Startups also have a key role to play in empowering the women of Pakistan. With the World Economic Forum having ranked Pakistan as the second worst country on gender equality in its Global Gender Gap Index, the need for greater female empowerment has become not only a social necessity but also an economic need. To this end, startups like Sheops and Aurat Raaj are playing a key role. Sheops is a female-only curated online marketplace where women can buy and sell products from, and to each other. Sheops allows countless women to take up the mantle of entrepreneurship and grow their businesses in a safe and secure environment. Their meteoric rise from being a small Whatsapp group to becoming a vibrant community of a 100,000 members, was covered by Facebook as a success story.

On the social empowerment front, Auraj Raaj a digital content platform that educates, entertains and empowers women through inspiring and informative articles, videos, podcasts, case studies, animated films, workshops and through their 'chatbot'. It has been set up by a young Pakistani woman, for Pakistani women, with the aim to equip women and girls to make better life decisions and important contributions to society.

Apart from having her startup inducted into the IBM Global Entrepreneur program last year, the founder was recently awarded a seed grant from The Do School, an international incubator, for her latest project, Raaji-an interactive chatbot which aims to educate and entertain Pakistani adolescent girls with issues pertaining to gender and self-esteem. Aurat Raaj was also recently featured on a list of 14 change makers with global impact.[2] From honor killing to child marriages, the series educates, empowers and entertains young Pakistani adolescent girls with content that can save their lives and reduce shame surrounding gender issues.

The Pakistani tech ecosystem, though still in its infancy, is replete with examples of social entrepreneurs that are improving the quality of life for the underprivileged and the differently-abled. ConnectHear is a tech startup founded by a group of university students who are working to give a voice to the deaf and mute community. They offer video interpretation services to assist their users in their everyday tasks, be it opening up a bank account or purchasing groceries. Additionally, they have an online channel called ConnectTV, which produces news and infotainment content in sign language. Since the marginalization of the deaf community also has economic repercussions (such as the shrinking of the talent pool), ConnectHear is engaged with local corporations in helping them integrate the deaf community into their workplace. In a short span of eight months, they have amassed 18,000 users in over 40 cities from 8 countries. Recently, they also organized Pakistan's first ever deaf-inclusive music concert. Their eventual goal is to build a platform that will be able to

1. United Nations Development Programme (2018), "Pakistan National Human Development Report: Unleashing the potential of a young Pakistan." Available at http://www.pk.undp.org/content/dam/pakistan/docs/HDR/PK-NHDR.pdf
2. Huffington Post (2018). "14 Local Change Makers Making Global Impact." Available at https://www.huffingtonpost.com/entry/14-local-change-makers-making-global-impact_us_5a5e70a9e4b01203d8097674

convert audio input into Pakistani sign language.

Another such example is that of BoloTech, a health startup which aims to help those children who have speech and communication impediments. This startup was formed when two young female software engineers saw the dearth of qualified speech pathologists in Pakistan: there are only about 50 specialized speech therapists to cater to 36.4 million people with speech disorders. This prompted them to harness the power of technology to create a speech therapy platform that makes the speech therapy process more efficient for both the patients and the trainers. Within just a few months of their launch, their solution has already been implemented in a few local hospitals in Karachi.

ModulusTech, another startup, builds houses using environment-friendly materials with a low carbon footprint. It is the brainchild of three NED University graduates who came up with the idea in the aftermath of the Syrian refugee crisis. One of the key uses of their technology is providing low-cost shelter to refugees and IDPs (Internally Displaced Persons). Their housing solution is also earthquake and cyclone resistant. Their prototype has a lifespan of 30 years, and comes equipped with amenities such as electricity, plumbing, and ventilation. The 260-square ft. house can be constructed in three hours with the help of three workers for a nominal cost of USD 3000. Their affordable, flat-pack housing solution was awarded the "Special Commendation Award" at the United Nations Industrial Development Organization-Global Cleantech Innovation Program (UNIDO-GCIP) Global Awards in Los Angeles. The UNIDO-GCIP Global Awards brought together startups and entrepreneurs from around the globe, who work with clean technology to build a more sustainable future.

Healthcare, education and special needs are all areas that have needed disruption for some time. Startups in the technology space have recognized this and started to provide solutions. For example, Sehat Kahani (literally translated as 'The Story of Health') has recently received a substantial grant in recognition of their work in the tele-health space. What they do is simple. They have developed a platform that connects at home, qualified female doctors who are not part of the workforce, to underserved patients in low and middle income markets providing access to quality health care. So far through their network of 14 E-Health Hubs across Pakistan, they have served more than 550,000 patients directly and indirectly.

Another example of a startup working in the healthcare space is Azaad Health, an

online HIPAA compliant platform which allows healthcare providers and patients to share medical information. It is a complete health information management and data analytics tool which enables the transfer of health data seamlessly and securely. Their basic belief is that complete knowledge of a patient's health is crucial to save lives in critical and emergency situations.

Looking at another aspect of the health problem is ProCheck, a startup that is focusing on tackling the counterfeiting of pharmaceutical products. The combination of rampant counterfeiting of drugs and high mobile phone penetration in Pakistan paved the way for ProCheck to come up with a way to help medicine buyers be sure of authenticity. How it works is that when a consumer buys medicine, they would find an eight-digit alphanumeric authentication code printed on the back of the strips. All they have to do is SMS the code to 9900 and they are informed whether the medicine is authentic or not. An increasing number of brands, both in pharmaceutical and food products, are using this now.

WonderTree is another startup that has received both a government grant as well as accolades on global platforms for the work that they have done and continue to do. This team has been developing games using Augmented Reality for the therapy and education of children with special needs. Their mission is to make special education affordable, accessible and effective. Their product is in use at 7 special schools in the country and there is already interest from parents and special needs schools from across the globe. The kind of impact this product can create is unimaginable-not only in enabling kids with motor or cognitive disabilities to become more integrated into society, but also for use in the physical therapy needs of older people and patients who are recovering from accidents.

Another area that one startup is looking at is mental health. The founder of ReliveNow went through a depression phase which she was able to overcome through treatment and counseling at the right time. As a consequence, she felt that she was the right person to set up an online platform that connects psychologists with people looking for counselling and therapy. ReliveNow allows people to get the help they need without fear of being judged. Users are able to circumvent the stigma associated with going to a counselor by going through a seamless, cost-effective counseling experience, which can be accessed from the comfort of their own home.

These startups and many more are certainly an indication of a possible tipping point for Pakistan but only if essential pieces of the

eco-system are quickly put into place. Despite grave obstacles and difficulties, these young entrepreneurs continue to bet on the future of Pakistan. While some will fail as they do anywhere in the world, many more are likely to succeed. It is time for the Government of Pakistan (GoP) to step in and bet on these young entrepreneurs by providing the most critical missing piece which is early stage risk capital and financing the upfront risk in these startups.

Most people forget or are unaware that it was the US Department of Defense which financed key technology innovations such as email, touch technology, GPRS and other critical functions we take for granted. Silicon Valley therefore, is what it is because the US Department of Defense bore most of the early stage risk. The GoP has a unique opportunity to play a similar role for nascent startups and innovations in Pakistan, thereby providing an incentive to private capital to invest alongside and expand the entrepreneurial eco-system which needs critical capital infusion to go to the next level.

Assuming the early stage risk is a highly strategic intervention in the investment spectrum for the public sector, it is akin to laying down the tracks for a railroad everyone can then travel on and build upon. Pakistan's negative security environment has made it particularly tough to attract venture capital or private equity investors, however, even in normal environments, early stage risk takers are few and far between, and hence the public sector can play a very appropriate leveraging, catalyzing and enabling role without crowding out private capital. Moreover, a provision of relevant and well-structured capital to companies will give a positive signal to foreign investors that the GoP is very serious about building the eco-system by taking the early stage risk and backing Pakistani entrepreneurs with investment capital.

With all the giant strides that the technology sector has taken in the recent past, it would be easy to forget that the Pakistani tech space is still at an embryonic stage. The relevant stakeholders and actors have a responsibility towards providing this ecosystem with the nourishment it needs to become a self-sustaining life force for our economy. For this purpose, P@SHA, the primary body representing the tech industry of Pakistan, has been working closely with the government to enact policy reforms that can help promote the tech space in Pakistan. The P@SHA team worked hand-in-hand with the team from the Ministry of Information Technology and Telecom to pave the path for the latest round of the incentives package recently announced by the Prime Minister of Pakistan. The incentives include extension of tax holidays on I.T. exports upto 2025,

setting up of Special Economic Zones for the tech sector and the promise of financing from commercial banks at preferential rates. This is in addition to a three year tax holiday for all startups that was announced earlier by the federal government. These provisions will provide 'technopreneurs' with the support they need to set up successful businesses and take them to scale.

The government's decision to set up National Incubation Centers across the major cities of Pakistan is another indication of the fact that the state harbors great hope for, and realizes the importance of, the future of Pakistani tech startups. The setting up of these incubation centers within the premises of existing universities, will allow for greater engagement between the industry and academia. This will also

Opinion

Improving Health and Standards of Living Through Technology: A Case Study

Usman Khan

CFA IMC
Faculty of Economics, Lahore University
of Management Sciences

Lack of adequate health care facilities becomes a fatality for many. Evidence suggests that in Pakistan, a mother loses a child every 37 minutes due to a delay in responding to an emergency. Such is the story of Sadia Bibi, a resident of a remote village in Rural Hafizabad, in the province of Punjab. She lost her first child two years ago owing to the non-availability of appropriate and timely medical care responding to a complication during her delivery-a complication that the mid-wife was unable to address resulting in an irreplaceable loss for the mother.

Subsequently, the District Government Hafizabad in collaboration with the Department for International Development (DFID), under the European Union's District Delivery Challenge Fund (DDCF), implemented the Sub-National Governance Programme (SNG) meant to design an Integrated Ambulance Service for rural Emergency Obstetric and Newborn Care (EmONC). As opposed to previous public sector initiatives whereby ambulances were usually misused, the service was inaccessible by real users and the project would wrap up without any substantial outputs and a wastage of public funds, the EmONC initiative incorporated different dimensions of available technology to address several issues.

This project proved to be an exception from the norm, owing to its use of technology to achieve its purpose. The pilot was initially tested in the district by using a manual wireless system, meant to serve as a trial run for 'teething problems'. A detailed 'lessons learning' analysis was conducted to highlight bottlenecks in operating the ambulances and delivering services. Based on this, an integrated ambulance management system was designed with some critical features including; (a) Innovative use of Geographic Information System (GIS) technology to place the ambulance to optimize catchment area, as well as to ensure efficient routing to the nearest 24/7 Basic Health Units (BHUs); (b) An UBER[1] type software to trace the location and status of each ambulance on

ambulances contributed by the district government were placed across rural Hafizabad and managed through this system integrated with 24/7 BHUs, District Headquarter Hospitals (DHQs) and Tehsil Headquarter Hospitals (THQs) through the patient referral system. The pilot responded to over 8,000 emergencies with a maximum response time of 14 minutes. Over 5,000 of these were critical emergencies. One of these emergencies attended was of Sadia Bibi who was transported to a medical emergency and was able to give birth to a healthy daughter. The intervention in Hafizabad had a much broader impact. Data suggests that the 'less than one week infant mortality' number fell from 358, to only 115, a remarkable improvement in terms of lives saved (Figure 1).

Figure 1: Less than one-week Infant Mortality
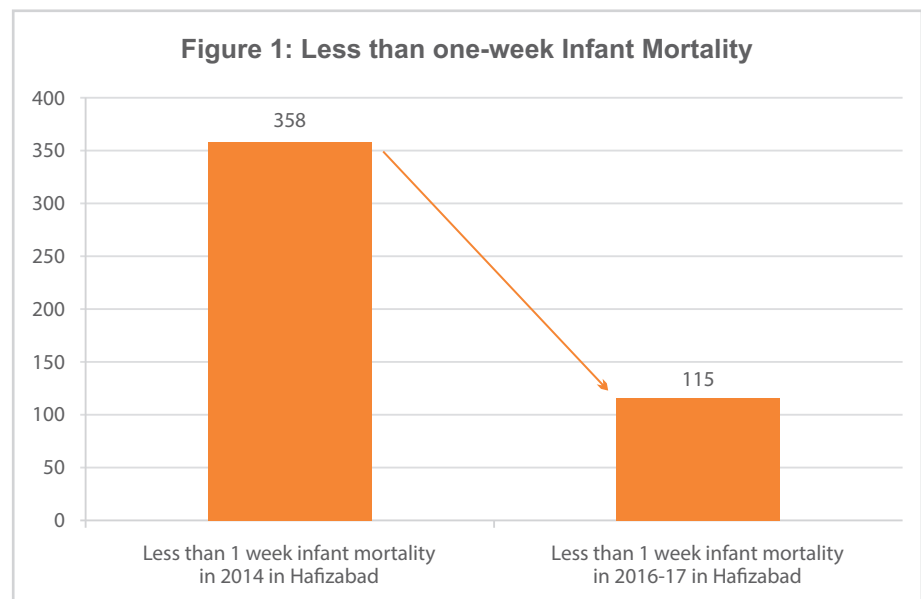
one screen with exact coordinates–this allows capturing ambulances that are engaged, free or out of service; (c) Equipping of each ambulance with a simple tablet that allowed audio video connectivity with the driver, tracked mileage, fuel consumption, response times and idle time for each ambulance, and made it available for monitoring at the central dashboard; and, (d) Integration of a patient referral facility that allowed the control room to notify health facilities in advance of the arrival of the patient. 15

Given the potential impact, the project has been scaled-up to cover all rural areas of the province under the 'Mehfuz Maa' (Protected Mother) Initiative. The service has added 450 ambulances and the total project cost exceeds PKR one billion. The service is now active in all rural areas of Punjab, managed through a central dash board and control room. The service is likely to support 1.5 million mothers annually and will critically impact upon the infant and maternal mortality statistic-a giant leap towards meeting the SDG agenda.

---

1. Uber Technologies Inc. is a peer-to-peer ridesharing, transportation network company headquartered in San Francisco, with operations in 633 cities worldwide.

Several other technology related interventions were also implemented under the DDCF, such as tele-diagnostic facilities to connect remote BHUs with doctors at a call centre, e-vaccination to ensure child traceability, and medicine inventory management at the BHUs.[2] With technical support and design integration provided by SNG, an integrated model of health management has been designed and is under implementation using technology as a common ground. As per the integrated system, patients walk into a BHU and are diagnosed using the tele-diagnostic set-up. Appropriate action is prescribed by the remote doctor; this may include calling emergency support, referral to a tertiary hospital or simple prescription electronically sent to the drug counter. The ANC follow up helps gather data on pregnant women who can not only be better traced, but in fact, the data is shared with the ambulance dashboard and e-vaccination setup for better planning and response. Figure 2 illustrates the integrated
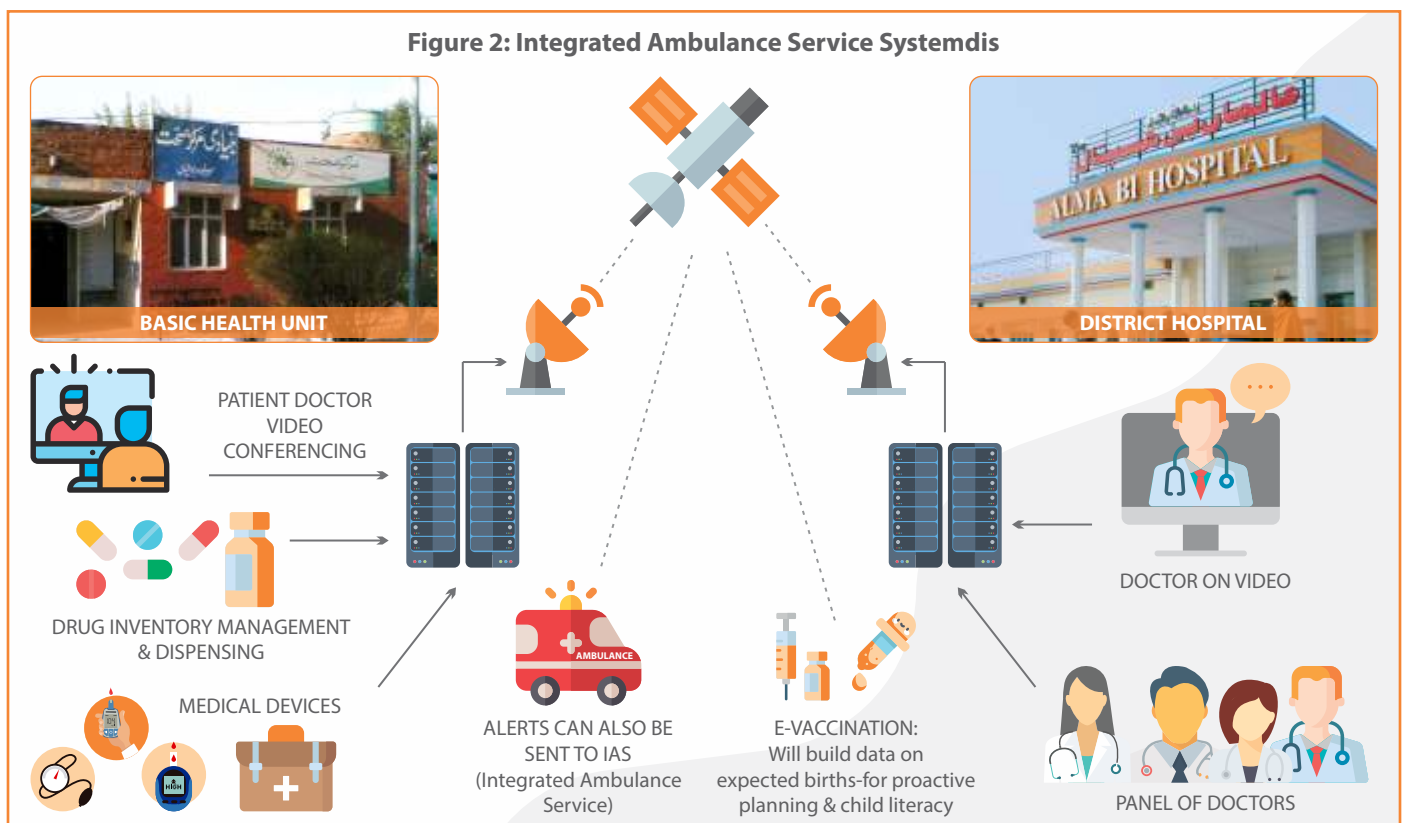
well as the medicine disbursement system to develop disease patterns specific to each BHU. These disease patterns are then being used in health planning meetings to take more informed and need based budgeting and planning decisions. Examples of this include addition of medicines for skin diseases, placement of nebulizers for children in winter months, sessions on hygiene awareness to avoid skin diseases and diabetes tracking etc. The district government created additional demands to procure blood sugar testing strips for this. Overall, the integrated system will produce credible data that can then be used for specific health profiling and ensure a transition to proactive and preventive health management rather than passive and curative-this will certainly employ resources more efficiently and will have lasting impacts on improving health service delivery.

The above examples demonstrate how technology has been gainfully employed to

solutions.

Hence, an appropriate use of technology can have a significant impact on the well-being of citizens. In rural Hafizabad, remote BHUs which were previously toughest to man, are now well connected using a technological solution and citizens do not have to travel to far off areas or spend extra costs to receive proper medical facilities at their doorstep. Such steps all contribute towards better living standards. Moreover, with better services, the citizens become aware about quality and are able to differentiate it from access only. The E-Vaccination project, that now ensures that each child is traceable in the system, is right in line with the SDG agenda of 'leaving no one behind', and is all possible due to a problem driven design supported by the optimal use of technology.

To conclude, a key lesson for those working on Information Communication technology (ICT) for development, is that

Figure 2: Integrated Ambulance Service Systemdis

BASIC HEALTH UNIT

DISTRICT HOSPITAL

PATIENT DOCTOR VIDEO CONFERENCING

DRUG INVENTORY MANAGEMENT & DISPENSING

MEDICAL DEVICES

ALERTS CAN ALSO BE SENT TO IAS
(Integrated Ambulance Service)

E-VACCINATION:
Will build data on expected births-for proactive planning & child literacy

DOCTOR ON VIDEO

PANEL OF DOCTORS

system.

The most important feature of this system is the collection and use of patient data for better and proactive planning. The district government in Sheikhupura (where the design was originally piloted) is using patient data from both the tele-diagnostic system that creates an electronic record, as

improve health outcomes and improve the standard of living of common citizens. It is important to realise, and as elicited in the examples above, that technology was used as an aid rather than the driver of change. The experiments were innovative in their nature as they first identified the actual problem, found a solution to it and then employed technology to aid efficient

technology solutions are usually complex whereas, development needs and solutions are usually hidden in much simpler interventions. The genius is to strike an optimal and workable solution that transforms complex technology to deliver simple needs of simple citizens, which can contribute towards improving lives.

---

2.   To access full details of these innovations please see, 'Healing Punjab' documentary available at https://www.youtube.com/watch?v=sDLF7SuuEkw&feature=youtu.be

Technology and Behavioral Reforms

Amna Batool

Director
Innovation for Poverty Alleviation
Lab (IPAL)

Aimen Shah

Program Manager
Innovation for Poverty Alleviation
Lab (IPAL)

Extreme poverty rates have been cut by more than half since 1990. While this is a remarkable achievement, one in five people in developing regions still live on less than USD 1.90 a day, and there are millions more who make just a little more than this daily amount. To compound this problem, people risk slipping back into poverty. Poverty is more than just the lack of income and resources to ensure a sustainable livelihood. Its manifestations include hunger and malnutrition, poor health conditions, limited or no access to education and other basic human rights, social discrimination and exclusion, along with the lack of participation in decision-making.

Since the turn of this century, the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) have focused on reducing extreme poverty in developing countries through betterment in health, education, agriculture, gender equality, water and sanitation, etc. Unfortunately, many countries not only missed the MDGs of 2015, but also face an even strenuous challenge with the post-2015 SDGs.

Pakistan has not made much progress regarding poverty alleviation. Food inflation is reversing the impact of any steps being taken to reduce poverty, and food insecurity is exacerbating the problem. To make matters worse, the global price shocks and financial crises have all undermined the progress of MDGs across most of the developing world.

Many of Pakistan's MDGs could have been achieved through proper strategies. Where policy makers play their role in defining implementation and execution strategies, we as technologists are doing our bit to improve sectors like health, education, agriculture, governance, etc. to improve the lives of people living at the bottom of the pyramid. Globally, quite a few technological interventions have shown positive results and that too, on a large scale. However, one size does not fit all.

Information and Communication Technologies for Development (ICTD) is a relatively new field that focuses on improving the lives of marginalized groups of people through technological solutions which are easily applicable and sustainable. IPAL focuses on field research to identify the root cause(s) of problems faced daily by low-income and low-literate communities in Pakistan and then come up with technological solutions to solve these problems. Our mission is to work on attaining, or at least getting closer to, the target SDGs, through technology-driven interventions/solutions to mitigate local problems that all contribute to poverty, such as working on providing better health, education, access to clean drinking water, etc.

Research reveals that most of the time, these communities do not have access to verified sources of information. Therefore, awareness raising is a preliminary step in ensuring behavioral change in the lower strata of society. However, information and education alone will not translate into behavioral change. While disseminating information and providing knowledge is a necessary first step, it is not sufficient to tip the scales in favor of behavioral change. On the basis of IPAL's research, there are various ways through which technology can be utilized to bring about behavioral change. A few areas of intervention are highlighted below.

Technology and Knowledge Acquisition
Approximately 303,000 women die each year worldwide, due to pregnancy or childbirth related complications. 99 percent of these deaths occur in developing countries, of which Pakistan alone is responsible for an estimated 30,000 deaths. Based on interviews with doctors, patients and direct observations, expecting mothers' lack of correct and timely information seemed to be a recurrent and prominent issue that an ICT intervention could target. Therefore IPAL developed an information system called MAA (Mobile Assistance for Antenatal), which was designed to provide basic antenatal care information through mobile technology, to expecting mothers who were categorized as normal risk pregnancies. Simultaneously, there were several women who were not the primary decision makers. Hence, the system was also employed to disseminate information to other members of their family as well. This revealed how a basic technological intervention, harnessed the power to affect lives in interlinked ways and on multiple levels.

Technology and Institutional Intervention
It is not easy to convince people to employ technology for improving their situation, whether at the micro or macro level. In such a case, designing a system which has room for a 'supervisory role' in order to induce long term and sustainable changes in behavior, becomes utmost important. To fulfil the World Health Organization's mission of vaccinating every child, an electronic vaccination system called 'E-Vaccs' was developed. Its primary aim was

Technological Interventions by IPAL:
a few examples

MAA (Mobile Assistance for Antenatal): A project aimed at informing expecting mothers having low income and low literacy about the most basic antenatal care through **mobile messages and/or robocalls**

Water ATM: A project which intended to curb filtered water wastage in Pakistan by designing a machine called water ATM, accessible by a **smart card**

WATER ATM

Har Zindagi – Every Life Matters: An immunization project to improve coverage and retention through a **digital immunization card**

Family Planning: A project designed to provide women accurate information via **information dissemination technologies** so that they may be able to choose an appropriate contraceptive method based on their specific health condition

FAMILY PLANNING

Gender and Technology: A project in collaboration with Google, to identify women's privacy, safety, content and access issues when it comes to shared mobile phone usage

---

to monitor the attendance of all field vaccinators. Under E-Vaccs, an immunization information system with an accompanying smartphone application for vaccinators was made, which also stored real-time immunization records onto a centralized database. Under this system, 3,750 smartphones with the mobile application loaded onto them, were provided to field vaccinators in a bid to improve their attendance. As a result, vaccination coverage improved from 36 percent to 94 percent, within two years. However, immunization retention[1] was still an issue. To address this, another technological intervention entitled, 'Har Zindagi – Every Life Matters', was developed to improve completion of vaccination courses and make a friendlier user-interface

for the immunization system.

Interventions like MAA, E-Vaccs and Har Zindagi have the capability to bring both technological and behavioral reforms. These projects have not just employed technical interventions to modify entire systems, but have also kept the needs of their end users and eventual beneficiaries in mind. This shows how technology may be put to good use and solve local problems, provided technological solutions utilize a user-centered approach. When feedback from the end user is incorporated into any system, it is bound to be more successful, simply because the user was part of the design process, therefore, in a stronger position to identify bottlenecks as well as useful features as

compared to developers in a lab.

The Power of Technology
Technology houses the potential to alleviate poverty through behavioral change. Knowledge flow is the first step, but it has to be followed by appropriate and timely steps, which are suited and adapted to each region's sensitivities. At the same time, not all problems have a technological solution, therefore technology must be used wisely. There will be times when technology can only do so much, and we need to take a step back so as to be able to evaluate the roles that other sectors and institutions can play in bringing the desired or requisite behavioral reform in such situations.

---

1. Retention refers to successful completion of the vaccination course (from 0 to 15 months of the newborn). Parents often used to forget their child's next vaccination date, and for diseases like measles, which have a significant time period between two vaccination dates, the dropout rates were very high.

Interview

Dr. Shahzad Alam

Director General
Pakistan Council of Scientific and Industrial Research (PCSIR)

Technology has widely been used as a tool to further social and economic development, be it through the digital realm or through innovative ways of doing things. In your opinion, what opportunities exist to be utilized in Pakistan in this regard? What challenges does the country face with regards to utilizing the full potential of technology and reaping development benefits?

Technological Change or Innovation is a fundamental force in shaping the patterns of transformation of the economy. As a consequence of the dynamics of technological change in a country, R&D organizations continuously have to expand and optimize their inhouse R&D by applying technological opportunities. Innovations are the results of a combination act of R&D activities and technological opportunities. R&D activities play a fundamental role, they aim at a systematic broadening of the existing stock of knowledge and its efficient application in the innovation process.

Technology, including the IT industry in Pakistan, has enormous potential for growth. Pakistan has the capacity to solve local issues using technology and communication methods. According to the Pakistan Entrepreneurship Ecosystem Report 2017, Pakistan has 360,000 software developers and 1,280 registered IT Companies and as a third largest supplier of experts for the leading contractor site freelancer.com, Pakistan is globally recognized for the quality of its softwares and web developers.

Challenges faced by Pakistan

Socio-Economic development is a multifaceted process, and a number of factors must dovetail together before economic growth and progress can occur.

The development process must be built on a foundation of high degrees of literacy and quality education at all levels. Pakistan has vast population at its disposal, and the challenge is to transform their energy/skills into wealth. In order to unleash their creativity, they must expose to a challenging educational environment that teaches them to think and find novel solutions to difficult problems.

The second important facet for development is a high level of expertise in the sciences. Pakistan needs to upgrade its universities and research centres to an internationally compatible level of excellence. Only when we have high-quality basic research in various fields and can work at the cutting edge of knowledge, will we have the capacity to utilize emerging and new technologies.

The third important facet of the development process concerns applied research and technology development. We must identify and launch focused projects directed at (a) Enhancing exports, (b) Fostering import substitutions, (c) Improving the quality and productivity of existing manufactured products, and (d) Bringing to market new and better products through supporting the creative talents of our technologists and engineers. This is a complex issue involving a strong linkage between research and industry.

The fourth facet of development involves government policies and mechanisms to encourage investment of entrepreneurs on indigenously developed products and processes. These measures include tax incentives, provision of risk capital by venture capital companies, protection of intellectual property rights, rationalization of import duty structures and much more business friendly policies.

The fifth and most important factor for success is involving the most creative people at all levels, which requires introducing measures that will persuade our brightest students to opt for science and technology when they are deciding on their careers. This involves introducing an appropriately attractive career structure and creating R&D institutions of international standards. Research grants must also be provided so that they can contribute meaningfully.

The public sector in the province of Punjab has been active as far as leveraging technology to address socio-economic needs is concerned. What lessons can other provinces learn to speed up the development discourse in their sectors via technological innovations? Are there any lessons or models from other countries that can be replicated?

Punjab Information Technology Board (PITB) is the biggest source of innovation of the public sector in the province of Punjab. The PITB's counter-extremism efforts are part of a larger digital government and technology-based development strategy in Punjab. In a province with low literacy but high mobile access—with less than a 50 percent literacy rate in rural areas, but 73 percent of the population with a mobile phone—the PITB has deployed phone and tablet-based systems to manage government services, fight against corruption and provide electronic-based services to the population. PITB has also established modern e-Khidmat Centres to facilitate general public in more than seventeen districts of the province.

Likewise, the other provinces may also follow the model of Punjab or they may realign the model as per their social requirement.

Lessons from other Countries

Progress of any sustainable development depends on the indigenous research and knowledge of the society in which it is implemented. Any successful adaptation and adoption of modern technologies has arisen from a scientific development of an indigenous knowledge system.

Women's involvement is also a crucial element in the development process. Women are actors in – as well as beneficiaries of – development. Women need science and technology to serve their development needs and should actively participate in the setting of priorities for how technological innovations can be used to address these needs. Countries that provide equal opportunities for women in education and in science and technology have shown to have positive effects – not only on the women themselves, but also on society as a whole.

Capacity-building is also needed at all levels – government policymaking, labor force skills, education and R&D, and enterprise development and innovation. We should focus our efforts on building and strengthening indigenous scientific, technical, vocational and engineering capacity to select and use existing global knowledge resources, in order to meet our country's needs for sustainable development.

Similarly, entrepreneurs add to national income. Entrepreneurial ventures generate new wealth. Existing businesses may remain confined to the scope of existing markets and may hit the glass ceiling in terms of income. New and improved products, services or technology from entrepreneurs enable new markets to be developed and new wealth to be created.

Additionally, increased employment and higher earnings contribute to better national income in the form of higher tax revenue and higher government spending. This revenue can be used by the government to invest in other, struggling sectors and human capital.

How can the use of technology be streamlined into national plans and policies in order to achieve the SDG goals? What role do you envisage for the government to promote the use of technology?

The Sustainable Development Goals (SDGs), otherwise known as the Global Goals, are a universal call to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. The SDGs are unique in such a way that they cover issues that affect us all. They reaffirm our national commitment to end poverty, permanently, everywhere. They are ambitious in making sure no one is left behind. More importantly, they involve us to build a more sustainable, safer, more prosperous planet for all humanity.

Governments alone cannot implement the SDGs. Collaboration with the private sector, civil society, universities and educational institutions will be required to promote the use of technology for achieving the SDG Goals.

However, the role that the government can play in achieving the SDGs goals is by: helping to design SDG-based policies; encourage SDG-oriented research and development; incubating new sustainable development businesses, such as hosting startup high-tech companies; SDG-based training of future sustainable development leaders through cross-disciplinary and experiential learning; and fostering multi-stakeholder engagement.

The importance of encouraging youth potential to achieve the SDGs must be emphasized, as well as the ability to assist them financially and educationally. Youth is not only the future; youth is also the present, and the most powerful weapon to build a better world by 2030.

I will focus on one important component of innovation: government support for R&D. The effective commercial application of new ideas involves much more than just pure research. Many other factors are relevant, including the extent of market competition, the intellectual property regime, and the availability of financing for innovative enterprises. That said, the tendency of the market to supply too little of certain types of R&D provides a rationale for government intervention; and no matter how good the policy environment, big new ideas are often ultimately rooted in well-executed R&D.

Looking ahead, many SDGs are within reach if we follow the example of some top performing countries over the Millennium Developmental Goals (MDGs) era, like Maldives, Cambodia and Panama. However, if we ever want to realize the SDGs and strive for the future we want, change should start now.

Globally, start-ups and the private sector have played a leading role in creating and implementing innovative technological mechanisms to benefit the society at large. In your opinion, what role are and can, start-ups and the private sector play in Pakistan in this regard?

Start ups and private sector are the primary driver of economic growth and dynamism and have great potential to promote sustainability. They create many high paid jobs; invest heavily in R&D,and are more likely to export their goods and services. Small and Medium Enterprises (SMEs) are also major source for job creation.

A private sector can turn the youth bulge from a liability to an asset, paying out a "demographic dividend". Pakistan's enormous youth population is often perceived as a threat to its stability, with large numbers of disaffected young people facing poor employment prospects.

Start ups and the private sector contributes to an increase in Pakistani consumer spending. As Pakistan's population moves into cities and into its prosperous late twenties and early thirties, demand for consumer goods is expected to increase rapidly. Pakistani consumer spending has already seen a 7.5 percent compounded annual growth rate since 2007. Multinational corporations that operate in Pakistan's consumer goods sector have seen high revenue growth, including Unilever, Colgate-Palmolive, Nestle and QMobile. QMobile is all about innovation, being the first local mobile phone company to enter a saturated market, it has penetrated quite deeply. These companies have actually experienced faster growth in Pakistan than their global average.

In addition, foreign assistance programs for Pakistan should encourage local Pakistani businesses to expand into the rapidly growing consumer sector.

In the case of Pakistan, our major problem is the historically low private investment/GDP ratio. To provide an impetus to private investment, the government needs to improve the enabling domestic policy environment and the overall allocative efficiency and productivity of public investment. Pakistani businesses should also explore better tapping the regional value chains that have

emerged as key drivers of growth in East Asian countries.

How can technology be employed in fragile areas to improve the rule of law and enhance socio-economic opportunities?

Quality education plays an important role in promoting socio-economic development, improving health and nutrition and reducing maternal and infant mortality rates. Quality education has used technology for centuries, from blackboards to textbooks, yet in recent history very little has changed in how education is delivered.

I conclude ultimately that, if smartly and strategically deployed, modern information and communications technology holds great promise in helping bring quality learning to some of the world's poorest and hardest to reach communities. The strategy for doing so need not emulate the trajectory of educational technology use in wealthier developed nations. Indeed, in some of the most remote regions of Pakistan, mobile phones and other forms of technology are being used in ways barely envisioned in Pakistan. Necessity is truly the mother of invention in these contexts and often leads to creative and promising ends for teachers and learners.

These areas need to develop a community-based platform where an appropriate order of things can help actualize the promises of ICT for reducing poverty of income and opportunity in a sustainable and equitable fashion. PCSIR, being a premier R&D organization of Pakistan, is striving hard towards the capacity building of the people and believe that socio-economic development is directly linked with the development of human capital. Potential to plan and manage development activities can only be enhanced among people once they are organized and provided access to necessary skills.

Khurram Zafar

Director
National Incubation Center
Lahore University of Management Sciences

Technology has widely been used as a tool to further social and economic development, be it through the digital realm or through innovative ways of doing things. In your opinion, what opportunities exist to be utilized in Pakistan in this regard? What challenges does the country face with regards to utilizing the full potential of technology and reaping development benefits?

Pakistan has a long way to go before realizing the full benefit that adoption of technology offers for socio-economic development. We can start with the very basic - moving from paper based processes to digitizing data capture so it can be searched, analyzed and used for extracting intelligence for policy making. Something done very effectively by NADRA, but numerous government entities still need to follow suit. The major impediment in adoption of even basic data capture processes is the lack of trained work force and vested interests that do not want transparency brought about through automation.

The public sector in the province of Punjab has been active as far as leveraging technology to address socio-economic needs is concerned. What lessons can other provinces learn to speed up the development discourse in their sectors via technological innovations? Are there any lessons or models from other countries that can be replicated?

While the government sector in Punjab has done some wonderful work, it has also failed to develop public and private sector capacity by in-sourcing all development within one government department. The model of Ignite, a federal government technology fund, is something that other provinces can replicate for more scale-able and lasting impact. Ignite's numerous interventions in collaboration with the private sector, will ensure capacity building, more disparate ownership of various projects, and leverage the skills and experience of a wide range of socio-economic actors wanting to bring about positive change through adoption of technology. The nationwide web of National Incubation Centers setup in collaboration with the private sector is a prime example of it. They are already producing startups like PakVitae solving the clean water problem, and Mauqa, a marketplace for generating employment at the bottom of the pyramid.

How can the use of technology be streamlined into national plans and policies in order to achieve the SDG goals? What role do you envisage for the government in promoting the use of technology?

The government needs to first embrace technology itself and commit to transparency and accountability. Ideally, this technology is procured from local vendors instead of importing tech from outside the country. Short of that, at the very least it should avoid uninformed policy interventions that curb innovation in the private sector. Policies that tax the revenue of young technology startups that are still not profitable, or mandate a small company to incur the cost and time overhead of monthly sales tax reporting, are some of the draconian measures that illustrate this point. Thanks to the efforts of Ignite, BOI, some informed members of the planning commission and a lot of lobbying by PASHA, these issues are being addressed, at least partially.

Globally, start-ups and the private sector have played a leading role in creating and implementing innovative technological mechanisms to benefit the society at large. In your opinion, what role are and can, start-ups and the private sector play in Pakistan in this regard?

Startups, research in leading universities and several development and private sector initiatives have the potential for pervasive impact in Pakistan and the region. Unfortunately, they don't find sustained support to fuel their growth. Development projects tend to have a fixed duration. Startups have a short life before which they either need to raise funding to fuel the next stage of their growth or die. Public funds that co-invest with the private sector can alleviate this to some extent. Additionally, a dedicated, fully funded organization staffed with private sector experts can be created to scout, fund and commercialize innovations in academia that can address the SDGs and exploit other commercial opportunities that the research offers.

How can technology be employed in fragile areas to improve the rule of law and enhance socio-economic opportunities?

I remember an entrepreneur at Startup Cup from a couple years ago, who had built a data analytics based, multi-variate model to loosely predict terror attacks. I don't think he got any traction locally but did manage to raise millions in the United States to form a data analytics startup. That's a lost opportunity for Pakistan. Internet in general, and internet based educational initiatives like Khan Academy, offer an unprecedented opportunity to educate our kids from all backgrounds, whether studying in madrassas or the most elite schools, to benefit from a well-rounded education. Just enabling access to internet can yield huge benefits here.

Interview

Faisal Khan
Cofounder and CEO
Peshawar 2.0

Technology has widely been used as a tool to further social and economic development, be it through the digital realm or through innovative ways of doing things. In your opinion, what opportunities exist to be utilized in Pakistan in this regard? What challenges does the country face with regards to utilizing the full potential of technology and reaping development benefits?

Pakistan has traditionally benefited from technology only in limited sectors such as the I.T. services (software development) sector and some new areas like the public sector (or what we like to call e-governance, etc.). There is also a discourse developing around concepts like civic innovation, open data, digital rights and cybersecurity. I believe serious opportunities lie ahead in using technology in other, more substantial, sectors of our economy like health, medicine, agriculture, livestock, energy, etc. I believe serious adoption of technology in these major sectors will bring out the real value in terms of socio-economic development.

In terms of barriers and challenges, there still remains a lack of understanding and therefore a genuine buy-in into the role of technology at the highest level (beyond digitizing some records in a department), let alone coordination between departments to spur adoption and innovation in different sectors. For example, to build capacity, deploy and to benefit from Big Data, there needs to be a serious, coordinated effort between the Education, Higher Education, Science and Technology, Industries, Commerce and Planning and Development departments. This can't be seen at the moment.

There is also an inherent, self-defeating problem in the way we 'pitch' the role of technology, say in government departments. You cannot expect officials to be open to technology when the first thing you target is digitizing their attendance and forcing everyone to use the biometric scanner (perceived as an implication that everyone is a defaulter!). Why would they accept technology as something positive and as an 'enabler'? It is like evangelizing that Artificial Intelligence is going to replace everyone, even doctors, and then requesting the same doctors to adopt electronic medical records. We need to be more nuanced and empathetic.

The public sector in the province of Punjab has been active as far as leveraging technology to address socio-economic needs is concerned. What lessons can other provinces learn to speed up the development discourse in their sectors via technological innovations? Are there any lessons or models from other countries that can be replicated?

Punjab has been lucky to have seen numerous digital initiatives in the past few years. Some of these have shown interesting results. I think other provinces should follow suit – especially after an impact assessment to understanding which interventions had more impact. I strongly believe technology interventions have to be contextualized wherever they are deployed. Unfortunately, this 'social science' side is usually ignored in tech circles.

Governments need to show agility in keeping track of all the trends and developments in different technologies since timeliness is of essence when investing in, and drawing value from fast-moving technological trends. For that, there has to be enough local capacity in any government to 1) Understand what the technology, and 2) To understand how it can benefit their citizenry in their local context. Dubai, for instance has shown incredible leadership in terms of adopting technology from big data sand genomics to the latest developments in block chain technology. How many departments in our government are aware of what block chain is?

How can the use of technology be streamlined into national plans and policies in order to achieve the SDG goals? What role do you envisage for the government in promoting the use of technology?

This goes back to a previous point where we said the higher-level leadership in any government has to develop a deeper understanding of what technology today means and how it can benefit their citizens. Only then there be a genuine interest and buy-in into adoption of technological solutions and investment into high tech. Only this can enable high level coordination and alignment to goals like the SDGs for the benefit of the country. The government needs to show urgency in adopting new approaches to technology like Open Data and leveraging the local tech ecosystem through Civic Innovation. The government needs to identify clear and specific goals for high priority sectors where technology adoption can provide maximum returns and also strategize to invest in the latest trends including artificial intelligence and robotics, augmented and virtual reality, genomics and synthetic biology. This will allow us to build critical mass in these new areas of technology, catalyze the 'production' of high tech and enable us to benefit from the fourth industrial revolution.

Globally, start-ups and the private sector have played a leading role in creating and implementing innovative technological mechanisms to benefit the society at large. In your opinion, what role are and can, start-ups and the private sector play in Pakistan in this regard?

According to a Kauffman Foundation study, startups (companies younger than 1 year of age) were responsible for the net creation of 70 percent of jobs in the US over a recent 20 years period. This goes on to tell us the powerful potential startups have for addressing the unemployment challenge. Startups are companies that inherently have to be innovative, work on new technologies tackling new problems in new areas. These are high risk areas, but at the same time promise high reward as well, when successful. The acquisition of Whatsapp for USD 19 billion (roughly twice the annual exports of Pakistan in that year) and the fact that a small 120-person gaming company has profits exceeding the combined profits of top players in Pakistan's textile, banking, oil and gas, electricity, cement, automobile and sugar industries, delineates the scale of revenue that successful startups can generate in the technology domain and their implication for our provincial and national GDPs.

The startup ecosystems in major cities of the country are growing fast with several praise-worthy government interventions (Planning Commission and HEC's National Centers, Ignite's funding to innovative startups, National Incubation Centres, initiative by KPITB and PITB, etc.) and I believe this growth can be further accelerated if a more coordinated effort is made at scale to foster the private sector in general, and these growing startup ecosystems in particular.

How can technology be employed in fragile areas to improve the rule of law and enhance socio-economic opportunities?

With the increasing penetration of 3G and 4G services, increasing access to remote and fragile areas of the country is natural, taking new and innovative economic opportunities to the farthest corners of the country. This includes new models of education, tele health services and jobs such as freelancing which is proving to be a decent way for talented youngsters, especially girls, to earn from the comfort of their homes. There is a lot more room for innovation that needs to be tapped.

Increasing access also means more and more people use mobile and internet services which helps in tracking criminal activities when the right instruments are in place. Digitizing criminal records also helps in faster and cheaper conflict resolution, for example, the efforts of KP IT Board in digitizing the FIR in police stations across Malakand to cite one example.

Interview

Tahir Mahmood Chaudhry

President & CEO
Pakistan Institute of Entrepreneurship

Technology has widely been used as a tool to further social and economic development, be it through the digital realm or through innovative ways of doing things. In your opinion, what opportunities exist to be utilized in Pakistan in this regard? What challenges does the country face with regards to utilizing the full potential of technology and reaping development benefits?

In the public sector, areas that can be explored further in using the power of technology include health care and education. Promoting technology to aid development can only come about through awareness trainings and the will to implement. Good governance is also a crucial factor.

The public sector in the province of Punjab has been active as far as leveraging technology to address socio-economic needs is concerned. What lessons can other provinces learn to speed up the development discourse in their sectors via technological innovations? Are there any lessons or models from other countries that can be replicated?

The province of Khyber Pakhtunkhwa is also an active player in terms of leveraging technology for development. Police reforms and the District Management System are both successful examples of the use of technology in the area. It is important that provinces share 'lessons learnt' so that similar mistakes can be avoided in future practices.

How can the use of technology be streamlined into national plans and policies in order to achieve the SDG goals? What role do you envisage for the government in promoting the use of technology?

The 18th Amendment has created a challenge in terms of development spending, with all provinces absorbed in individual spending in silos when there should be a collective effort and collective plan of action across the country. In order to achieve this, it is important to return some devolution powers back to the Federal Government so as to bring coherence in spending. Only when this issue is tackled will it be possible to move onto other branching ones, such as absorbing technology in national policies and plans.

Globally, start-ups and the private sector have played a leading role in creating and implementing innovative technological mechanisms to benefit the society at large. In your opinion, what role are and can, start-ups and the private sector play in Pakistan in this regard?

In order to find innovative solutions, startups require a lot of guidance to first understand the scope of issues. Hence, awareness is key, foremost, followed then by utilizing technology and other tools to aid development.

How can technology be employed in fragile areas to improve the rule of law and enhance socio-economic opportunities?

Technology can be used to positively influence the culture of the region and bring about attitudinal shift. Whichever sector it is utilized in, in fragile areas, it will bear fruit provided there is awareness and the will to implement.

Youth Voices

Tallal Ahmad

Research Associate,
Fintech Center, International
Technology University

"Given the proliferation of mobile technologies, technology can be leveraged for dissemination of information, and can really bring about behavioral change and improve living standards in developing countries like Pakistan. Youth comprises 17 percent of the global population and can bridge the 'technological divide' through early adoption of technology in all areas, as opposed to those before them."

"Development in technology is parallel to the development of nations, as nowadays technology has become an essential part of our lives. Our youth has many ideas: their passion and drive to change the world can enable them to deliver something extraordinary and revolutionary for the development of technology."

Aaira Suhail

Student

Hafiz Muhammad Umar Shehzad

Educator/ Maker-space Manager

"To solve development challenges, technology can be best utilized by using it as a tool to enhance research and design practices. As much as there is a need to teach technological skills to the youth to solve development challenges, combining them with social sciences and development studies will help make these technological interventions sustainable."

Youth Voices

"Technology can serve as agent of development especially for underprivileged communities. It can be utilized to provide customized learning solutions in both education as well as technical skill training, thus helping these communities to improve their living standards."


M Asad Manzoor

Software Engineer (I.T Services)

"Smart use of technology, especially in developing countries, can do wonders. In Pakistan for instance, technology has been used to combat crime, disease and tax evasion through data collection. This data collection has been made possible by technological innovations such as geo fencing etc, Youth is a catalyst for change. Not only are they the future, but they are also the early adopters of technology. This quality sets them apart in being the most suited vehicle to translate technology into development."

Beenish Fatima

Research Associate

"Technology is creating a noteworthy impact in the social, economic and political sectors of the nation. Youth tends to be innovative, creative and adaptive so they stand a bigger chance to benefit more from the rapid growth of technology. Being the potential beneficiaries of access to technology, the youth can play an active role in implementing technological solutions for all problems."
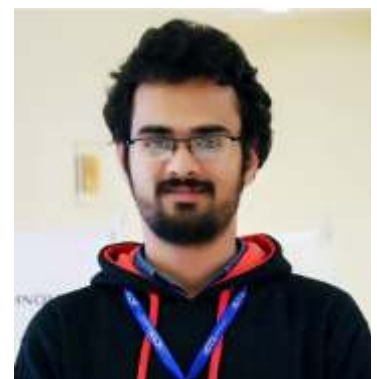
Muhammad Umair Anwar

Electrical Engineer

DEVELOPMENT ADVOCATE
PAKISTAN