**S&T Policy for Pakistan**

*The countries of developed world have realized the importance of S&T led growth and prioritized it in budgets, law, policies and functions. The late comers also followed the same and leapfrogged their progress like China, India, Malaysia, Singapore and South Korea. We can simply call them* ***Entrepreneurial******Governments****. The countries like Pakistan are yet unable to prioritize S&T and unable to catch the waves of fast progress.* ***They might miss the future if continue ignoring S&T led growth.*** *This article raises basic questions as how the leadership of developing country like Pakistan will realize significance of S&T led growth and what priorities areas to fix in the early stage are.*

1. **Pakistan National Security Lies in Science and Technology (S&T)**

The science and technology makes the nations strong and secured. This S&T helped the nations win wars and stay ahead of the enemy in defence technology. Pakistan was threatened by the nuclear technology and secured by the same when Prime Minister Bhutto said: “we will eat grass but acquire nuclear technology”. The S&T father of USA, Dr V. Bush wrote the same concept to the president of the USA in “Science- Endless Frontier” He said that USA and allies won war due to investment in science and better technology. The instrument of national security and competitiveness lies in uninterrupted policies and investments in science and technology. The USA led the world in the last few decades due to leadership in economics based on science, technology and innovation. The case of other leading countries also reflects that growth, competitiveness, security and development are backed by science and technology.

* **National Security Depends on Science and Technology**

The human history is known for most unwanted phenomenon wars. The innovative techniques, tools and instruments played a critical role in the national defence of the nations. The balance in war technologies helps nations avoid wars and resolve conflicts through dialogue. Therefore nations invest heavily in defence related technologies and use them in civil purposes also by innovative new applications. We enjoy many good technologies these days earlier invented for defence purposes. Pakistan invested heavily and uninterruptedly in defence-related science and technology. Therefore Pakistan is a nuclear power, competitive in many defence technologies and exports defence-related products. The civil use of these technologies is not explored nor exploited to great extent yet.

* **Food Security Depends on Science and Technology**

Food security is a basic need of every society. The food security is reflected by many indicators like the supply of high-quality economical food, disease-free crops, high yielding varieties and sustainable food packaging. The countries invest heavily to ensure smooth supply of food to the citizen. The human history also travelled from stone-age to agriculture age. The human earlier learned to produce a variety of food in varied seasons and weathers. Pakistan is producing 11 million bales of cotton for the last 3 decades due to innovation by a scientist of NIAB. Pakistan does not have the policy to protect innovations of plant breeders and variety developers. The scientist and the institutions got nothing in terms of royalty or reward. The lack of S&T policy for IP killed the spirit of innovation in Pakistan in the agriculture sector. Therefore Pakistan is left behind in agriculture innovation in every aspect. We import agriculture machinery, variety, pesticides, fertilizers, seeds, and other value-added processes. We import flowers and herbs to produce medicine. Pakistan food security is at risk due to lack of S&T policy initiatives, less S&T investment and particularly S&T as least priority of Govt till today.

* **Health Security Depends on Science and Technology**

The health security of a nation can be determined by its level of dependency on foreign sources. Pakistan imports basic drugs (APIs) from India, China and other countries. The problems in supply from one major supplier can lead to high cost of medicine. Pakistan needs to invest in the science of medicine to produce running drugs and save foreign reserves of billions. The new age of drugs is emerging around microbiology, biotechnology and marine biology and synthetic biology. Pakistan seriously lacks S&T policies in the area of biological science, technology and industrial production.

Pakistan was dependent on others in health care solutions due to S&T negligence. Pakistan will remain dependent as still no interest in S&T is making Pakistan unable to catch next waves of health technologies. Pakistan is left behind in health tourism and can develop 1-2 medial specializations to attract patients from all over the world. Pakistan needs to invest heavily in science and research of universities and medical schools. Pakistan invests heavily in cure side ignoring prevention and community health. This makes Pakistan vulnerable to disease attacks. The focus needs to be a shift from cure to prevention and promotion of healthy lifestyle in public.

* **Economic Security Depends on Science and Technology**

The economic drivers change over the course of new inventions and innovations. Now we know that the owner of an app can run the largest car company without purchasing a single car. The little chip maker can be richer that farmer of 1000 acres due to a great factor of value addition and technology. The largest economies of the world are tech economies. They have invested heavily in science to explore new patterns of nature. They produce more innovative products and solutions.

Pakistan has no choice but to prioritize science and technology to create innovative economic activities. The investment in science will help Pakistan to shift from raw material export to value-added export. Pakistan export chromite ore for Rs. 25000/- per ton. Pakistan can export dichromate for Rs. 125000/- per ton if required processing technology is developed.

The raw material economy can never be competitive nor can achieve high export targets. Only value-addition through innovative technology can ensure the economic security of Pakistan. Pakistan has a high rate of brain drain due to the traditional economy. The investment in new technologies will create new ventures, generate employment opportunities and increase the growth of businesses. Pakistan needs required S&T policies to connect innovation with economics and provide an enabling environment for science led ventures to grow and prosper.

* **Social Security Depends on Science and Technology**

The adoption of new technologies, increased education, globalization and urbanization put high pressure on existing social values. The change in living style demands new rules of social living. The social fabric demands new knitting demanded from regulators, policymakers and executors. Cybercrimes is one reflection of this new technology led social networking. The Govt investment is needed to formulate laws, develop new technologies and design execution to ensure social security of people. In the modern world, there is the emergence of a shared economy. People share homes, room, cars, offices, and many other private resources. There is a need for many new technologies to facilitate this sharing, ensure security and protect citizens from any possible harm.

The social sharing is another new phenomenon in human life where private data is shared through tools and devices. The misuse of data creates a lot of social problems. A recent well-reported an incident of leaking pictures of male and female sitting inside the car by some employees of the concerned department created a lot of social issues in the society.

The government needs to invest in data security related technologies to protect the social life of people.

**The Summary**

The speed of technology change is very fast. The countries need to invent, innovate, diffuse and reinvent continuously. The process is not possible without active and dynamic science and technology policy culture. The S&T policy creates an entrepreneurial state that pro-act for new challenges. According to a World Bank report, Pakistan S&T sector is salary paying machine with zero budget to produce any output. We have 300 S&T organizations whereas our export is very less.

At the moment, Naya Pakistan is without competent S&T minister, S&T advisor, and parliamentary committee for S&T, parliamentary secretary for S&T or any other high powered S&T position. The Government has set up a task force for knowledge economy headed by very competent scientist, *Dr Ata ur Rahman*. He has revolutionized the higher education of Pakistan. The nation expects the same role of high highness in the S&T sector too.

1. **11 Areas of Science and Technology for S&T Led Growth**

Pakistan needs serious efforts to develop and implement science and technology policy for better socioeconomic development. Pakistan has latest S&T policy 2012 waiting for the attention of Government. We present here some inputs critical to implement S&T policy in Pakistan.

1. **Government Ownership and Entrepreneurial State**

Historically Science and Technology are driven by the state with the help of competent scientists. General Park Chung-hee of Korea picked *Dr Choe* to initiate S&T led growth. President *Franklin D. Roosevelt* of USA picked *Dr Vannevar Bush* to lead S&T growth in the USA. There are such other examples indicate that S&T growth needs the leadership of scientists backed by serious support of Government. We saw this demonstration when *Dr Ata-ur–Rahman* was given the leadership role to bring revolution in higher education, fully backed by the Government. Pakistan achieved S&T growth in the 1960s and 1970s due to the leadership role of the scientists. Unfortunately, after that S&T was delisted from the state priories and headed by the non-scientific community. S&T led growth also demands entrepreneurial behaviour of the state showing full ownership of country affairs. The blame game phenomenon can serve nothing. Pakistan stands at around *[[1]](#footnote-1)126th* in innovation. This means 125 countries out of around 140 are ahead of Pakistan in innovation. The entrepreneurial state must take this as responsibility, proactively take measures and promote S&T to bring ranking down to around 50. Pakistan S&T should be governed by the board of competent experts to create a dynamic culture of performance and rewards. The government needs to be entrepreneurial one and facilitate in all the aspects of innovation supply chain as discussed in the following section.

1. **S&T Incentives for Innovators**

The humans are driven by incentives. The governments always design lucrative incentives to achieve its development goals. S&T in Pakistan touched the dead end due to zero incentives for innovators to solve local problems. The government must come up with very attractive incentives for the scientists having will and capacity to supply innovations for local problems of Pakistan. Pakistan has crossed BRIC countries in the area of publishing *“Highly Cited Papers”*. But Pakistan did not cross BRIC in agriculture mechanization, hybrid seeds, ICT export and other applied development areas. The scientists find incentives in publishing and not in supplying innovation to solve local problems. Pakistan is funding research projects for five decades. The life of labour making bricks manually under the burning sun has not improved a little in the last five decades. The facial reflections of little kids playing on mud along with bricks making mothers question about R&D in Pakistan.

1. **S&T Incentives for Industries/Investors**

The real estate in Pakistan skyrocketed due to very high profits on investments. Private sector investments in R&D touched the bottom because there is no profit in R&D investments. Pakistan lacks regulations and legislation regarding venture funds. Industry finds insignificant incentives to pour money in R&D and spend 4-5 years to develop innovative products in collaboration with local innovators. Pakistan needs to announce S&T incentives like zero import duty on R&D imports, reduced duty for five years on import substitution and export-oriented innovative products, five years tax credit for university-born innovations and one window operation for startups/R&D venture. These kinds of incentives will attract private incentives to invest in R&D and help the government to build a knowledge economy in Pakistan.

1. **Strengthening IP Regime**

Pakistan has ignored developments in the area of IP protection. This has resulted in low motivation for technology development and commercialization. The week IP culture is worsened by poor law enforcement and legal support. Pakistan registers a patent in 6 years whereas the USA grants a patent in 2-3 years averagely.

Pakistan needs S&T policy related to strengthening IP organization, improving law enforcement, develop specialized judiciary system for IPR, promoting IP education from school to university, launching specialized degree program in IP management, developing human resource in IP management and fostering IP commercialization.

1. **Students and Faculty Training for Technology**

The faculty and students in Pakistan are not trained for technology development nor inspired to take challenges of supplying innovations. The academic system needs to shift its focus from data to concept-based learning. The learning and teaching should shift from contents delivery and memorization to application based projects and assignments. The faculty needs to get projects from the market and assign students to work on real-life problems of community and industry.

The university governance system should not allow students to pass without good skills based on real-time projects. The faculty needs to be appraised for real-life research based on market inputs. Faculty should be spared to interact with community and industry, spend time there and do summer internship in the fields to get training on technology development.

1. **Funding for Technology**

Pakistan has only one fund for technology development by HEC, which is initiated recently in 2017. Rest of the funding programs aimed to fund science and research. This caused serious weakness in the capacity of Pakistan to develop prototypes and diffuse technologies. Pakistan needs S&T policy to initiative minimum 10 technology funds in few identified S&T priorities. These funds should be available only for prototyping and commercialization of academic research results. This funding also should be based on industry partnership and economic viability. TDF–HEC is an excellent example and needs to be replicated across 10-15 disciplines.

1. **Inquiry-Based Science in Schools and Colleges**

The technology output is mostly expected from graduates at higher education level. Their prior academic training from school to college highly affects their performance in higher education. In the advanced world, the students are trained to deal with the inquiry, solve problems and discover new ways of business in the previous 12 years of education. In Pakistan, they are trained to memorize and they do the same when reaching higher education. This inculcates blocked thinking leaving no room to think freely and independently.

Pakistan must reframe the education system from Ratta to inquiry-based teaching and learning. The students from family to school and college should be inspired to think and develop curiosity about nature and life. They should be given such training and environment where they can challenge the existing rules of business and invent a new one. This will help them to develop innovative solutions when joining higher education and create new ventures to solve global problems.

1. **S&T Policy as Subject in Academia**

All the developed countries in the world offer degree programs in S&T policy, innovation management, technology and IP management. These countries develop own human resource to deal with S&T policy affairs. S&T policies are guided by leaders having a proper education in science, technology and policy formulation process. Unluckily, there is the only one-degree program in Mehran University on science and technology policy. S&T policy needs to be endorsed by HEC. HEC needs to encourage universities to launch S&T policy programs to provide a trained human resource.

1. **International S&T Collaborations**

Pakistan yet needs to speed up its journey in science, technology and innovation through proper policy implementation and dynamic leadership. The world has made tremendous advancements in this area. Few countries started the same S&T journey 200 years before the birth of Pakistan. Few started much after Pakistan but leapfrogged the progress. Pakistan needs to learn from these countries and develop collaboration in S&T policy areas. The ideal countries would be UK, South Korea, China and USA. Pakistan needs to launch joint degree programs on S&T policy education. Pakistan needs to make some arrangements to bring advanced technologies and build local capacity. The S&T collaborations with developed world help Pakistan learn the technology business quickly and incorporate best practices into own systems and culture. Pakistan can increase export many times by initiating S&T collaborations with developed countries and develop own technology capacity for innovation and value addition.

1. **Vocational Training for S&T**

The countries have strong vocational capabilities can only rise to great innovation level. The technology business in production setup cannot be advanced unless handled by highly trained skilled workers. The precision in machining and tooling is must to produce innovation based value-added products. The high standards of quality of products by advanced world rely on their sophisticatedly trained and skilled workers. Pakistan in spite of many attempts could not make a big mark in the area of vocational training. We are yet supplying raw labour to our own industries and to the international market also. The highly skilled labour can increase Pakistan foreign revenue many folds in form of remittances. The innovation capacity of industries in Pakistan also heavily depends on technically skilled workers. Pakistan should make vocational training as a top priority to provide employment also.

1. **Quality Standards and Enforcement**

Innovation rests and prospers in the environment of quality standards. The market having products standard enable innovators and thinkers to compete on innovation, creativity and unique ideas ensuring compliance with minimum standards. The poor standards and poor compliance like we have in Pakistan encourage duplicators to produce very low quality products and kill the spirit of innovation and creativity in the society. Nobody can invest in R&D if there is risk of being copied and low quality duplications.

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1. *Global Competitiveness Report 2017-2018* [↑](#footnote-ref-1)