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Information Sharing: The Missing Ingredient in Science, Technology and Innovation Policy of Pakistan-Agriculture Perspective

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ABSTRACT

The purpose of this paper is to focus on the important role of information sharing in advancing innovation that is presently missing in National Science, Technology and Innovation (STI) Policy of Pakistan approved in 2012. Information is a key resource for making innovations in science, technology and policies. Like other countries of the world, almost all government departments in Pakistan continuously collect information according to their mandated responsibility. The ultimate objective of this information collection activity is to benefit it for making decisions. But sound decisions require information that has been evaluated and synthesized persuasively. Information that is developed or accumulated from multiple sources and is objective, reliable, accessible and usable. Then this information is benefited for decision-making in thrust areas such as metrology, environment, health, energy, biotechnology, agriculture, water, minerals and ocean resources. We take the example of agriculture mentioned as one of the thrust areas in the National STI Policy of Pakistan and investigate which types of information is necessary for making innovation agricultural policy. The paper concludes that a single department cannot collect every type of information required to make innovations in technologies and policies. Therefore, information collected by various government departments needs to be shared and integrated at the national level to better understand the local context of Pakistan.

Key Words: Innovation, Information Sharing, Science and Technology, Agriculture, Pakistan

1. INTRODUCTION

National Science, Technology and Innovation (STI) policy of Pakistan [1] revolves around 16 main thrust areas with the aim to improve the performance of these sectors by incorporating science, technology and innovation to strengthen the country's economy, increase productivity and control unemployment, poverty as well as diseases. Agriculture sector had been a major contributor in the economy of Pakistan but dilemma is like many other sectors, it is also on the decline for the last two decades. Thus there is urgent need to focus consistently on agricultural innovations and improving agriculture production. In Pakistan policies are usually cultured through experimentation rather than crafted based on data and information inputs from all relevant stakeholders.

This scenario challenges agricultural policies of the country and the policy making process as well. To understand issues and set right priorities relevant for the development of agriculture sector of the country, information locked by various public sector organizations is a prerequisite. The cost and efforts consuming acquisition, processing and maintenance of information, involve huge finances and large amount of mental and physical labour. Moreover, practically no single organization can have processing capability, storage capacity and skilled manpower to collect every type of information i.e. information relating to thrust areas such as metrology, environment, health, energy, biotechnology, agriculture, water, minerals and ocean resources etc. Therefore, each government organization is legally mandated to collect, process, and maintain specific type of information. That's why governments all over the world are making arrangements to enable sharing of information for optimum benefits. Unfortunately countries like Pakistan are still lacking behind in this context. Resultantly, not only time and public money is being wasted in collection of the similar information but also only a fractional part of the collected information is utilized for planning to

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attain economic and social development in the country. This implies that information sharing among the organizations is crucial for boosting innovations in science, technology and public policymaking such as agriculture.

The rest of this paper is organized as: Section 2 highlights the latest trends in science, technology and innovation strategies globally. Section 3 focus on thrust areas of national STI policy of Pakistan. Section 4 briefly explains research methodology adopted to carry out this research. Section 5 presents inventory of information essentially required for agriculture policy making. Section 6 elaborates rationales for information/data sharing. Finally, last section concludes the study and suggests future research directions.

2. SCIENCE, TECHNOLOGY AND INNOVATION STRATEGIES

Science, technology and innovation strategies are common around the world from developed countries to developing countries. According to [2] national strategies for science, technology and innovation (STI) contribute in government policy making from multiple aspects. Firstly by aligning, the socio-economic development with the government's STI vision. Secondly by identifying and prioritizing investment in STI. Thirdly by engaging various stakeholders including R&D bodies, funding agencies, public and private sector organizations involved in policy making and implementation processes. Policy trends envisioned since 2010 includes identifying new sources of economic growth and competitiveness, targeting innovation in strategic technologies or sectors (e.g. agriculture, industry, nanotechnology, biotechnology, ICT, etc.) , considering global challenges (e.g. climate change, energy security, etc.) to align public investments in STI, stabling R&D expenditures, emphasizing on demand-side innovation policies, enhancing social cohesion, improving public support for basic research and incorporating human resources development strategies.

3. NATIONAL SCIENCE, TECHNOLOGY AND INNOVATION POLICY, 2012

National Science, Technology and Innovation (STI) Policy was introduced in 2012. The mission behind the policy introduction was to improve security, prosperity and social cohesion of Pakistan based on applications of science, technology and innovation in all the areas of socio-economic activities. The policy mainly focus on "ST&I Planning and Management Structure, Human Resource Development, Indigenous Technology Development, Technology Transfer & Creation of Absorptive Capacity and International Cooperation as well as R&D Thrust Areas". To promote research and development in Pakistan, 16 thrust areas are identified in the policy. The trust areas includes "Metrology, Standards, Testing & Quality (MSTQ), Environment, Agriculture & Livestock, Energy, Health & Pharmaceuticals, Biotechnology & Genetic Engineering, Water, Minerals, Ocean Resources, Electronics, Information & Communication Technologies (ICTs), Space Technology, Materials Science, Nanoscience & Nanotechnology, Lasers & Photonics and Engineering" (NSTIP, 2012). The purpose of identifying these trust areas is to sustain and improve economy of the country, cultivate research and engineering, upscale R&D institutions and to promote collaboration and coordination among R&D bodies including academia, industry as well as public and private sector organizations of the country.

4. RESEARCH METHODOLOGY

To prepare inventory of information required for making innovative agricultural policies for Pakistan, we critically reviewed relevant scientific literature, the latest published reports by Food and Agriculture Organization of the United Nations (FAO), Organisation for Economic Co-operation and Development (OECD), Consultative Group for International Agricultural Research (CIGAR) as well as Government of Pakistan (GoP). We make use of expert's opinions, news articles and personal observations to mention names of custodian organizations of the information. Figure 1 briefly describes the applied research methodology.

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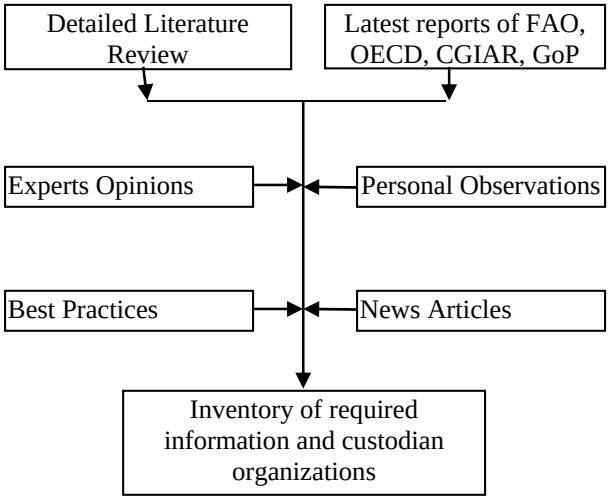
Figure 1: Research Methodology



5. AGRICULTURE- A KEY THRUST AREA

It is impossible to focus on all thrust areas of national STI policy at a time and according to [3] "Pakistan does not have proud history of implementing the policies and plans". Thus being agriculture based economic country, first priority of national STI policy should focus on improvement and sustainability of agriculture sector. Agriculture sector has direct link with other key thrust areas such as meteorology, health, energy and water. Thus improvements in agriculture sector will indirectly improve other thrust areas as well. The essential information that is required to focus on agriculture sector and plan the strategies is listed as Table 1.

Table 1: Essential information required for agriculture

Required Information	Concerned Department / Ministry
Crop land area [4],[14],[24]	Pakistan Agricultural Research Council Pakistan Bureau of Statistics Survey of Pakistan Ministry of Petroleum & Natural Resources
Water/irrigation availability [4-7],[19-22],[24]	Pakistan Water and Power Development Authority (WAPDA) Pakistan Bureau of Statistics Survey of Pakistan Pakistan Council of Research in Water Resources
Labour [4]	Pakistan Bureau of Statistics
Climate change [4], [6],[8-12],[18],[21-22],[25]	Ministry of Climate Change Pakistan Meteorological Department Pakistan Environment Protection Agency Provincial Environment Protection Departments
Weather conditions [4], [14],[21]	Pakistan Meteorological Department
Population [4],[24]	Pakistan Bureau of Statistics
Fuel/Energy (oil, gas, solar power) [4], [6]	Ministry of Petroleum & Natural Resources Oil and Gas Development Company Limited Pakistani Alternative Energy Development Board
Soil type, fertility & moisture [7],[14],[20]	Soil Survey departments
Crop type [14], [17]	Pakistan Bureau of Statistics
Rain Fall [7]	Pakistan Meteorological Department
Fertilizer use [7], [19],[24]	Pakistan Agricultural Research Council Pakistan Bureau of Statistics
Economy [13],[20]	Ministry of Finance (Pakistan) Pakistan Bureau of Statistics
Socio economic/political [13], [20],[24]	Pakistan Bureau of Statistics
Research & Development	Enablers
ICT[24]	Enablers
Satellite Imagery[14]	Space and Upper Atmosphere Research Commission

From Table 1, it can be noted that bad effects of climate change on agriculture have been mentioned

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more in scientific literature as compared to other factors. Therefore, it merits to discuss in more detail about climate change, its effects on agriculture and various kinds of needed information to understand the phenomena of climate change. The detail of datasets/information required to analyze and study the effects of climate change on agriculture along with names of custodian organizations of the information is shown in Table 2.

Table 2: Information required for study of climate change effects and custodian organizations

Required Information	Concerned Department / Ministry
Emission of gases	Hydrocarbon Development Institute Ministry of National Health Services Regulations and Coordination
Consumption of ozone depleting substances	Pakistan Environment Protection Agency Provincial Environment Protection Departments
Coasts zones including sea level rise	National Institute of Oceanography Marine Pollution Control Board Sea Port Authorities Harbour departments Maritime Security Agency Department of. Fisheries
Temperature	Pakistan Metrological Department
Rainfall	Pakistan Metrological Department
Water bodies	Federal Flood Commission Provincial Irrigation Departments Pakistan Council of Research in Water Resources Ministry of Water & Power
Households	Pakistan Bureau of Statistics
Population	Pakistan Bureau of Statistics
Administrative boundaries	Survey of Pakistan
Satellite Imagery	Space and Upper Atmosphere Research Commission

6. WHY INFORMATION SHARING IS ESSENTIAL?

The above scenario indicates that getting all needed information even related to a single thrust area such as agriculture mentioned in the National Science, Technology and Innovate Policy 2012 becomes practically impossible due to lack of information sharing. Moreover, information sharing would also help to reduce duplication of effectors in information collection which obviously cost significant part of public exchequer. Certainly, the scenario demands interagency coordination to enable information sharing at national level which is also objective of the policy.

Benefits of sharing of information/datasets also includes smooth and easy accessibility to information assets possessed by various organizations and availability of metadata to decide about fitness of a dataset for intended use such as for disaster management, food security, water resources management, natural resources management, home land security and environmental protection [15].

7. CONCLUSION AND FUTURE DIRECTIONS

No one can deny that Pakistan is in dire need of innovations to cope up effectively with the quickly changing socio-economic and geo-political landscape of the country. National Science, Technology and Innovation Policy of Pakistan approved in 2012 is indeed a remarkable effort to boost science, technology and innovation for sustainable socio-economic growth. The policy underscores the need to share human resources and technical facilities but lacks information/data component that is essentially required by humans as well as machines to operate upon. Moreover, policy makers are nowadays more open to empirical evidence supporting the central role of STI policies for sustainable economic growth [16]. Indeed, research is needed to establish platform for exchanging and sharing information [23] especially locked by public sector departments to make innovations in science, technology and policies for Pakistan.

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REFERENCES

1. National Science, Technology and Innovation Policy 2012, Ministry of Science and Technology, Government of Pakistan.
2. OECD (2016), Science, Technology and Industry e-Outlook. https://www.oecd.org/sti/outlook/e-outlook/, Accessed on July 5, 2016.
3. Science Technology & Innova1on Strategy 2014-18, Ministry of Science and Technology, Government of Pakistan.
4. OECD/FAO (2016), OECD-FAO Agricultural Outlook 2016-2025, OECD Publishing, Paris. http:// dx.doi.org/l 0 .1787 /agr_outlook-2016-en, Accessed on July 5, 2016.
5. Ariel Dinar (1991). Economic factors and opportunities as determinants of water use efficiency in agriculture.
6. CCAFS. 2016. Annual Report 2015: Change for the better. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Available online at: bitly.com/ccafs2015, Accessed on July 5, 2016.
7. P.S. Shirgure (2013). Research review on Irrigation scheduling and water requirement in citrus.
8. Steenwerth et al. (2014): Climate-smart agriculture global research agenda: scientific basis for action.
9. Morton JF (2007): The impact of climate change on smallholder and subsistence agriculture. Proc Natl Acad Sci U S A 2007, 104:19680–19685.
10. Reidsma P, Ewert F, Lansink AO, Leemans R (2010): Adaptation to climate change and climate variability in European agriculture: the importance of farm level responses. Eur J Agron 2010, 32:91–102.
11. Vermeulen SJ, Campbell BM, Ingram JSI (2012): Climate change and food systems. Annu Rev Environ Resour 2012, 35:195–222.
12. Intergovernmental Panel on Climate Change, Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB Tignor MMB, Miller HL Jr: Climate Change 2007: The Physical Science Basis (Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)). Cambridge, UK: Cambridge University Press; 2007. [http://www.ipcc.ch/pdf/ assessment-report/ar4/wg1/ar4_wg1_full_report.pdf] (accessed 7 July 2016).
13. Olanrewaju Olaoyea (2010): Why policies fail In Nigeria, an evaluation of agriculture policies made from 1972-1985.
14. Mobushir Riaz Khan (2011). Crops from space improved earth observation capacity to map crop areas and to quantify production. PhD thesis, Enschede, The Netherlands.
15. Asmat, A., and Munir, A. (2012). Is SDI development, waste of time and money for Pakistan? Published in the Proceedings of Global Geospatial Conference 2012, Canada.
16. Ramón Padilla-Pérez and Yannick Gaudin (2013). Science, technology and innovation policies in small and developing economies: The case of Central America.
17. Lucia Moro (2016): FAO Uses GIS to Protect Agricultural Economy of Vulnerable Countries https://www.gislounge.com/fa-uses-gis-protect-agricultural/
18. Asian Development Bank (2009). Building Climate Resilience in the Agriculture Sector in Asia and the Pacific
19. Mahmood Hasan Khan (1984). Agricultural Policy Issues in Pakistan. Published in The Pakistan Development Review Vol. XXIII, Nos. 2 & 3 (Summer-Autumn 1984)
20. Shahid Hussain Raja (2015). Pakistan's Agricultural Sector: Challenges and Response
21. DECO (2015), DECO Review of Agricultural Policies: Colombia 2015, DECO Publishing. http://dx. doi .org/1O.1787 /9789264227644·en
22. Food and Agriculture Organization of the United Nations, Rome (2014). Food and Nutrition in Numbers
23. Data for Policy (2015). Policy-making in the Big Data Era: Opportunities and Challenges. Book of Abstracts p.86
24. Rais Ahmad (2014). Factors affecting agricultural development in. Uttar Pradesh
25. DECO/FAD (2016), DEeD-FAD Agricultural Outlook 2016-2025, DECO Publishing, Paris. http:// dx.doi.org/l 0 .1787 /agr out look-20 16-eng

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