

Barriers to the National Innovation System of Pakistan: Exploring the Stakeholders' perspectives

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This research has explored the barriers to the National Innovation System (NIS) of Pakistan from a stakeholder's perspective. This study contributes to literature on the innovation system by recognising the significance of NIS for economic performance. The semi-structured interviews were conducted to gather data from directors of ORICs and selected Chambers of Commerce and Industry from the Federal capital and the Punjab province in Pakistan. After the collection, the data was analysed through NVIVO software, version 11. The participants highlighted the barriers to innovation in Pakistan. The thematic analysis shows the systematic problems which may stimulate policy makers to improve policy. This research has proposed to reduce the barriers to innovation in Pakistan and therefore encouraging innovation, through increased efficiency and effectiveness, to accomplish higher competitiveness levels.

Key words: *National innovation system, Barriers to NIS of Pakistan, Semi-structure interview*

Introduction

In 1980s, the development of NIS notions was started particularly in the northern hemisphere in industrial countries, and can be traced from the work of Lundvall, the National Policies of Innovation or the National System of Innovation (Freeman, 1987, 1988; R. R. Nelson, 1988) who declared it as an indispensable basis of technological change and long-term national economic development. However, the research on the NIS constructs is still in the earlier stage, and the studies on NIS from developing countries perspective is in the primitive stage. The majority of literature is concentrated on analysis of NIS from a developed country's perspective. Even though, several researchers from various academic disciplines have

contributed to the concept development process of NIS by many approaches, but few researches have focused on the NIS of developing countries. Scholars mainly studied the successful catching-up developed countries such as Singapore, Korea and Taiwan which have intensive technological learning and aggressive policies (Hou & Gee, 1993; Kim, 1993; P. Wong, 1996; P. K. Wong, 1999).

This research has tried to supplement the NIS studies in developing countries by taking Pakistan as a case study. It claims that certain NIS nature and related problems in developing countries that are less successful with respect to technological catching-up are varied from learning intensive developing countries and developed countries. With a rich understanding, it would be possible to make recommendations for policy makers that help them to generate effective and systematic NIS in developing countries like Pakistan.

Literature review

National Innovation System

In the mid-1980s, the notion of an NIS was developed by Nelson (1988), Lundvall (1988), and Freeman (1987). They defined NIS as “the interactive system of existing institutions, private and public firms (either large or small), universities and government agencies, aiming at the production of science and technology (S&T) within national borders. Interaction among these units may be technical, commercial, legal, social and financial as much as the goal of the interaction may be development, protection, financing or regulation of new S&T” (Niosi, Saviotti, Bellon, & Crow, 1993, p. 139). The NIS of a country needs a set of institutional, political, organisational, social and other policy measures that are applied by a government which improve interaction and exchange among various actors of the innovation system and eventually increase the innovative performance of a country. Further, the NIS is classified on meta, macro and meso levels. The meta level has interrelations among actors and internalisation of alliance (Blanc & Sierra, 1999; Carlsson, 2006). In these networks, knowledge-based economy plays important role namely international firms, public and private research centres, and universities and research-based techno-scientific collaborations. These networks were investigated in the neo-evolutionary Triple Helix model (Leydesdorff, 2001). The macro-level has social capital and decentralisation which impact the economic performance (Bjørnskov & Svendsen, 2002). This meso-level and analysis of cluster performance is based on the institutional characteristics, knowledge base, innovation and organisational nature (Asheim & Coenen, 2004; Munk & Vintergaard, 2004). NIS is also frequently referred to as the Triple Helix Model because of the nexus between three tiers; the government, the academia, and the industry.

Barriers to the National innovation systems

Various studies have reported the barriers of innovation in the developing countries (Bartels, Korla, & Vitali, 2016; Irawati, 2010; Ranga & Etzkowitz, 2010; Rivera, 2010; Ryan & Daly, 2019). The findings recommended that three kinds of barriers are faced by actors such as university policies, university issues and relationship issues. Relationship issues involve the various work culture and links among the government agencies, industry and university. University issues include perception of university capabilities and status. This also includes policies, for example, many countries (e.g. Latin America) have encouraged to introduce the right policies and integrate activities related to knowledge as well as policies of intellectual property or lack of commercialisation (de Mello & Etzkowitz, 2008; Sutz, 2010). In this line of research, the barriers of relationships within the institutions are mentioned by many scholars. They named those barriers as vague research interest, lack of S & T research, and socio-economic development (de Mello & Etzkowitz, 2008), weak links in order to produce knowledge among three actors while having immense funds from governments and donors (Dzisah, 2009; Sutz, 2000), lack of local research demand of new technology (de Mello & Etzkowitz, 2008), universities preferred public initiatives rather than private, strict bureaucracy, lack of funding, traditional philosophy of universities and lack of capabilities (Bianco & Viscardi, 2008; de Mello & Etzkowitz, 2008; Sutz, 2000), ineffective government policies (Irawati, 2010), lack of commercialisation, lack of governmental focus (Ranga & Etzkowitz, 2010; Rivera, 2010), the gap among industrial strategies and research policies, poor regional knowledge integration (Bianco & Viscardi, 2008), and a lack of coherence and coordination in policy development and implementation process (Rivera, 2010). However, empirical studies claimed that a qualitative study gives the better chance to explore the barriers of collaborations among universities, government and industries that will help the developing country for successfully moving towards a knowledge-based economy.

Methodology

The inquiry and context of this research helped us to select the research approach or paradigm which is named as “interpretivism” and inductive stance (Hair, 2010). The inductive stance is applied to search the barriers of NIS in Pakistan because qualitative research is appropriate for getting the in-depth information (Creswell, 2003). This study is exploratory in nature due to which, convenient sampling method was adopted. About nineteen directors of ORICs and chambers from Punjab and Federal provinces of Pakistan were selected because of constraints time, cost and availability; this is a suitable method of qualitative study (Creswell, 2013). On the basis of following criteria, the respondents were approached: they should be managerial employees and also have more than three years of working experience in ORICs or the chamber.

Data Collection

To achieve the assumptions of qualitative research, this study has applied the technique of semi-structured interviews to gather the responses regarding barriers to university, industry and government collaboration in Pakistan. Moreover, this technique has the ability to minimise the issues of self-made validity about the questionnaire that was related with close-ended questionnaires to search the phenomena which is unique from the participant's perspective (Jarvenpaa & Todd, 1996). After reviewing the literature on NIS and the triple helix model (Ranga & Etzkowitz, 2013), the interview protocol was developed that has open-ended questions. The questions were added under the supervision of qualitative research experts that who were not the part of this research and interview protocol was adjusted after incorporating the opinions of experts (Turner, 2010).

Sampling

In this study, "*purposive sampling*" (Bryman, 2012; Miles & Huberman, 1994) was used to select the respondents. The objective of purposive sampling was to select strategically the respondents so that they were able to answer the relevant questions of a research (Bryman, 2012). We personally assessed the interested institutions like ORICs, chambers and research organisations for data collection. Top management of ORICs, chambers and research institutions were selected from major cities of Pakistan: Lahore, Faisalabad, Gujrat, Sialkot, Islamabad, Peshawar and Karachi. It is essential to state here that this selection was not made to know differences and comparisons between respondents from these cities. We claim that it improved the diversity of respondent's experiences relating to the national innovation system (NIS).

Analytical Process

In the current study, the participant's responses were recorded on the audio devices and saved as a repository which was transformed into transcriptions. Braun and Clarke (2006) have introduced steps for doing the qualitative analysis which is followed in this research. First, the recorded interviews were transcribed; second, the scheme of coding was developed to know the relevant data regarding the barriers to university, industry and government collaboration in the Pakistani context. The codes were re-identified as the key themes to confirm the coherence. For this reason, software "NVivo-11" was used. Table 2 reveals the findings of coding and figure 4 visually depicts the themes into a conceptual model. The participant's demographics describes that directors were experienced and had a high education level with different age groups of both genders (see table 1). The interviewees' views have reflected the key barriers of NIS in Pakistan. Thematic analysis was conducted on the data collected.

Analysis and Interpretation

This section presents the data analysis results and interpretation thereof.

Theme 1: Lack of understanding of the university's real purpose

Recently, the demands of society are changing that reform the organisational and structural activities of universities and linked it with society needs (Brooks, 1993; Rosenberg & Nelson, 1996). Respondents shared their views how universities are contributing in developing the NIS.

Our universities should not call as university but degree distribution institutions. In west, the university where I served last year, has added three core activities in mission statement; teaching, discovery (research) and dissemination of truth, not only knowledge.

From the thoughts of respondents, it can be expressed that universities have no deep knowledge regarding actual purpose of higher education institutions which is the discovery and truth.

Theme 2: Slow adaptation of new university roles

According to TH, universities play a significant role to introduce and exchange knowledge through traditional production of knowledge, research and disseminations activities such as graduating students into the community and workforce, teaching and publication (Afonso, Monteiro, & Thompson, 2012; Etkowitz, 2003). Respondents talked about the roles of universities over time in Pakistan.

The role of universities is changing from knowledge creation, skilled development of manpower to play a role in economic development. Now, universities are creating knowledge and products as well as training students in business incubation centers so that they can run their own business in form of SMEs which participated in economic development of Pakistan...

From the remarks of respondent, it can be explored that universities know the new roles of universities and also trying to adjust accordingly.

Theme 3: Producing more job seekers

Meanwhile, students pursue higher education for different educational objectives, and students select institutions for various reasons (Bastedo & Gumport, 2003). Among these diverse purposes, economic perspectives emphasise the importance of educational outcomes

after graduation based on future income. With the belief that more education reduces the possibility of unemployment, Brunello (2001) argues the role of higher education is as a training centre for future workers.

Students have various objectives to pursue higher education and they select institutions due to different reasons (Bastedo & Gumport, 2003). Among these reasons, economic aspects signify the educational outcome in the form of income and Brunello (2001) also claimed that HEIs is known as the training centre of future employees which minimise the unemployment. Respondents described the condition of job market and the role of universities in Pakistan.

Universities of Pakistan are distributing degrees after every six months regardless of exploring the needs of industries. As a result, we have more job seekers rather than job creators in the job market...

The views of respondent showed that universities are not exerting efforts to reduce the unemployment rate in Pakistan.

Theme 4: Only balancing the research budget

Nowadays, the research environment in universities is changed in developed countries because they have adopted performance-based research funding systems. Efficient measures and funding instruments are considered in universities for whole research funding systems (Hicks, 2012; Pruvot, Claeys-Kulik, & Estermann, 2015). The following quotation explains the utilisation of research funds given by the Pakistani government.

Receiving funds means getting one cent from the government and converting them into 24 cents or dollars. Look at our universities; they are busy only balancing their research budgets...

This comment highlights that researches which are conducted in the universities have not achieved the synergy effect in the outcomes. Inefficiency or wastage of funds may happen due to unproductive usage of government resources.

Theme 5: Increasing quantity, not quality of doctorate students

The commercialisation of education has become famous and research productivity of universities is revealed through peer reviewed books, competitive research grants and journal articles (Hattie, 1997). Students and teachers are responsible for generating these research outcomes. Respondents shared their opinions about the quality of PhDs in Pakistan.

Due to fewer jobs in the market and recent changing policies of HEC forced people to get more degrees. Now we have increasing number of unemployed M.Phil. and doctorate student

The respondent talked about the significance of meaningfulness and quality of PhDs.

Theme 6: Strike and inadaptability of fresh PhDs

Having career adaptability and practical experiences can help the students to handle the university to work transition (Monteiro & Almeida, 2015). The ways how fresh PhDs in Pakistan are contributing in universities, were also discussed as:

As per hiring criteria of faculty, fresh PhDs get a job in universities and have no experience of teaching and they don't know how to teach the students.

This response revealed that fresh PhDs have a lack of adaptability skill and quality of students, due to which doctoral students have been limited to research and higher education institutions for getting jobs.

Theme 7: Lack of multidisciplinary knowledge

In developed countries, university collaboration is integrated and grown denser across the institutional divisions and faculty members. This type of academic research contributes in dynamic intellectual cohesion (Rawlings, McFarland, Dahlander, & Wang, 2015). A respondent described the possible reason of no innovation behaviour or problem-solving attitude of the Pakistani nation.

New generation feel shamed on working by their hands. They liked readymade and artificial things in daily life. They should develop the learning attitude and used the research skill in solving the routine problems of house and colony. When I was young, my father forced me to know how to cook the food, how to stitch the shirt, and how to repair the switch...etc along with my studies but new generation do not know all of this.. How we can innovate the products or service with this behavior in academia

The respondent demonstrates the importance of multidisciplinary knowledge to solve problems of individuals and society which is also the source of innovative ideas.

Theme 8: Ambiguous structure of economy

The economic structure of any country examines the structural learning, institutional performance, impacts the income distribution patterns and determines the political direction as well as economic performance (Constantine, 2017).

a) Misconception about economy “agriculture-based knowledge economy”

Few respondents illustrated that the types of economy from a nation’s perspective.

We can’t separate the agriculture-based economy and knowledge-based economy. They are interlinked with each other. Pakistan should have knowledge-based agriculture economy.

The respondent shared their views as most of the people in Pakistan do not know the nature of economy whether it is a knowledge-based or agriculture-based economy.

a) Pakistan as a Knowledge-based economy

Few respondents depicted that Pakistan does not have a knowledge-based economy.

Research is based on process. Developed countries had achieved their agriculture targets and shifted towards knowledge-based economy. Pakistan is not listed in knowledge-based economy that’s why known as underdeveloped country, because in Pakistan, research is not implemented.

The respondent indicated that research is not implemented in Pakistan which is the key reason of not shifting of an agriculture economy towards a knowledge-based economy.

a) Pakistan as an agriculturebased economy

Most of respondents shared their views on Pakistan as an agriculture-based economy.

We have agriculturally based economy. According to my point of view, Pakistan get earning through export of agricultural products.

The responses of the respondent indicated that Pakistan does not have a satisfactory agriculture-based economy due to lack of research in the agriculture sector. In this situation, the responsibilities of agricultural institutions have not ended in production of knowledge or new knowledge.

Theme 9: Lack of understanding of the innovation concept

Universities are required to redefine their vision and mission for shifting towards research universities (Edmondson, 2012). Companies give profit to highly qualified researchers because up to ten percent of new processes or products are based on academic-industry collaboration (Bekkers & Bodas Freitas, 2008). The question regarding what are innovation and its types within economy was asked from respondents.

Innovation has become a term for us. Our education has no concern regarding innovation, grading of subjects are done on the basis of memorization of subject contents instead of it is linked with problem solving and creative skills. Student gets education for the sake of degree and job. An owner of the business hires a candidate for a job because he/she has no time to do those activities and job has certain problems. But our students have no problem-solving skills.

The respondent mentioned that the education system of Pakistan does not teach the term innovation and its role to students.

Theme 10: Lack of trust among actors

Trust is essential in developing the collaboration among universities and industry (Attia, 2015; Canhoto, Quinton, Jackson, & Dibb, 2016). Historical experiences of collaboration, or small projects undertaking and similar decision-making and operating styles are needed to develop and maintain new partnerships (Barnes, Pashby, & Gibbons, 2002; Bstieler, Hemmert, & Barczak, 2017). Respondents expressed their views on trust level among university, industry and government linkage in Pakistan.

Faculty required publications for job promotion if he/she published a paper and also wants to public, but due to profit concern industry showed no interest in it.

The responses illustrated that trust is weak among the actors. Lack of trust is a serious barrier in developing countries for development of IS.

Theme 11: Bureaucracy

The academic leadership should be flexible in developing strategic partnerships, shared strategy and vision to accomplish the goal (Calder, 2007; Rahm, Kirkland, & Bozeman, 2013; Rohrbeck & Arnold, 2009). The question was asked, how leadership of universities are participating in the NIS of Pakistan.

We need empowerment in term of financial and decision making. Long procedures in organization have become hurdle, we need to fast them.

Most of the people have taken bureaucracy as a barrier for developing innovation culture within an organisation.

Theme 12: Lack of funds

In the knowledge-based economies, government seeks creative methods for funding the institutions and activities. Among these institutions, universities have a prominent place

(Weiss & Passman, 1991). The majority of the respondents demonstrated the significance of funds for conducting and implementing the research in Pakistan.

Innovative ideas are not the responsibility of any actor. Every person can do innovation. For example, if university student has an idea then industry should provide the funds. But unfortunately, it is not happening.

From the views of respondent, it is found that the government research budget is low and industries are not interested to do research and providing funds, as well as the fact that universities are more dependent on government funds instead of private funds and they are not using the funds efficiently and effectively.

Theme 13: Outdated innovation performance of faculty, students and management of HEIs

Good university teacher should be good in research. In the HEIs of developed countries, the performance management system considers the relevant international publications that are linked with organisational strategy and secure the research implementation (Cadez & Guilding, 2008; Ferreira & Otley, 2009). Respondents indicated the performance of faculty and students from innovation perspective in Pakistan.

Everyone wants to live in their comfort zone. The performance of faculty is measured on the bases of number of publications. The golden rule of management, is that you will receive what you measure? Faculty members get promotion on publications. They can't do innovation. We are not measuring innovation so we are not getting it.

Innovation has become a term for us. Our education has no concern regarding innovation, grading of subjects are done on the basis of memorization of subject contents instead of it is linked with problem solving and creative skills. Student gets education for the sake of degree and job. An owner of the business hires a candidate for a job because he/she has no time to do those activities and job has certain problems. But our students have no problem-solving skills.

The responses have mentioned the several issues like quality of teaching, performance evaluation of teacher and student, curriculum and examination systems, job security, job burden and required skills for innovation performance.

Theme 14: Language barrier

The relations among universities and companies are based on good personal connections (Barnes et al., 2002; Collier, Gray, & Ahn, 2011). These connections should be done on an operational level instead of at top management (Wu, 2017); it involves new activities, mutual

information exchange, regular interaction and continuous feedback. Both partners should also have appropriate language because different styles and dictions in business environments and academia becomes a hurdle (Baba, Yarime, & Shichijo, 2010; Gawel, 2014). Respondents highlighted the usage of language in industry and university relationship in Pakistan.

Universities and industries have two different languages as industries have not high qualified people, they faced difficulty when we conduct any seminar or workshop with university, we hire translator who change the technical presentations into simple words so that industrialists can easily understand.

Qualified people used technical language which becomes a hurdle for industrialists. The influence of language is addressed extensively in the literature. The language barrier also happened due to lack of absorptive capacity and ambiguity.

Theme 15: Slow intellectual property rights' process

The intellectual property rights and written contracts can assist in developing trust (Hemmert, Bstieler, & Okamuro, 2014). Non-disclosure agreements and confidentiality is important in property rights and establishing partnerships (Attia, 2015; Rampersad, 2015) because it minimises the chance of future conflicts (Ankrah & Al-Tabbaa, 2015). Respondents shared their view about the role of intellectual property rights in the NIS of Pakistan.

Lack of Intellectual property rights enforcement and long procedures. Professors want to avoid all these. Pakistan has policies but there are no law enforcements.

The response depicted that ORIC deal with the IP protection in the universities. Pakistan has a law regarding protection of IP rights but due to lack of funds, tough and long procedures, the faculty avoids this process.

Table 2: List of barriers in NIS of Pakistan

Sr.	Barriers	No. of respondents
1	Lack of understanding of the university's real purpose	15
2	Slow adaptation of new university roles	10
3	Producing more job seekers	17
4	Only balancing the research budget	19
5	Increasing quantity, not quality of doctorate students	15
6	Strike and inadaptability of fresh PhDs	11
7	Lack of multidisciplinary knowledge	14
8	Misconception about economy "agriculture-based knowledge economy"	13
9	Pakistan as a knowledgebased economy	9
10	Pakistan as an agriculturebased economy	11
11	Lack of understanding of the innovation concept	14
12	Lack of trust among actors	11
13	Bureaucracy	13
14	Lack of funds	18
15	Outdated innovation performance of faculty, students and management of HEIs	16
16	Language barrier	13
17	Slow intellectual property rights' process	17

A further examination of the above barriers shows the linkage between different factors. The linkages are shown below in the form of a conceptual model:

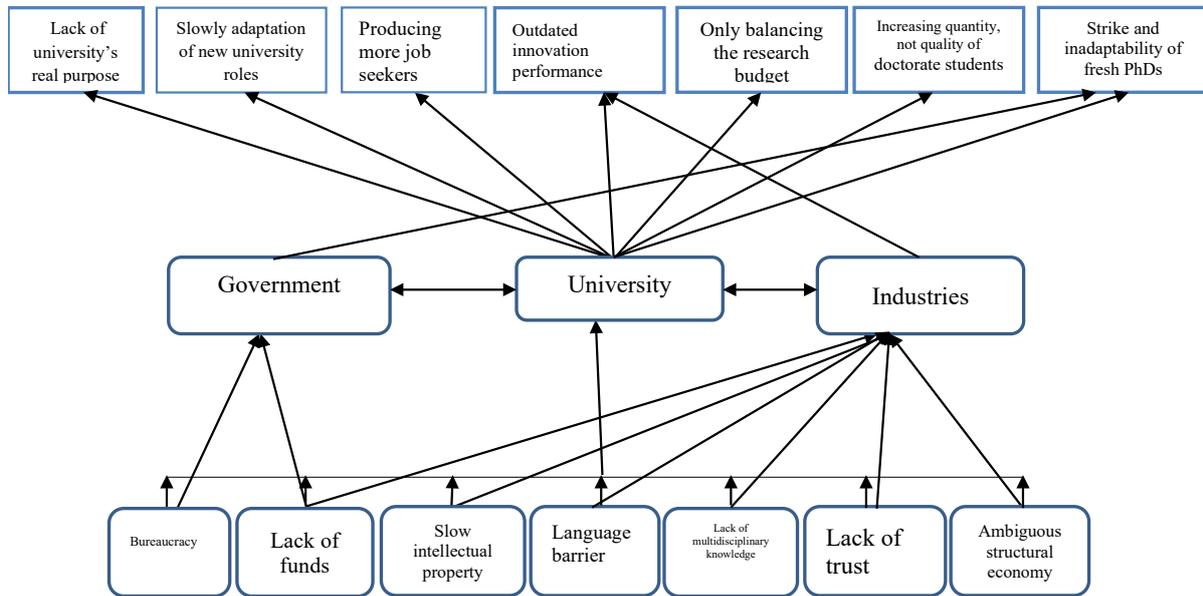


Figure 1: Interrelations among barriers to the NIS of Pakistan

Discussion

This exploratory study has shed light on the NIS of Pakistan. The overall views of stakeholders showed that a strong collaboration among university, industry and government plays a significant role in economic development of Pakistan. The results of thematic analysis indicated the barriers exist in the NIS of Pakistan and most commonly named such as only balancing the research budget, producing more job seekers, lack of funds, slow intellectual property rights' process and outdated innovation performance of faculty, students and management of HEIs, but all type of barriers are equally important in NIS. Because literature has discussed the understanding of the university's real purpose is essential since Krishna (2019) explained the significance of universities in the NIS and their three learning academic revolutions such as teaching, research and innovation. Slow adaptation of new university roles has no space in the NIS as Buddelmeyer et al. (2010) found that universities are no longer the places of research. Research is stopped at the stage of invention or discovery of new knowledge/idea but now innovation, its applicability with new outcomes will be base future students and university (Buddelmeyer et al., 2010; Sonka & Chicoine, 2004) . In the upcoming era, innovation adaptation determined the failure or success of any institution (Buddelmeyer et al., 2010). Further, producing job seekers is not valuable for a country because in higher education, employment is a graduate outcome and pedagogy for the sake of employability (Pegg, Waldoock, Hendy-Isaac, & Lawton, 2012). Businesses and universities need to increase and maintain their activities for employability skills among students (Universities UK, 2009). Only balancing the research budget is not the purpose of government grants. The efficient application of government expenditures needed understanding of circumstances in which investments become most productive. For instance,

the social planner should know how the marginal impact of money of research grants is different among various fields, disciplines, institutions and researchers (David, Hall, & Toole, 2000). Increasing quantity, not quality of doctorate students becomes a hurdle in the economic development of country. Hence, the study of Auriol (2010) mentioned that doctoral studies are the essential indicators of a knowledge-based economy and doctoral students are highly skilled scholars who are qualified for creation, use and dissemination of knowledge. They become vital resources for new knowledge for a knowledge-based economy (Carter, Fazey, González Geraldo, & Trevitt, 2010).

Strike and inadaptability of fresh PhDs demonstrated the incompetency and condition of the job market in Pakistan. In this decade, the role of doctoral studies has changed into integrating education and R&D by cooperation with the community and prepares scholars to work in different professions of society for solving the socioeconomic troubles (Gül, Gül, Kaya, & Alican, 2010). Lack of multidisciplinary knowledge does not develop meaningful research. Knowledge-based economies require such professionals who can explore, learn, innovate and design the products or services through interdisciplinary education (Carillo, 2006). Ambiguous structure of economy creates misconception among stakeholders of NIS. Mistaken beliefs and cognitive biases influence the individual and political behaviours (Caplan, 2007). Several studies (Chen & Dahlman, 2005; OECD, 1996; World Bank, 2007) mentioned that a knowledge-based economy is developed on four pillars. Firstly, an institutional and economic framework provided incentives for production, use and dissemination of knowledge to enhance welfare and growth. Secondly, a person who has the ability of production and implication of required knowledge. Thirdly, adaptive IS according to global and local needs. Lastly, dynamic infrastructure of information is essential for facilitating information and communication processing. Pakistan is an agriculturally-based country; the responsibilities of agricultural institutions have not ended in production of knowledge or new knowledge. They need the use, adaptation and dissemination of inventions for success (Chema, Gilbert, & Roseboom, 2001). Lack of understanding of innovation issues should be addressed because the education system can divide the innovation into two categories to teach the innovation such as revolutionary and evolutionary innovations. Evolutionary innovations are received through various incremental processes or technology advancement. Revolutionary innovations need the learning behaviour of the individual for innovation. Because it has four basic requirements; something better is required, rather than what is already present, new to the customer, economically viable and having widespread appeal (Arnold & Bell., 2001). Lack of trust among actors discouraged them to work together. Several scholars also considered that trust is essential in fostering a university's and industry collaboration (Attia, 2015; Canhoto et al., 2016). Bureaucracy caused inflexibility and the complex structure of universities (Schofield, 2013) can become a hurdle for the NIS success because the universities' rigid framework is opposite to the companies' flat hierarchy of management (Boardman & Bozeman, 2015; Schofield, 2013). Lack of funds slow the process of doing and implementing research outcomes within country. Several studies have

been reported in the literature, which indicate that private and public research funding within universities are complementary (Arrow, 1962; David *et al.*, 2000). Outdated innovation performance of faculty, students and management of HEIs decreases the overall performance of higher education in Pakistan. Innovations in education are essential significantly because education has a crucial role in developing a sustainable future. Innovation combines the biological process, mutation that keeps the evolving species so that they can compete for their survival (Hoffman & Holzhter, 2012). The language barrier has occurred because stakeholders have a different business and academia knowledge background. But, similar knowledge backgrounds are easier to absorb and understand that resulted in collaboration (Van Wijk, Jansen, & Lyles, 2008). Slow intellectual property rights' process is not encouraged in a knowledge-based economy as there is a need of entrepreneurial start-ups, venture capital and intellectual property (Siegel, Waldman, Atwater, & Link, 2003).

Implications for policy makers

Developing countries like Pakistan are not known as identical animals. Basically, the NIS characteristics of Pakistan are different in following ways: a) The NIS is not contributing in the economic development of Pakistan. Since Pakistan is experiencing a structural change from an agriculturally-based economy to service and industry-based economy in terms of export and production but the NIS has remained fragmented and weak as well as not satisfactorily developed. b) In the case of Pakistan, the mismatch among the NIS development level and economic structural change has led to the worst economic crisis in the last 60 years and has changed its framework of institutions. According to Fremann and Perez (1988), the mismatch among the techno-economic paradigm and socio-institutional framework contributed to structural change and crisis. c) Pakistan is less developed in terms of technology so it should not only focus on innovation activities but also enhance those factors that contribute to stagnancy and perpetuation of a fragmented and weak NIS. d) The government of Pakistan has lacked in performance-based governmental subsidies criteria as well as government agencies have incompetent individuals to initiate policies and collaborate with other NIS actors. Some policy implications can be drawn from the experience of Pakistan. It may be helpful for remaining developing countries that have similar NIS conditions.

1. Governments of developing countries like Pakistan must plan and apply policies that assist in addressing the fragmentation and weakness of the NIS. Particularly, governments should target on those factors that perpetuate or remain unchanged for a long time in the NIS of Pakistan, and on shifting towards knowledge-based economy.
2. In developing countries, governments must be effective and important players in the NIS, institutional reforms of bureaucracies are required. Bureaucracies should be free from political pressure of interest groups and be able to create favourable co-operation with NIS actors. They should be run by dedicated and capable government officials

who are committed to shared goals. Promotion and recruitment based on meritocracy like East Asia and Japan should be implemented. Additionally, to attract individuals to bureaucracies, intrinsic job satisfaction, salary packages, perquisites, prestige and job security should be close enough to rewards provided by private industries.

3. To solve the co-ordination problem inside bureaucracies and between private and government firms, personnel rotation between government agencies and among private and government firms must be encouraged.
4. The abovementioned government level reform is not impossible. In the beginning, developing countries are not needed to transform the complete system of bureaucracy, but they can involve economic agencies and ministries that play essential roles (effects on actors or policies) within the NIS.

Limitations and future directions

The key limitation of this research is the non-probability sampling due to which the results of the study are not generalised on the whole population. In addition, the interviewer bias is a big challenge for conducting prejudice-free interviews and this bias could influence the interview outcomes. In this situation, we recommend a mixed method design for addressing the issues of the current study. The suggested design is appropriate because it confirms the past researches while developing room for getting additional insights in this emerging inquiry. From the theoretical perspective, this research has only highlighted the barriers of NIS in Pakistan. The future studies can explore more causes, outcomes and possible solutions to handle these barriers.

Conclusion

In sum, this research has filled the gap by qualitatively identifying the barriers to the functioning of NIS in Pakistan. These findings may guide the policy makers to develop achievable standards and targets to motivate industry and firms to become productive and create better working environment for actors to do innovation.



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