Role of Higher Education in National Innovation System:

Case of Pakistan

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by

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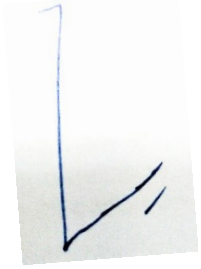
I hereby declare that this thesis has not been, and will not be, submitted in whole or in part to another University for the award of any other degree.

Signature: 

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Abstract

This thesis investigates role of Higher Education in the National Innovation System in Pakistan. Through the triangulation of data obtained from primary and secondary sources, it both examines and extends some of the theoretical assertions made by the Western theorists (Nelson & Winter, 1982, Metcalfe, 2000, Freeman, 2002; Lundvall, 2002 & 2010, Fagerberg, 2003 & 2010, Malerba, 2005). The term National Innovation System (NIS), although relatively new to the developing countries is well established in the developed countries' context. Western theorists (Chaminade & Edquist, 2005; Van der Steen, Marianne, Enders & Jurgen, 2008) emphasise appreciating and realizing the role of universities in building innovation systems and the knowledge economy. However, as stated above, there is dearth of research on NIS in the developing countries', and so is true for Pakistan. The primary aim of this research is to examine applicability of the NIS approach in the socio-economic and cultural context of Pakistan.

This research systematically explored ways as how do universities contribute their share in building and strengthening the National Innovation System in the indigenous context of Pakistan. The major findings include that setting up National Innovation System unfolds itself in the form of intertwined institutional layers, resources, R&D, policy making, political and administrative support by crafting and adhering to the long-term economic vision through implementing successive sets of reforms. To do so this, the Study proposes an indigenous model of the National Innovation System to be employed seeking preeminent role of Higher Education Institutions (HEIs) through systematically unfolding ways to exploit economic significance of knowledge.

Structure of the Thesis

The study is organized in seven (7) chapters, as follows;

a) 1st Chapter introduces the reader with the premise, relevance and theoretical significance of the Study.

b) 2nd Chapter presents 'Literature Review'. It brings out the historical and theoretical anecdote of the concept, viz. 'National Innovation System'; the role of 'higher education' in the dissemination, generation and application of knowledge and as such in the creation of knowledge economy. The theoretical stimulation to the development of the NIS concept is premised in failure of neo-classical economics in differentiating between information and knowledge (or technology), and as such between the codified and tacit knowledge, thus leaving out organizations and institutions in having a role in the economic growth and development. Appraisal of the literature has helped in identifying gap in the body of knowledge hence in conceiving scope of the Study. The gap in the literature justify taking up the (instant) Study for understanding the role of higher education in the National Innovation System in Pakistan.

c) Chapter 3 brings out a succinct albeit encompassing treatise on the context of higher education polices and development plans in Pakistan and the content relevant to the Study, in hand. The synthesis presented brings the institutional set up, context, programs, policies and the interface of higher education (sector) with other socio-economic sectors and so forth. The synthesis keeps its attention attuned to the role of higher education in the National Innovation System in Pakistan. The recital includes history of the higher education sector's development in the historical, economic and socio-political context of the country as well as highlights the Post 2002 reforms brought out in the higher education sector in Pakistan.

d) Chapter 4 & Chapter 5 bring out the ontological and epistemological considerations that guided the research. Methodological issues relating to qualitative elite interviewing with specific reference to using the chosen framework are discussed. Use of the analytical framework (Groenewegen, J. & Marianne van der, S., 2006) allowed peeping into the research questions. Issues relating to access to the research participants, access to the

secondary data sources/documents are discussed. Issues experienced in data collection and interpretation of research results are also discussed, and so are the issues relating to validity, credibility and integrity of results are discussed.

e) Chapter 6-8 presents the research results. Chapter 6 presents a summary of the results and preamble to the ensuing analysis and discussions on research results. Chapter 7 & 8 respectively present discussions on 'Critical Functions of Higher Education in the NIS in Pakistan' (Theme 1 & 2) and on 'Creating Critical Functions of Higher Education in the NIS in Pakistan' (Theme 3-9). The results and the discussions are organized under the explicit themes as they emerged from the primary data. The results are analyzed in light of the interview discourses duly interspersed and corroborated with the help of secondary data and its interpretation by the researcher.

f) Chapter 9 comprises of findings of the Study. It brings out an indigenous model in response to the research questions, delineates limitations of the Study and presents recommendations for future research. The thesis is expected to make a much-needed contribution to the body of knowledge for understanding and for aligning the role of higher education in the National Innovation System in Pakistan.

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List of Acronyms

CIS – Community Innovation Survey

COMSTECH – The Ministerial Standing Committee on Scientific & Technological Co-operation of the OIC

DUI – Doing Using Interacting

DAI – Degree Awarding Institute

EU – European Union

EUROSTAT - EU Science and Technology Statistics

GCR – Global Competitiveness Report

GoP – Government of Pakistan

HE – Higher Education

HEC – Higher Education Commission, Pakistan

HEI – Higher Education Institute

ICT – Information & Communication Technology

IS – Innovation Systems

IT – Information Technology

NIE – New Institutional Economics

NIS – National Innovation System

OECD – Organisation for Economic Co-operation and Development

OIC – Organization of Islamic Cooperation

OIE – Old Institutional Economics

R&D – Research & Development

STI – Science Technology & Innovation

ST&I – See STI

UGC – University Grants Commission

UIS – UNESCO Innovation Survey

UNESCO – United National Educational, Scientific and Cultural Organisation

WEF – World Economic Forum

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Words would probably not explain the support and belief that my better half reposed in me. She was the one to endure with me the ardous, patchy and uncertain path that I opted to tread. I am especially thankful to my two sons, Haris and Hassan, who have so patiently braved through my struggle. Moreover, my life would be incomplete without the love and affection of my brother, sister and their families.

For a midcareer professional like me, thinking of embarking upon PhD is a leap of faith and many things come to mind which are bound to cast shadows of self-doubt. However, in my case I was lucky to be in the company of beacons of guidance as high as Dr. S.M. Junaid Zaidi, the founding Rector of my employing organization, COMSATS University Islamabad and Dr. Mukhtar Ahmed, former Chairman, Higher Education Commission, Pakistan. I consider myself lucky to be able to get advice from Dr. S.M. Junaid Zaidi and Dr. Mukhtar Ahmed. I am thankful to both these eminent persons for the encouragement and support extended to me during the course of this research project. I am sincerely grateful to Prof. Dr. Raheel Qamar, the incumbent Rector, COMSATS University Islamabad for his constant interest in my research progress and for providing an enduring support.

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Chapter 1

1. INTRODUCTION

This study seeks to explore the role of higher education in National Innovation System (NIS) in Pakistan. Pakistan is a developing country and there are increasing expectations from the higher education sector to make significant contributions to the national growth and development. As the world economy is transforming at an unprecedented pace, the forces of globalization and technological progress are reshaping ways people live and think. Knowledge, as embodied in individuals, societies, and in technology is one of the critical underlying determinants ensuring growth and development. Therefore, those countries and societies are at advantage, where the creation and diffusion of knowledge is rooted in the social practices. Concurrently, long term investment in education, training, research and its gainful utilisation helps in building societies amenable to learning and knowledge creation (Dahlman & Utz, 2005; Santos, 2007).

This chapter begins by outlining innovation, national innovation system (NIS) and higher education in the NIS. It then goes on to examine the linkages through which higher education contributes to the national innovation system. Finally, it highlights the importance of some indigenous contributions of higher education in the NIS in the historic and socio-cultural context of Pakistan and highlights the key issues that this research seeks to address.

1.1 Innovation and its Theoretical Roots

All powerful economies are driven by knowledge and are distinguished on the basis of stage of their development, and the numerous ways in which knowledge is accumulated and is applied to a practical effect (Metcalfe, 2000). Such application of new or adaptation of existing knowledge to a new use are called ‘innovation’. Its significance is an inescapable economic reality, as it is a source of improvement in products and processes (Schumpeter, 1912, 1934, 1942; OECD, 2005) and overtime nurtures the ability for creating new knowledge and technologies. Therefore, it is often regarded as a critical determinant in increasing the national competitiveness and thus contributes to

wealth creation (Freeman, 1987; Lundvall, 1992 & 2002). Innovation[1] is thus viewed as the key to considerable economic growth and during the preceding four decades or so, there has been a considerable increase in interest in understanding its role in building knowledge economies (see for example Abramovitz, 1986; Carlsson, 1995; Edquist, 1997; Fagerberg, 1994; Freeman, 1987; Gerschenkron, 1962; Godin, 2007; List, 1841; Lundvall, 1988; Nelson & Winter, 1982; Niosi, 1993; Sharif, 2005; Schumpeter, 1912; Solow, 1956; ; Van der Steen, 1999; Veblen, 1898). More specifically it is a key element of the 'growth' as Baumol (2002) notes:

> "… virtually all of the economic growth that has occurred since the eighteenth century is attributable to innovation".

The word 'innovation' and its role in increasing competitiveness in national economic system have intrigued many scholars. For example, works by Freeman (1987), Lundvall (1992), Nelson (1993), Niosi (1993), Fagerberg (1994), Carlsson (1995), Saviotti (1996), Edquist (1997, 2006), Ambale (1997), and Godin (2007) and much before them, Smith (1776) have made significant contributions in building concepts such as 'specialization of labour', 'evolution of institutions', 'co-evolution of technology and institutions', to name a few. These theorists primarily focused on increasingly interdependent and interactive linkages among actors (such as individuals, state, industry, research institutes, universities, suppliers, end users, intermediaries, standard setting bodies, financial institutions, etc.) and institutions (such as laws, social rules, cultural norms, routines, habits, standards, etc.) to understand the process of 'innovation'. The classical and the neoclassical economics though assume 'technology' or 'knowledge' equivalent to 'information' and assess the productive performance and competitive advantage only in terms of material (land, labour, capital and natural) resource endowments (Hall, 2003).

The innovation studies have their theoretical roots in the 'evolutionary economics' where they see the organizations and institutions continuously evolving to develop increasingly interactive and inter-dependent linkages between the producers and the users of knowledge (Freeman, 1995;

[1] Includes any of its variant or a word substantively communicating 'new use of knowledge' such as 'Invisible hand' by Adam Smith, 'mental capital (facilitating new use of knowledge)' by List, and so forth

Mytelka 2000). Furthermore, the evolutionary economics argues that countries need first to build their 'absorptive capacity' (Narula, 2003)[2] before they can generate or even utilize technology. (Mytelka & Smith, 2002) describes the 'absorptive capacity' as the ability to develop internal capabilities for learning. These capabilities, in turn, are represented by the number and level of scientifically and technologically qualified staff in an organisation. The capability to innovate succeeds, only when coupled with an ability to understand and respond to the market demand (Arnold & Bell 2010; Niosi, 2010). The following section entails the concept of national innovation system.

1.2 National Innovation System (NIS)

The concept of national innovation system (NIS) has gradually evolved in late 1980s to establish linkages between innovation and economic development (Lundvall, 1992, Freeman, 2002, Nelson & Winter, 1993, Niosi, 2008). The concept was first introduced and has been rooted in the empirical work of Chris Freeman (1987). Building upon the initial work by Freeman, various researchers exploring the NIS approach seek to explain the interplay among formal and informal institutions and networks facilitating flow of intellect within and across industrial clusters and regional and national borders. As such, it is a system of interconnected institutions that create store, and transfer knowledge, skills and artifacts which define new technologies. Balzat and Hanusch (2004) have described NIS as a historically grown subsystem of the national economy and an interactive process among various actors comprising of institutions and organizations carrying out innovative activity.

It is thus a systemic approach to innovation in which interaction among technology, institutions, and organizations is central to carrying out innovative activity (Groenewegen & Van der Steen, 2006). Withstanding above, rather than the discrete links, the national innovation system

[2] It is the ability of economic units to acquire and internalize knowledge developed elsewhere if they are to "catch up"; Narula, Rajneesh (2003), Understanding Absorptive Capacities in an "Innovation Systems" Context: Consequences for Economic and Employment Growth, Danish Research Unit for Industrial Dynamics, MERIT-Infonomics Research Memorandum series, Issue 04, pp. 1-56 ~ Prepared for the ILO, background paper for the World Employment Report, 2004.

is thus seen as a set of institutional arrangements acting in sync to promote the development and diffusion of innovation. The (economic) incentive structures support and strengthen the relationship among various actors to innovation, which in turn stimulate the process of innovation and diffusion of technology (Carlsson, 1995; Patel & Pavitt, 1994). National Innovation System perspective provides an insight in answering a classical question in development literature, i.e., 'what role the state should play in promoting economic development' (Edquist, 1997; Ringo, 2002; Lundvall, 1992; Nelson, 1993; Reinert, 1999; Torun & Çiçekçi, 2007). As against the deterministic role of the state, one calling for exercising 'control' or the other extreme in which there is belief in the *laissez-faire* market forces; the NIS offers an 'intermediate' view. It calls for fostering 'innovation' as state taking measures for undoing market imperfections and promoting competition. It lies between a 'pure market' view of the operation of enterprises (with its emphasis on individual enterprise facing input and product markets) and a 'planning or state-led' model warranting periodic government interventions (Bryman, 2012; OECD, 2012; NSF, 2012; Skousen, 1992; Teubal, 2000).

In Innovation Systems perspective, individual enterprises operate within (or are embedded in) a set of institutions and non-firm organizations – a 'supporting structure' which determines both the behavior and outcomes (Tebul, 2000). The 'supporting structure' consists of the economic, social, political and geographic context. Central to instituting and strengthening the 'supporting structure', is the need for long-term investment in building human resources. These include measures for producing corpus of knowledge, educating and training 'knowledge workers', promoting research and technological progress at one end, and simultaneously nurturing the role of other actors in the NIS (Mowery & Sampat, 2006).

The theories on innovation have gradually expanded their focus and complexity, beginning with the individual firm or entrepreneur, broadening out to the environment and industry in which a firm operates, and finally encompassing the national system of regulations, institutions, technology, human capital and government programs as well (Niosi, 2002). It thus implies an end to the comparatively 'hands off' project-based funding policies so far pursued by many

organizations and countries to be replaced by closer engagement with a multitude of actors in the innovation system (Arnold, Erik, Bell, & Martin, 2010).

There has long been a discussion (Lundvall, 1992; Fagerberg, 1994) as to which institutions would be included in the NIS. A classification proposed by Lundvall (1992) makes a distinction between the narrow and the broad systems of innovation. The former relates to the national science and/or technology systems or to the STI mode (Mowery & Oxley, 1995) while the later takes into account social institutions, macro-economic regulation, financial systems, education and communication infrastructure and market conditions as far as these have impact on learning and competence building process (Gu & Lundvall 2006). In national systems of innovation, 'learning economy' refers to building of competencies and not just to the increased access to information; i.e. the 'learning' going on in all sections of the society and not just high-tech sectors, and one where net job creation is in knowledge intensive sectors (Gunaskara, 2006; Lundvall & Johnson, 1994; Lundvall, 1992).

Thus, the availability of qualified and skilled workforce is a sine qua non and critical in stimulating the national economy through production of knowledge (and/or technology) and its application in the economic mainstream. This requires an education system that is effective at all levels (from primary education to the postgraduate training including tertiary technical education) capable of supplying people having the requisite academic, technical and trade related skills (Government of Pakistan, 2011). Therefore, the following section tends to explore such link between Higher Education and National Innovation System.

1.3 Higher Education and National Innovation System

Universities play an indispensable role as a source of fundamental knowledge, and the lion's share of basic research carried out by them is significant for maintaining a strong, flexible, and resilient economy. Florida (2002) argued that the research universities have long played a considerable role in (creating) knowledge-based economies.

The character of robust innovation systems is important at different levels and requires complex inter-institutional linkages; i.e. one where the user-producer linkages exist and one where an organic and interdependent relationship is present among actors and institutions of the national economic system (Lundvall, 1992). However, the process through which knowledge transforms into newer applications does not necessarily follow a linear path i.e. from basic to applied research and/or to product (or process) development; it rather comprises of cyclical iterations of incremental and at times fundamental improvements and changes. In modern knowledge-based economies, industrially relevant and technology driven role of higher education is long recognized. Recognizing this role, numerous initiatives were brought into effect in the developed countries in the preceding four (4) decades, where it was aimed to link universities to industrial innovation. Many of these initiatives include creating science parks, business incubators, and capital funds such as venture or risk capital, that are believed to link knowledge produced in the universities to industrial innovation (Mowery, 2004).

The development of knowledge economies, over the preceding decades, strongly manifest a deep pragmatic shift across the globe in terms of reorienting national economic and production structures including reconfiguring the role of national education and training systems (Jowi, 2013). The role of education, more notably, the higher education has increasingly been recognised influential in driving both the regional and national economic growth, building competitiveness and safeguarding sustainable development (Brendenius, Lundvall, & Sutz, 2009). Today, the universities and higher education institutions (HEIs) are not only producing new knowledge, but are also developing knowledge work force, creating enterprises, and (are) productively engaging with communities. The HEIs are envisaged as citadels of enlightenment and national pride contributing actively to the development. The produce of such institutions, i.e. knowledge workforce and new knowledge, is considered a sine qua non for instituting a culture amenable to learning, research, development and innovation.

The narrow and broad definitions of the NIS also characterize a distinction against a competing concept viz. the ‘triple helix of innovation’. In the latter concept, universities, government and businesses are three important poles in a dynamic interaction (Etzkowitz &

Leydesdorff, 2000) and is a closer equivalent to the 'innovation system' in the narrower sense. The NIS in the broader perspective, extends beyond national science systems to include systemic relationships for knowledge generation, its dissemination and application; all institutions influencing upon competitiveness and productivity and hence upon business and economy.

Besides the narrow and broad definitions of innovation systems, Schoser (1999) also distinguishes between formal and informal elements in the mutual interaction of organizations and institutions. Broadly, the elements can be categorised into the following parts.

The first part (1) focuses on functioning of universities and research institutes, patents and publications, etc. which are examples of components of the formal and narrow innovation systems. The second part (2) focuses on the educational and financial system, the labour market etc. They are included in the formal and broad definition of the innovation system. The third part (3) focuses on such elements as willingness of firms to cooperate among them, with research institutes, with other elements of the technology policy etc. The fourth part (4) focuses on the degree of trust in the society or the values of the educational system, etc. and is included among the informal and broad components of innovation systems.

Calling the elements with a higher numerical number as the higher order elements, the elements identified in the (4) tend to influence successively the institutions identified in (3) and (2) which in turn influence those identified in (1). However, the relationship and inter-dependence is not one way alone, it is rather two way, i.e. if the higher order institutions influence the lower order institutions, they in turn are also influenced by the lower order institutions over an extended period of time. There appears thus a hierarchical albeit two-way relationship among them. The mode of innovation and performance of the system in either, the narrow and/or the broad systems are highly interdependent. The national innovation system is thus characterized by complex inter-institutional and inter-dependent user-producer linkages among actors and institutions of the national economic system promoting competitiveness (Lundvall, 1992). The study aims at investigating the role of higher education in national innovation system in Pakistan as well as explores its various aspects and limitations as brought to the fore in this study.

1.4 Context of the Present Study: Pakistan

For the present study, a notable issue to consider is that the National Innovation Systems approach was mainly developed in the Western context. Pakistan is therefore a particularly interesting site and (as developing country provides a different) context within which the role of higher education in national innovation systems is studied. The Islamic Republic of Pakistan (hereinafter referred to as 'Pakistan') is a country comprising of multi-ethnic, multi-linguist diverse population of over 207 Million spread over some 796,000 Sq Km (Government of Pakistan, 2018). It is endowed with bounty of natural resources (ibid). A highlight of the population profile brings out that nearly 2/3rd of its population is below the age of 30. This alone makes a compelling case to invest in people to allow the country to (be able to) realize returns through turning this 'resource' into 'capital'.

Pakistan has however, not fared well with the developmental challenges and falls quite low both on social and technological advancement in the world ranking (GCR, 2017-18). The sporadic reforms introduced under the aegis of different developmental plans, education and science & technology policies have often been slated as foreign transplants and have not been akin to the socio-cultural processes in vogue in the country (Qadeer, M.A., 2006). Consequently, this did not let science and technology plays its due role in realizing the enormous potential in allowing the country in catching up with gainful knowledge application (Government of Pakistan, 2010; Khawaja & Khan, 2009; Mukhtar, Islam & Siengthai, 2011).

Research illustrates a positive correlation between a robust higher education sector and economic growth (Abbas, 2001; Pegkas, 2014). However, the higher education sector in Pakistan historically remained under great strain owing to lack of funds which over the years shaped a sector devoid of linkages with industry to able to respond to the market needs. The outdated curriculum taught by under qualified faculty produced weak students. The administration of universities was heavily politicized and a culture of sycophancy and cronyism was rampant. Low enrollment, wide disparities among regions, economic compulsions faced by sections of students, social exclusion such as for girl students, etc. and poor physical infrastructure further contributed to the deteriorating state of the higher education in Pakistan (Hussain, 1999; Memon, 2007).

A process of reforms was introduced in the higher education sector Post 2002 and the sector as it stands today may still be considered in transition. Under the reforms process, a new draft of the university charter was proposed. It was aimed at restructuring the governance and administrative decision making at the public sector universities. The proposed charter included safeguards to prevent interference by political and other outside influences by giving more voice to the academics. Under the reforms process, the curriculum revision mechanisms were mandated to be taken up each three (3) years with participation from industry professionals beside academics and higher education administration supervisory authorities and professional associations. Funding was increased to institute programs, such as hiring of foreign faculty at market competitive rates, attracting Pakistani diaspora to come and serve at the local universities to teach there and form research collaborations with their (employing) universities abroad. A vigorous human resource development program was launched where young faculty members from universities were sent to pursue research degrees at reputable universities abroad and to the ranking universities within the country. Moreover, faculty mobility was encouraged through providing them research as well as travel and living expenses grants. Universities were provided similar funding to invite reputed international researchers/academics to Pakistan. In terms of infrastructure; funding support was provided for construction of buildings, upgradation of equipment, library and reliable internet backbone for electronically linking the universities. The university faculty was provided social elation in their respective pay scales, pay scales were significantly enhanced, tax rebates were allowed to the teaching and research faculty, support was provided to researchers for filing patent applications for protection of intellectual property rights and so forth. For nearly a decade, a stream of funding was provided to support the reforms process and the universities were given the liberty to implement programs that were best suited to their needs.

The reforms have brought a silver lining to the future of this important sector of the national economy and in the words of Rivera-Batiz (2007), the higher education sector in the country is beginning to be hailed as the engine of economic growth and development of the national economy.

Therefore, this study is designed to answer following four main research questions:

a) What are the primary functions of higher education in the NIS?
b) What are the broad strategies that can be employed to effectively create and manage those functions?
c) What are the actors, institutions and linkages within the system that collectively implement the strategy? and
d) What are the monitoring and evaluation mechanisms that bring feedback and the consequent repositioning of higher education in the NIS?

The following chapter provides detailed review of relevant literature presenting works of prominent theorists and few of the conceptual approaches competing with the NIS. The prominent works include those by Lundvall (1992, 2002, 2007) in his conception of innovation systems as set of institutions contributing to the creation, dissemination and diffusion of knowledge in historically contingent and socially embedded processes; Freeman's (1987) conceptualization of the systemic relations among institutions promoting economic development, the 'Layered Institutional Model' presented by Groenewegen et al's (2006) presenting institutions as a multi-layerd hierarchical construct either promoting or impeding innovation, etc. The latter mentioned model is used as guide to study the role of higher education in the NIS in Pakistan.

Chapter 2

2. LITERATURE REVIEW

In the previous chapter, it was discussed that 'knowledge', as embodied in human beings (as human capital), societies and in technology is one of the critical underlying determinants ensuring sustainable economic development. Therefore, in order to better understand the role of NIS in the knowledge economy, we seek to understand the emerging role of knowledge.

2.1 Knowledge and its Emerging Role

A post-modern society's potential to augment its social and economic welfare hinges on its ability to generate, accumulate, and disseminate 'applicable knowledge' (Bryson, 2000). The post-industrial era of yesteryears is succeeded by a post-modernist thinking as to seeking a new role for knowledge which is commercially and socially exploitable. The application of knowledge combined with entrepreneurial zeal creates economic opportunities thereby influencing growth and development (Burton-Jones, 2001). The economic premium associated with creating applicable knowledge have contributed to the incessant and conspicuous leaps in the evolution and progression of mankind through often irregular augmentations of knowledge and technical progress (Braunerhjelm, 2007).

The term 'knowledge economy' coined in the 1960s signifies a shift from traditional economies to ones where the knowledge takes the central precedence (Cooke, 2001). Though there is no single agreed upon definition of a knowledge economy, according to the World Bank, knowledge economies are defined by four pillars including *institutional structures* that provide incentives for entrepreneurship and the use of knowledge, *skilled labour* availability and good education systems, *ICT* infrastructure and access, and, finally, a v*ibrant innovation landscap*e that includes academia, the private sector and civil society. Consequently, such an appreciation of knowledge among four pillars of a knowledge economy as a productive resource has placed universities at the centre stage of attention and expectations. Thus, academic institutions and companies engaging in research and development laid important foundations of such a system. The economists and economic policy managers continue to appreciate and strengthen their resolve that

national productivity, competitiveness and hence the economic growth hinges on knowledge (Adler, 2001). The scientific advances and their application in the form of new products and processes, growing impact of technology especially the ICTs on every sphere of life, a shift to knowledge-intensive industry and services, and so forth; consequently necessitate and put more demands on the higher end of qualifications and skills spectrum (OECD, 2000; Smith, 2000).

Subsequently, appreciation of knowledge as a productive resource has placed universities at the centre stage of attention and expectations. Withstanding the traditional role viz. knowledge generation and its dissemination, the new dictates of post-modernist era drive universities to generate knowledge, which would find its way into the economic mainstream (Slaughter & Rhoades, 2004). Consequently, universities or institutions of higher learning *per force* have to be akin with the social context constituted both by the formal and informal institutions such as cultural and social norms, language, routines, habits, laws, rules, standards, form and the role of state and its institutions, private organizations, firms, other universities, financial and knowledge intermediaries, and so forth (Lundvall, 2000, p. 24; Niosi, 2002, p. 292).

The cyclical relationship described above among knowledge generation, dissemination and its applications translate into 'learning' which in turn improves productivity and drives competitiveness. Learning is thus a socially embedded process, which relies upon the institutional and cultural context. Since each successive stage of 'learning' relies on the accumulated knowledge, therefore 'learning' also tends to rely on the historical context. The continual interaction among producers and users of technology (or the knowledge) makes possible new combinations for the use of knowledge i.e. (it) spurs innovation (Bessant, Caffyn, & Gilbert, 1996).

A systemic relationship among the actors and institutions that create, store, and transfer knowledge, skills and artifacts which enunciate new technologies define 'innovation system' (Mowery, 1994). These systemic linkages portray a non-reductionist character in either promoting learning or erecting constellations of blocks impeding it. The systemic linkages promoting innovation defines *innovation systems*; an approach which underscores knowledge as a productive resource for spurring economic development (Johnson, 2001).

2.2 Evolution of the NIS Approach: Theoretical Perspectives

The theoretical links between innovation and economic development have long been an area of interest among the economists (Fagerberg, Srholec, & Verspagen, 2010). The historical roots of the efforts can be traced back as early as in the works of Adam Smith towards the later part of 18th century. Much of the progress during the industrial revolution in that era was explained considering the concept of 'Division of Labour' promoted by Adam Smith (Smith, 1937). The concept suggests allocating each worker with the job, which suits him best, thus resulting into an increase in productivity through the ingenuity of the worker in making improvements on the shop floor. Growth to Smith (1937) is proportional to increasing the 'Division of Labor', wherein, each worker is proficient of a specific area (a particular subtask) of production, resulting into a qualitative increase in productivity. The concept is considered a point of departure for subsequent thoughts in modern economics (Çiçekçi, 2007). Smith (1776) seemed exclusively concerned with the broader 'institutional' structure of nations[3], a notion which according to some of the latter economists is in consonance with the precepts of the present-day institutional economics (Basalla, 1998; Nelson & Nelson, 2002). Adam Smith nevertheless emphasized it as:

> *"... all the improvements in machinery, however, have by no means been the inventions of those who had occasion to use the machines. Many improvements have been made by the ingenuity of the makers of the machines. In the progress of society, philosophy or speculation becomes, like every other employment, principal or sole trade and occupation of a particular class of citizens ... and quantity of science is considerably increased by it"* (Adam Smith, 1776, pp. 15-16).

Following Smith, Fredrick List's (1841) conception of the 'National Systems of Production' took into account a wider set of national institutions including educational/ scientific/technical training and policy (making and administration) institutions for the promotion of strategic industries

[3] These include in the narrower sense actors such as; government through its ministries, departments, standard setting and regulatory bodies, public research institutes, universities and other higher education institutions, professional, industry and business councils and associations, (diverse) industry, etc. contributing to and influencing the setting out of agendas and shaping the relationship between applications of science and society, at large.

and adaptation of the imported technology, building national infrastructure such as networks for transport of people and commodities, etc. (Freeman, 1995a, b; Lundvall et. al. 2002). List (1841) while strongly criticizing the theory of 'Division of Labour', and referring to it as 'cosmopolitan' argued that if followed and adopted by other countries, should be able to provide 'catch-up' which might not be true given that the national infrastructure (or in the words of List, the 'National Systems of Production') differs in each country.

List (1841) argued that there was a strong need for the government intervention of a country, like Germany, is to catch-up with the leading economies. List (ibid) presented a broad agenda for government's role in building the necessary infrastructure that could contribute to the technical progress. List referred to the 'mental capital' in what is equivalent to today's 'human capital' as core of the productive power.

Some of the later contributions re-affirmed List's point of view suggesting that when Britain became industrialized, technology was relatively labour intensive and small scale. But in the course of time, technology became much more capital and scale intensive. Therefore, when Germany embarked upon developing itself technologically, the conditions for entry had changed considerably. Technological innovation required reshaping of organizations or even the community in which such organizations were functioning (Freeman & Perez, 1988). The social systems since not being deterministic, they allow intervention by the state and other impending forces such as 'technology' itself (Hughes, 1983). Gerschenkron (1962) while citing the example of Germany argued that the government developed new institutional instruments for overcoming obstacles to technological development through investing in human resources and linking financial sector to the industry's needs for modernization. Gerschenkron (ibid, p.7) held that these experiences continue to remain valid for other technologically lagging countries. Lundvall (1992) too while agreeing to List's findings argued that List lacked analytical tools for developing his ideas further. The subsequent developments in the latter half of the 19th century and after are illustrative of bringing in the use of analytical tools and quantitative aspects in the discipline of economics.

The classical economics brought to the fore the notion of 'Value Theory' (Rescher, 1969) and 'Distribution Theory' (Yang, 1983), wherein value of a product was thought to depend upon

the costs involved in producing that product. The break-up of input, output, expenditure and net savings are distributed among the factors of production and the individuals; thus, introducing the concept of 'marginalism' (as coined by Jevons, 1866). The accompanying proposition that the economic actors make decisions based on margins brought a shift in the economics stream from classical to neoclassical approach (also referred to as the 'marginal revolution' (Dingwall & Hoselitz, 2007). The neoclassical strand in economics rests on three basic assumptions as argued by Weintraub (1993, 2007):

a) That people have rational preferences among the outcomes that can be identified and associated with a value;
b) That individuals maximize utility and the firms maximize profits; and
c) that people act independently on basis of full and relevant information.

In other words, human beings were assumed/conceptualized as 'rational actors' and modeled as 'optimizers' who make choices that lead to 'better outcomes or best possible advantages' in any given set of 'circumstances'. The latter may include; price of resources, goods and services, price of the finished product or services, (ubiquitous) availability (rather indifference to) technology, levying of taxes, regulations, etc. (Veblen, 1900).

Considering such limitations of the standard economics, an American economist and sociologist, Thorstein Veblen (1898) developed a theory of social and economic evolution and transformation incorporating 'technology' as a factor influencing and shaping the institutions. The genre was consequently termed as 'Evolutionary Economics'.

Veblan used the Darwinian ideas of variety, heredity and selection and applied these to the economic evolution. Veblen stated technology, or state of industrial art as he used the term**,** *a joint stock of knowledge* derived from the past experience, held and passed on as an indivisible possession to the community, at large (adapted from Veblen 1921, pp. 28); thus rejecting any theory based on the individual and private initiative, or personal motivation (Gürkan, 2005; Van der Steen, 1999). Veblen's major contribution was not the influence of a given set of institutions on the economic behavior; rather, he focused on the institutional change in the study of economic evolution, thus

laying the foundations for the analysis of endogenous institutional change. In his perception, institutional change and technical change are interrelated, and changes in any one will sooner or later lead to some changes in the other i.e. the process of 'cumulative causation'.

In contrast, Joseph Schumpeter's (1912) analysis of the capitalist society, substituted the neoclassical aspect of 'technology or knowledge' (i.e. being freely available), to when the new knowledge or new use of knowledge i.e. an 'innovation' becomes a fundamental variable explaining competitive advantage and spurring economic development. Schumpeter attributes new uses of knowledge as 'entrepreneurial behavior' and explains it to be at the heart of innovation. Schumpeter finds that the approach that has for a too long time been neglected in the mainstream economics. The theory lies on the premise that 'entrepreneurs' in any society persistently challenge existing order (of business) by introducing innovations, which to Schumpeter are simply defined as the 'new combinations of knowledge application' and are manifested in terms of new goods, new processes, new markets, new sources of supply and new systemization of an industry. This generally referred to as the effort of a lone entrepreneur, also referred to as the 'Schumpeter Mark I' (Schumpeter, 1934, pp. 65; Van der Steen, 1999). Secondly, Schumpeter delineated a distinction between 'innovation' and 'invention', with former being a social activity (or function) carried out within the economic sphere for commercialization purposes, whereas the later can be principally carried out everywhere without any intent of commercialization. Three decades later, Schumpeter (1942) in his much referred contribution, *'Capitalism, Socialism and Democracy'*, emphasized on the significance of innovation and organized R&D activities in established large firms, i.e. Schumpeter Mark II. Thus, the visionary entrepreneur's role as the driving force for the innovative activity (Schumpeter I) was replaced with large R&D firms and laboratories operating in oligopolistic industries (Hanusch & Pyka, 2007; Fagerberg, 2003; Keklik, 2003; Schumpeter, 1947 & 1949). In summary, Schumpeter's (latter) focus was on technical change from within the firm (or business) as an engine of economic development, thus laying the foundations for theory of endogenous technical change (Van der Steen, 1999).

Veblen's (1899, pp. 190) work on the processes of institutional change reflected his inspiration of institutions as, habits of thoughts, points of view, mental attitudes and aptitudes, that

are static, backward looking and resistant to change. According to him, alterations in the institutional structure are only reliant on the pressures from the dynamics of the technological progress (Davanzati, 2006; Rutherford, 1984). This has been supported by Walker (1977, pp. 20) in his study, as according to him Veblen considered, new habits of thought resulting from emergence of new ways of making a living, which are in turn the result of technological change and attributed new institutions as the result of a dynamic impact of technology.

However, Schumpeter diverges from Veblen in regard to power of institutions, and suggested growth to be primarily driven from the entrepreneurial innovations which themselves are influenced by the institutional environment. This has been illustrated in 'Schumpeter Mark I' pattern of innovation (often characterized by 'the creative destruction'), wherein, entrepreneurs introduce new ideas and innovations in industry, launch new enterprises, challenge existing firms and continuously disrupt the existing methods of production, organization, and distribution (i.e. widening). On the other hand, 'Schumpeter Mark II' pattern (characterized as 'the creative accumulation') suggests predominance of large established firms with an accumulated stockpile of knowledge and competence in the R&D, production, distribution and financial resources; in turn creating relevant barriers for new entrepreneurs and small firms (Breschi et. al. 2000).

Veblen's work about Germany's industrialization (1915) optimistically argued about the possibilities for the technological and economic catch-up by the industrial latecomers and the poorer economies (Fagerberg & Srholec, 2008). Soon after the end of World War II (1939-1945), this optimistic mood was shared by the neoclassical strand in economics, which assumed technology as a freely available 'public good', thus nurturing development everywhere for everyone as long as the respective markets are allowed to perform their task freely and are able to absorb improved technologies (Solow, 1956 & 1970). However, from 1960s onward, the economic historians (and social scientists) such as Alexander Gerschenkron (1962) and Moses Abramovitz (1973, 1979) seemed much skeptical with the philosophy of the neoclassical economics. To them, technological catch-up is not spontaneous and requires considerable efforts, as institutional and human capital components of the social capability develop only slowly.

It has been observed that over the past few decades, there has been a revival of interest in the institutionalist thinking within economics and social sciences. Consequently, a growing literature of institutional analyses has emerged in the works of several notable economists including Schumpeter, Searle, Hodgson, Douglas North, Nelson, Winter, Freeman, Lundvall and so forth (Schmid, 2004). John Searle, an American philosopher, also contemplates institutional logic and built his theory of institutions from the 'Institution of Language', which he postulates as central to all institutions. In his theory of speech acts, collective intentions (i.e. desires or beliefs) become socially productive only through the constitutive norms and rules of language. Searle notes the potential of language, an institution in itself, to assign a status to those things which don't possess it due to their physical nature; that distinguish human beings and allows for constructing and sustaining institutions. He further argued that a community cannot function without a common language, and a language delineates a community's boundaries, thus prohibiting unsavory intruders or alien topics for discussion (Finch et. al. 2005; Kasozi, 2004; Searle, 1995).

Hodgson (2006) saw institutions making up the social life, and introduced the notion of durability, encompassing the informal as well as formal, and depicted awareness to the 'generative' and 'sustaining' role of habits. Being an institutional economist, he described institutions as, 'systems of established and prevalent social rules' that structure social interactions including language, money, law, systems of weights and measures, table manners, and firms (and other organizations) are thus all institutions. He further argued that institutions create structured thoughts, stable expectations and actions through consistency in human activities; thus, leading to an easier, predictable and more efficient social life. Furthermore, institutions constrain behavior, as the existence of rules or laws imply constraints, however such constraints may open up new choices and actions that otherwise would not exist (Hodgson 2006).

Continuing research on institutional economics attempted to answer certain puzzles as they existed in the neoclassical economic paradigm i.e. the decision to make, to buy, or to look for substitute organizational arrangements and an interpretation as why (do) some countries are rich and some are poor? The work by Coase (1937, 1960) and Williamson (1975) gave birth to a new genre in economics, often referred to as the 'New Institutional Economics' (NIE) approach. Their work

on understanding the property rights and contracts at the firm level was furthered by Douglas North. Douglas North (1990, 2010) through his Noble - Prize winning work presented an analytical framework for examining the characteristics of institutions and institutional change on the economic (or societal performance). He argued that the property rights and transaction costs are two fundamental determinants of economic performance. Institutions to North (1991) are humanly devised constraints that structure political, economic and social interactions. To him, some economies develop institutions that produce growth and development, while the others develop institutions leading to stagnation, or decline. North (1990) in particular attributed the issues surrounding the developing world to the rots in the institutional framework of the society and argued that, Third World countries are poor because the institutional constraints do not encourage productive activity. North (1990, pp. 54) further emphasised that the inability of societies to develop effective low-cost enforcement of contracts is one of the most important source of both historical stagnation and contemporary underdevelopment in the Third World countries. His notion of institutional change sees organizations as 'players of the game' which engage in purposive activity with the economic entrepreneurs acting as agents of change to alter the existing institutional framework (Kingston & Caballero, 2009).

On lines like North (1991), Lundvall (1992, pp. 26) defines institutions as, "… the set of habits, routines, rules, norms, and laws that regulate the relations between people and shape the human interaction". He further distinguished between the idiosyncratic characteristics of national institutions, and local institutions of various subsystems of innovation. Scott (1995;2001) asserts that the institutions are social structures that have attained a high degree of resilience. They are composed of cultural-cognitive, normative, and regulative elements that together with the associated activities and resources provide stability and meaning to social life. Additionally, institutions connote stability but are subject to the change processes that are both incremental and discontinuous. Similarly, Lin and Nugent (1995) conceptualised these as set of humanly devised behavioural rules that govern and shape the interaction of human beings, in part by helping them to form expectations of what other people do.

Thus, one can easily argue that institutions refer to the norms, rules of conduct and to informal and formal institutions that govern the way the society operates i.e. behavioural rules, social customs, faith, rapport among economic agents, habits of agents, to name a few and the informal institutions; and the role of the state in economic life, administrative system, judicial system, mechanism of getting into power, laws relating to private property and contracts, agencies for regulating economic and financial system, educational structure, labour market relationships, laws of taxation and inheritance, are a few examples of the formal institutions (Muro & Tridico, 2008). Thus, innovative performance largely depends on the extent as how these actors and contextual factors exist in a complex, yet systematic relationship, as elements of a collective system of knowledge creation and dissemination for the technological progress and economic growth and helps in understanding the NIS (Kriaucioniene, 2001; OECD, 1997; Soete et. al, 2009).

Another strand which significantly gained currency during 1980s and 1990s was the philosophical work carried out by economists trained in economic modeling / econometrics, who adhered to an evolutionary theory of economic growth, such as Nelson (1982), Winter (1982), Mirowski (1983), Freeman (1987), Lundvall (1988), Mowery (1989), Malerba (1992), Orsenigo (1993), Carlsson (1995), Edquist (1997), etc. Voluminous literature emerged arguing on the various 'capabilities / competencies' that are required to be generated by countries, industries and firms in order to successfully exploit technology for economic growth (Fagerberg et al. 2009; Nelson & Nelson, 2002). Consequently, various concepts such as 'technological capability', 'absorptive capacity' and 'innovation systems' were coined and a growing body of the empirical literature emerged particularly focusing on the characteristics of growth and development. The work provided a major source of inspiration / insight for certain mechanisms and evolutionary institutional economic processes successfully implemented in numerous developing countries (Dutraive, 2009).

2.3 National Innovation Systems

A precursor to the term National Innovation System (as 'innovation system') was coined by Freeman as early as 1982 (1988, 2002) and soon the term itself found its way in a growing body of literature (Balzat & Hanusch, 2004; Carlsson, 1995; Dosi et al. 1988; Edquist, 1997; Lundvall, 1992; Nelson, 1993).

Innovation is regarded as fundamental, inherent and a ubiquitous phenomenon in capitalism. It is the key driver for enhancing productivity, competitiveness, and ensuring long term economic growth of nations (Johnson, 2001). It would be relevant to re-capitulate few definitions of the NIS to underscore the diversity yet a close conformance to a central core in various definitions of the NIS. Freeman (1987) originally defined NIS as, "… a network of institutions in the public and private sector whose activities and interactions initiate, import, modify and diffuse new technologies". Nelson (1988) refers NIS as, "… the institutional set - up of a national economy emphasizing the industrial structure and the organization of R&D system". Lundvall (1992, pp. 2) in his major contribution defined NIS as, "… a system of innovation is constituted by elements and relationships which interact in the production, diffusion and use of new, and economically useful knowledge and (that) the elements and relationships, are either located within or rooted inside the borders of a nation state". Lundvall strongly argued that NIS is a socially embedded system, as learning is its central theme, which itself is social activity involving interaction among people. Metcalfe (1995) describes NIS as the, "set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provide the framework within which governments form and implement policies to influence innovation process. As such it is a system of interconnected institutions to create, store, and transfer the knowledge, skills and artefacts that define new technologies". OECD (1997) defines NIS as, "… a complex set of relationships among actors producing, distributing and applying various kinds of knowledge". Similarly, Balzat and Hanusch (2004) describes NIS as, "… a historically grown subsystem of the national economy in which various organizations and institutions interact with and influence one another in carrying out of the innovative activity".

In the realm of standard economics innovation appears as an extraordinarily rare, accidental, and exogenous event (Hobijn & Jovanovic, 2001; Gompers et al. 2008; Pastor & Veronesi, 2009) which temporarily agitates general equilibrium, and thus a new state of equilibrium is instituted through a process of adjustment reflected as 'price' or 'market' based mechanism. This conception might have been adequate for the pre-industrial societies[4] but not the present day capitalist society. This implies that in all spheres of the economy, and at all times, there are on-going processes (either

[4] refers to the particular social traits and forms of political / cultural organization that remained prevalent before the onset of industrial revolution (i.e. from 1760 - 1840)

gradual or incremental to quantum shifts to discontinuous) of learning, searching and exploring which transforms into new products, techniques, forms of organizations, and markets, etc. (Martin & Nightingale, 2000).

The gradual and cumulative aspects of new combinations of knowledge may be planned, happen through serendipity or as Lundvall (1992, pp. 9) stated:

> *"...sometimes, an innovation might be almost inevitable – the new combination might be easy to find and to realize. In other cases, it might take an enormous intellectual effort or an extremely creative mind, to identify a potential new combination. And, sometimes, the process of innovation results in radical breaks with the past, thus making a substantial part of accumulated knowledge obsolete".*

Lundvall & Johnson (1994) illustrate modern economy as a knowledge-based economy or more adequately in current era, term it as a learning economy, wherein strengthening of knowledge base is emphasized as a promising strategy/resource aspiring for economic growth and learning as the most significant process. As against the Principal Investigator centric model (e.g. Schumpeter) which assumes a linear model of technological development, the NIS approach elucidates an interplay among policies, institutions, and formal and informal networks facilitating the flow of intellect within and across the industrial clusters and national (and regional) borders. Learning is thus primarily an interactive, and hence, a socially embedded process – together the economic structures and institutional milieu form the framework for, and dynamically influences the process of (interactive) learning, thus resulting into significant innovations.

Van der Steen (1999, pp. 18) defined interactive learning as:

> *"a process in which firms innovate along the line of certain institutionalized interactive learning trajectories. This is based on the preposition that innovation is basically an interactive learning process, and (one) which requires the knowledge - sharing or exchange, interaction and cooperation among various agents in a production or value chain".*

Thus, all critical inputs to the process of innovation doesn't spring from the efforts in science, research and development being carried out in large scale corporate and government laboratories rather, learning takes place in connection with routine activities of production, distribution, and consumption (i.e. everyday experiences of the workers, production engineers, and sales representatives, etc.), thus producing new knowledge/insights and in turn influencing the agenda for determining the course of innovative efforts (Freeman, 1982; Lundvall, 1988 & 2007). Apart from learning entrenched in the routine activities, organizations and economic agents might engage, especially under certain extreme circumstances, when the survival of organization is threatened in the process of searching and exploring, consequently, creating inputs to the innovation process (Giddens, 1984). Searching (Lundvall, 1992) refers to looking for alternatives/substitutes (in terms of products, processes and markets, etc.) close to ones already well-known to the organization. Exploring refers to a quest (pursued) in research (i.e. in academia or research organizations, outside the private firm) and is less goal-oriented than profit-oriented (Nelson & Winter, 1982).

Since human knowledge does not subsists all by itself and is rather coded in the central nervous system of the human beings, which have limited life spans and swiftly vanishes out (except for genetically coded knowledge); it must be accumulated in one way or the other within the society. Institutions play a considerable role in determining how this is possible. This draws our attention to the fact that besides the explicit knowledge (the one i.e. formal and codified), a significant proportion of human knowledge is the one that cannot be easily articulated in codified forms (i.e. tacit knowledge); it includes; skills, techniques, know - how, routines, etc. (Polanyi, 1962; Granovetter, 1985). Thus, knowledge in this perspective is experience-based and can only be accumulated through practice in a context and transmitted through networks of human relations (in turn referring to its social embeddedness and interactive nature of learning processes). Therefore, in a system of production, firms exploit their governance structures and routines to coordinate and utilize the person-bounded knowledge, but also store knowledge overtime, independent of the one possessed by individuals. Some of this knowledge may prove conducive for further development/accumulation of knowledge, while its other segments might obstruct this process by preserving 'unproductive habits of thoughts' (Lam, 1998; Veblen, 1919). Accordingly, the national patterns of knowledge accumulation are reflected in the different institutional structures able to hold

the knowledge. The relationship between institutions and learning is critical, as knowledge which is not institutionally sustained and doesn't fit in the cultural context, tends to be forgotten (Douglas, 1987; Van der Steen, 1999). Without active support of institutions, society would not be able to 'remember' and would soon 'forget' what it has already learnt (Edquist, 1997; Metcalfe, 2000). A related aspect is that system (or sub-systems) exhibit strong complementarities among its constituent components. If, in a dynamic system, one significant, complementary component is missing, or fails to make progress, it tends to retard or recede the growth of the entire system. Rosenberg (1982) have termed this event as 'Reverse Salient' and 'bottleneck' (of the system) respectively.

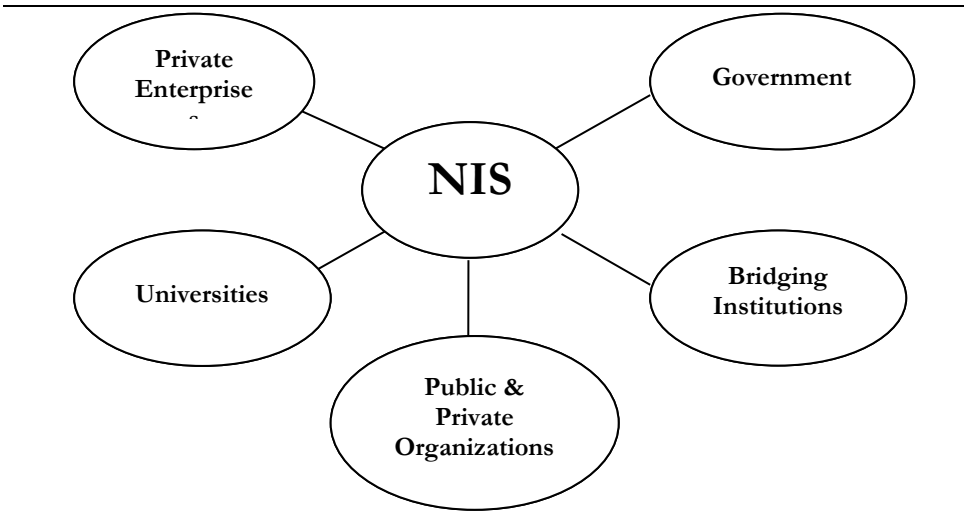
Institutions are central to the evolutionary thinking, and as stated earlier, shape the interactive learning process in the economy. Institutions provide agents and collectives with the guide-posts (i.e. informational 'signpost') for action, and make it possible for the economic systems to survive in an uncertain world, characterized by multiple and concurrent innovative activities (Dosi, 1982; Grønning, 2008). Institutions help reducing skepticism, coordinate use of productive knowledge, arbitrate conflicts and offer inducement systems, and by serving these principles, they provide stability necessary for the reproduction of society, i.e. thanks to 'autopoiesis' as defined by Luhmann.

The systemic relationship among the institutions (both formal and informal) specifies that innovation and learning, is affected by the prevailing institutions and the socio-economic structures. The prospects and hence the efficacy of learning increases in the sub-national innovation systems (sectoral/regional/technological) due to the proximity and (prospects of) more interaction among them (Lundvall et al. 2009). The form and conception of organizations, institutions, and socio - economic structures that focus upon interaction among the economic agents and in turn upon learning and change makes the innovation studies closer to the realm of institutional economics (Gilsing, 2000). Institutional economics and innovations studies thus constitute the theoretical precursors of the National Innovation Systems (NIS) approach (Sharif, 2005, pp. 8).

The conception of NIS recognizes that an interactive, yet, relatively complex relationship either exists or needs to be nurtured among various actors of the innovation process. According to

OECD (2005), NIS institutions, defined in the narrow context, can be divided into five main categories i.e. government, bridging institutions, public and private organizations, universities and private enterprises.

Fig. 1: Elements of the 'National Innovation Systems' Conceptual Approach (OECD 2005)



The term 'National Innovation System' has also been widely accepted by several international organizations including Organization of Economic Cooperation and Development (OECD), International Monetary Fund (IMF), The World Bank (WB), The World Trade Organization (WTO), etc. Organizations like the WB, which once used to dismiss institutions as ~~the~~ 'mere details' (WB, 1997) that don't affect the wisdom of the economic theory have started to realize the approach as an integral part of their analytical perspective (WB, 2002)

2.4 Application of General System Theory

As stated above, the 'innovation systems' portray historical contingencies and rely upon accumulated knowledge at a given point in time. The innovation systems are prone to gradual evolution and are seen to make transition towards higher order. Thus, an often-cited question in 'innovation systems' studies relates to how are they different from the 'closed system', ones in which the second principle of thermodynamics holds good and which calls for events in physical

nature moving towards states of maximum disorder (entropy). The difference between these, the so to say, 'closed systems' and the living world, is one that the latter are generically 'open systems' i.e. the exchange of matter and energy flows across the system 'boundaries'. These systems show gradual evolution and transition towards higher order, heterogeneity i.e. a quest for survival and hence organization. Bertalanffy (1972) provides answer to this predicament in his General Systems Theory. He explains that in all irreversible processes i.e. closed systems, entropy must increase. The change of entropy in closed systems is always positive, i.e. order is continually destroyed. However, in open systems, there is not only production of entropy due to (certain) irreversible processes, but also the import of entropy which may well be negative. The open systems, thus defy entropy. Thus, 'living systems', as open systems, maintaining themselves in a steady state, can avoid increase of entropy, and may even progress towards states of increased order and organization. The examples in biology include, homeostasis, or maintenance of balance in the living organism, the prototype of which is thermoregulation in warm-blooded animals, or the theory of communication and control finding its applications in 'control systems' in electrical engineering.

2.5 Luhmann Social Action Theory to NIS

The self-organizing communications between the external world, which is chaotic and those within a system which is more organized is reflective of the discipline pursued by a living organism, behaviour of an individual or a society, in what we call adaptiveness, purposiveness, goal-seeking and the like. The system is defined by Boulding (1985) as 'anything not in chaos'. Luhmann further accentuated, "… a general systems approach to emphasize that human action becomes organized and structured into systems. Turner (2003, pp. 55) stated that "when the actions of several people become interrelated, a social system can be said to exist …". This brings us to the core element of Luhmann's theory of communication. According to Luhmann, social systems are systems of communication, and society is the most encompassing social system. A system is defined by a boundary between itself and its environment, dividing it from an infinitely complex, or (colloquially) chaotic, exterior. The interior of the system is thus a zone of reduced complexity: Communication within a system operates by selecting only a limited amount of all information available outside. This process is also called "reduction of complexity". The criterion according to

which information is selected and processed is ‘meaning’. Both social systems and physical or personal systems operate by processing ‘meaning’.

Furthermore, each system has a distinct identity that is constantly reproduced in its communication and depends on what is considered meaningful and what is not. If a system fails to maintain that identity, it ceases to exist as a system and dissolves back into the environment, from which it had initially emerged. Luhmann called this process of reproduction from elements previously filtered from an over-complex environment ‘autopoiesis’ (literally meaning ‘self-creation’). The NIS is seen to follow the analogy of Luhmann social theory, where communications among its elements continuously regenerates itself to keep the ‘system’ and its ‘system-ness’ intact.

As described earlier Luhmann perceived social systems primarily as the communication networks (based on shared meaning), and modern society as the most encompassing social system differentiated in terms of various functional subsystems – legal, economic, science, religion, and so forth. As opposed to Parsons (1969), who believed in one single overarching and integrated system striving for equilibrium; Luhmann argued that modern society has maintained stability without any reliance on the society - wide consensus (Adam & Sydie, 2001; Furseth & Repstad, 2006; Holmes & Larmore, 1982). It is in this vein that Luhmann opposed the Marxist claim (i.e. all aspects of capitalist societies are based on economics ~ Korten, 1995), and emphasized that no single key institution is formative for all of the other institutions (Tim, 2005).

The interior of the system is a zone of reduced complexity. Communication within a system operates by selecting only a limited amount of all information available outside. This process is also called "reduction of complexity". The criterion according to which information is selected and processed is ‘meaning’. The social and physical or even the personal systems operate by processing ‘meaning’. Thus the self-organizing communications between the external world, which is chaotic and those within a system, which is more organized, is reflective of the discipline pursued by a living organism, behaviour of an individual or a society, in what we call adaptiveness, purposiveness, goal-seeking and so forth. This reference to ‘communication’, then becomes the core element in Luhmann's theory of communication or Luhmann’s theory of ‘social systems’.

In his 'Theory of Autopoietic Systems', Luhmann postulated systems as autopoietic in character i.e. organic in nature and emphasized that the social systems are self - referential systems. These systems are composed of elements (actions) which they produce by an arrangement of their elements (Luhmann 1984, pp. 65). Similarly, the system continuously refers to itself by distinguishing itself from the environment. This is done by drawing and maintaining boundaries which could be crossed occasionally. The self-referential system is a self-reproducing or 'autopoietic' unit, itself producing the elements which comprise the system, and this requires capacity to distinguish elements that belong to the systems and those … to the environment of the system" (Luhmann 1983, pp. 992-993). In this respect, the system is understood to have 'needs', and its sub-systems contribute to the well-being of the system as a whole. Calhoun (et al. 2002) and Makarovič (2001) argued that Luhmann's system theories have long been one of the most controversial sociological concepts of the twentieth century, as it has drastic implications for how one system can affect the other in absence of the interpretations of the other systems.

In the discussion at hand, the 'systems' element refers to an interdependent relationship between institutions to influence upon the (interactive) learning processes of economic agents/actors (Sharif, 2005; Van der Steen, 1999). The innovation systems are seen to follow the analogy of Luhmann social theory, where communications among its elements continuously regenerates itself to keep the 'system' and its 'system-ness' intact.

The use of unit 'national' in the 'national innovation systems' is little conspicuous to start with; in an era of globalization and one in which the world economy, at large, is transforming at an unprecedented pace. Yet the moot point is that the institutions, both formal (such as organizations, laws, procedures, explicit codes of conduct, variety of hybrid networks, etc.) and informal (such as cultural or social norms, taboos, routines, and so forth) are distinct for each country and together constitute an institutional environment influencing learning and capacity building. Moreover, as against the codified 'knowledge', the 'knowledge' embodied in individuals and institutions have less prospects of transfer across national borders unless the individuals or a group of individuals themselves actually move. It is also seen that some countries are using their distinct milieu of institutions to drive growth of their economy better than others. Hence the word, 'national'

circumscribes the 'innovation system' as exists in each separate country. The challenge lies in competing internationally and participating in knowledge supply chains to take their due share in the domestic and global markets. Among other factors, a critical mass of qualified human resource capable of assimilating, utilizing and generating new knowledge and the consequently long term investments in education, training and research are though imperative to build capacity (Dahlman & Utz, 2005; Levy et al. 2005; Santos, 2007).

2.6 Competing Conceptual Approaches to NIS

There are several conceptual approaches/competing theories that posit against the neoclassical strand in economics and linear model of innovation for explaining technological growth. Such approaches include Porter's (1990) Cluster or Diamond Model of Thinking, Gibbon's (1994) New Production of Knowledge, and Etzkowitz and Leydesdorff's (1997) Triple Helix Model of University-Industry-Government Interactions.

These perspectives have been debated and discussed broadly in S&TS policies (see for example, Cohen et al. 2002; Hicks & Katz, 1996; Godin & Gingras, 2000; Pestre, 2003; Jansen, 2002; Shinn, 2002; Ziman, 2000). Briefly, Porter's (1990) Cluster or Diamond Model of Thinking presented in his groundbreaking study, *'The Competitive Advantage of Nations'* argued against the classical theory of international trade.

He proposed that comparative advantage resides in the factor endowments that a country may be fortunate enough to inherit and illustrates that a nation can create significantly new factor endowments such as skilled labor, strong technological and knowledge base, government support, and culture etc. (Sharif, 2005).

In fact, attention was drawn as why does a specific country (state or region) was successful in specific industries (McKelvey, 1991). Carlsson et al. (2002) further elaborated that the point of greatest dissimilarity between Porter's Model and NIS Conceptual Approach lies in level of their empirical analysis.

Due to its industry-oriented focus, ‘Porter’s Model’ strongly emphasized the role of competition amongst various actors within industries (i.e. market competition), while restraining non-market interactions with entities outside the industry. In this regard, the systems definition is narrower than the NIS Conceptual Approach (Mastroeni et al. 2009).

Gibbon’s et al. (1994) notion of the New Production of Knowledge shown in Figure 2 sketches emergence of a socially distributed knowledge production system, which is characterized by context-driven, problem-focused, trans disciplinary and reflexive research that engages a multidisciplinary group of practitioners brought together to work on specific problems in the real world.

Fig. 2: Michael Porter's Cluster or Diamond Model of Thinking

Source: Porter, M. E. (1990)

This is also known as ‘Mode 2’ knowledge production and contests against the traditional research, which is academic, investigator initiated, and discipline based.

The latter is labeled as ‘Mode 1’ knowledge production. Etzkowitz and Leydesdorff (2000, pp. 116) elaborated it as;

> “*the so - called Mode 2, …is the original format of the science before its academic institutionalization in the 19th century … Mode 2 represents material base of science, (as to) how it actually operates. Mode 1 is a construct, built upon that base in order to justify autonomy for science, especially in an earlier era when it was still a fragile institution and needed all (the) help it could get”.*

Although the Mode 2 knowledge production has attracted a considerable interest in the science, technology and society studies due to its broad scope. Hessels & Van Lente (2008) argued that problems in its descriptive or empirical validity (i.e. lack of empirical evidence for the rising attributes of ‘Mode 2’, and non - justification of the universality of claims as the dynamics would be different in different national contexts/scientific disciplines (Albert, 2003; Godin, 1998; Shinn, 2002; Tuunainen, 2002), theoretical and conceptual approach/strength (i.e. lack of theoretical underpinning and references to the sociological theory (Shinn, 2002), and its political value (i.e. implicitly supporting the observed trends (Weingart, 1997) disregards its acceptance in contrast to the NIS conceptual approach.

Etzkowitz and Leydesdorff’s (1997) Triple Helix Model of the University-Industry-Government Interactions engages university as the centre of excellence with its academic based research and development activities, industry as source of customer demand based on commercial activities, and government as a policy maker. The amalgamation of these diverse actors lie at the heart of ‘Triple Helix System’, that supremely increases knowledge spillovers in the region; thus increasing competitive advantage for economic development, either at the regional or national level (Irawati, 2006). The ‘Triple Helix’ refers to a spiral model of innovation that captures multiple reciprocal relationships at diverse stages in the process of knowledge capitalization, and the spiral

is meant to elucidate that the overlay of communications and expectations at network level guides reconstruction of institutional arrangements overtime i.e. the (causes) evolution of the system (Etzkowitz & Leydesdorff's, 2000; Jofre, 2008).

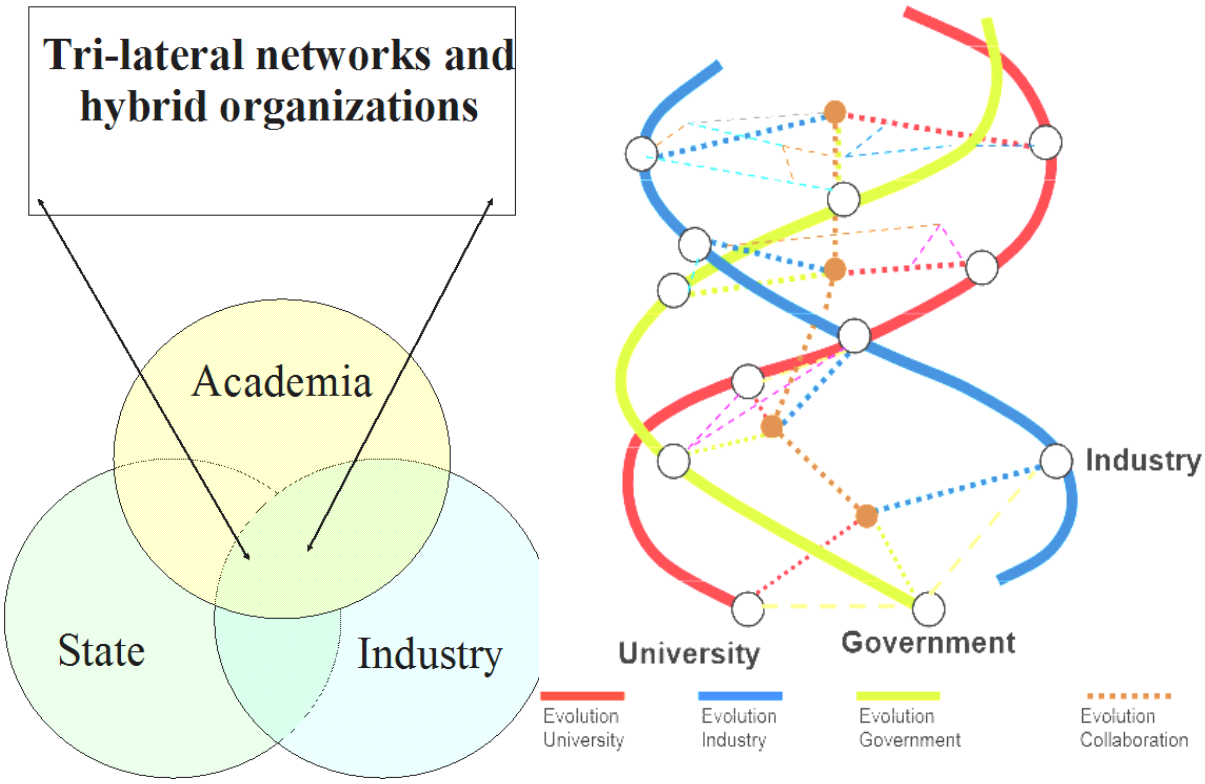
The institutional arrangements relating to such reconstructions lie within the national institutional milieu which per se is broadly influenced by the governmental policies. Thus, triple helix hypothesis is that the 'system' is not expected to get stable; on the contrary it remains in an endless transition.

Sharif (2005) argued that the point of greatest equivalence between 'NIS Conceptual Approach' and 'Triple Helix Model of University-Industry-Government Interactions' lies in role of the government to create conducive conditions for innovation.

Similarly, point of greatest dissimilarity is that the 'Triple Helix Model of University-Industry-Government Interactions' assigns a more central role to universities both as human capital provider and seed-beds of new firms in emerging knowledge economy (Etzkowitz, 1999).

Whilst the 'NIS Conceptual Approach' regards the well-managed firms as having the most substantial impact on a country's innovative capability.

Fig. 3: The Triple Helix Model of University - Industry - Government Interactions



Source (s): Jofre (2008) and Etzkowitz & Leydesdorff's (2000)

The inputs/outputs approach assumes a linear model of technological development (i.e. science leads to improved technologies, which leads to industrial improvements. Whereas the national innovation systems (NIS) approach offers improvements over alternative frameworks that conceptualize technological development in terms of inputs (e.g. science funding) and outputs (e.g. publications and patents). Therefore, national innovation stresses dynamic networks of policies, institutions, and people that mediate knowledge flows across national borders and within domestic industries. Additionally, it views innovation efforts as intimately linked to broader macroeconomic and educational policies and offers a more realistic picture of development processes. Thus, the development of human capital via education and training is essential for fostering absorptive capacity and that economic policies must be designed to compel international competitiveness. Thereby, this systemic approach allows policy-makers to identify leverage points or weak links

within the network. In general, NIS case studies suggest that public and academic efforts can support, but may not substitute for the technological efforts of firms (Nelson & Rosenberg 1993).

'Knowledge' and 'learning' are fundamental to the NIS approach. In the analysis of National Systems of Innovation (NSI's) by Lundvall (1992, 2007), learning refers to the adaptation and competence building and competence building takes place only through learning by doing (Arrow, 1962; David, 1970; Rosenberg, 1982), learning by using (Rosenberg, 1982; Lundvall, 1988), and learning by interacting (Lundvall, 1985; Morgan, 1996). Learning is therefore more related to the 'implicit' or tacit' (Lundvall, 2007; Lundvall & Johnson, 1994; Popadiuk & Choo, 2006; Johnson et al. 2003; Rosenberg, 2004; Torun & Çiçekçi, 2007) knowledge as against the 'explicit' or 'codified' knowledge .This also connects learning with constructivism, as ~~it~~ learning appears ~~as~~ an interactive and social process, wherein, learners actively construct meanings from their experiences in connection with their prior understandings and the social settings (Driver et al., 1994) and **as such offers a conceptual complementarity for using (social constructivism) as the methodology chosen for this study**.

2.7 Measuring Competitiveness & Innovation

The NIS concept as detailed in above sections portrays socially embedded and mutually constitutive linkages among institutions, technology and economics (Freeman, 1987). The development of the concept initially circumscribed qualitative interactions with little analytic tools developed to measure, monitor, control, and replicate such systems across different (geographic, sectoral or technological) aggregation levels. The succeeding discussion illustrates reference to surveys, albeit not in an exhaustive manner, which bring out quantitative and comparative statistics across nations.

Precursor to developing guidelines for instituting surveys measuring competitiveness and innovation relate to the science and technology policy studies. Quantitative assessments were made through bibliometric data, patents, trade mark, R&D statistics, etc. A noteworthy reference in this respect is the development of Oslo Manual by the OECD in 1992. The guidelines contained in the Oslo Manual are used in carrying out European Community Innovation Survey (CIS) by OECD/EUROSTAT. Other notable surveys include those carried out by the World Competitiveness

Yearbook published by the Institute of Management Development; Global Competitiveness Report by the World Economic Forum, European Innovation scoreboard by EU Lisbon Summit, 2001 and so forth (Arundal, 2001; OECD, 1992; Evangelista et al. 1998; Mendonça, Pereira & Godinho 2004; WCY, 1989; WEF, 2004; Smith 2004). Periodic qualitative assessments are made by the national planners through writing policy notes, summaries or position papers of the status of innovation in their respective regions/countries.

a) The Community Innovation Survey/EUROSTAT Survey

As stated earlier, different S&T and R&D surveys were precursors to a number of models and analytical frameworks that led to the initial innovation surveys, taken up on a limited scale, in the late 1980s (Arundal, 2001; Evangelista et al. 1998; Smith, 2004; Mendonça, Pereira & Godinho 2004). Experimentation with early surveys and their results were used to evolve a coherent set of concepts and tools that helped in developing the first edition of the Oslo Manual in 1992. First European Community Innovation Survey (CIS) was carried out in 1992 in light of the guidelines contained in the Oslo Manual. It primarily focused on technology product and process (TPP) innovation in manufacturing sector. The Oslo Manual was later revised by the Committee for Scientific and Technological Policy, OECD in 1997 (2nd Edition) and in 2005 (3rd Edition) to incorporate an expanded coverage of the 'services sector' (2nd Edition) and latter incorporating a broadened definition of innovation to include marketing and organizational innovations; a much expanded coverage of knowledge flows and the role of linkages in the innovation process; and an adaptation to reflect increased awareness of innovation in less R&D-intensive industries, such as services and low-tech manufacturing etc. (3rd Edition). The successive revisions incorporate new theoretical insights ~~and~~ as improved datasets become available. The changes are made gradually so that year on year results remain comparable and still capture the essence of evolution of an economy's performance relative to the competitiveness of others. The aim is to keep innovation measurement abreast of policy needs and developments in the innovation literature.

First CIS experienced some difficulties; partly due to lack of standards existed then and partly due to a short time-frame.

However, its contribution lies in setting the minimum standards and affording comparability of data across the participating countries. Until 2016, nine (9) cycles of the CIS were carried out with the last one undertaken in 2015.

The CIS surveys provide statistics broken down by countries, type of innovators, economic activities, etc.

The CIS initially collected innovation activities data from the OECD member states. Since participation was voluntary and assuming, and rightly so, that innovation also occurs outside OECD member states, data contributions were also asked from non-OECD member states in its subsequent cycles.

The number of countries participating in different cycles of CIS accordingly varies.

The CIS surveys are part of the EU Science and Technology Statistics (EUROSTAT). Since 2011, the UNESCO Statistics Office instituted UNESCO Innovation Surveys (UIS) in the light of additional guidelines prepared and added (for carrying out UIS) as an annexure to the Oslo Manual. Besides CIS, the UIS also relied upon surveys conducted by the Association of South East Asian Nations (ASEAN), African Unions-New Partnership for African Development (AU/NEPAD), and Red de Indicadores de Ciencia y Tecnología (RICYT).

Most of the successive survey designs for carrying out innovation systems' measurement are inspired by and rely upon the CIS framework.

b) World Competitiveness Yearbook

World Competitiveness Yearbook (WCY) report is published by the Institute of Management Development (IMD), Switzerland since 1989. The report measures a number of factors for assessing competitiveness of nations and enterprises.

The following constitute the main factors assessed in the WCY; a) Economic Performance, b) Government Efficiency, c) Business Efficiency and d) Infrastructure.

Each of these four factors have been broken down into five sub-factors, i.e. a total of 20 sub-factors (Table 2.1)

Table 2.1: The Components of Competitiveness Factors

Economic Performance	**Business Efficiency**
83 criteria	**71 criteria**
Domestic Economy	**Productivity**
International Trade	**Labor Market**
International Investment	**Finance**
Employment	**Management Practices**
Prices	**Attitudes and Values**
Government	**Infrastructure**
73 criteria	115 criteria
Efficiency	Basic Infrastructure
Public Finance	Technological Infrastructure
Fiscal Policy	Scientific Infrastructure
Institutional Framework	Health and Environment
Business Legislation	Education
Societal Framework	

Source: Methodology and Principles of Analysis, IMD World Competitiveness Yearbook 2016, p. 484-488.

Each of the 20 sub-factors use a number of criteria for making assessment but carry the same weight in the overall compilation of results. This on the one hand, makes the results comparable against the other factors and it also create 'fire barriers' in preventing the weightage issues affect the overall results in a disproportionate manner.

The WCY uses both quantitative and qualitative factors albeit separately. The data is obtained from those published by international, national and regional organizations, private institutions and a network of over 50 partner institutes worldwide associated with the IMD in preparing the WCY. Among some 340 criteria, the break up is; 137 include 'Hard Data' i.e.

statistical data; 87 as background information but not used in the calculation of the rankings; while another 118 criteria are drawn from the annual executive opinion survey and referred to as the 'Survey Data'. Accordingly, the distributions between the Hard Data and the Survey Data is approx. 2/3rd and 1/3rd. Factor ranking are derived using data processing methodology for the Hard Data and using scales (similar to the Likert's Scale) albeit on a scale of 1-7. The results are interpreted using Standard Deviation Method (STD), which measures the relative difference between the economies' performances. The STD value for each criterion is computed and is then used to rank different economies. Precise way of calculating the ranking is not disclosed for proprietary reason by the proponents.

The Executive Opinion Survey (the Survey Data component of the WCY) is made from individuals for an economy in which they have worked and resided for a year. Approx. 5400 individuals participated in the Survey Data in 2016, while nearly 100 individuals on the average opining per economy. Since opined by a large number of individuals, the results reflect widespread knowledge about each economy and draw on the wealth of their international experience.

c) Global Competitiveness Report

The Global Competitiveness Report (GCR) emphasizes the role of natural resources, human capabilities, research, educational institutions, government organizations, financial systems, cultural and social values - provide an environment in which firms are created, organized, and managed. The competitive environment provided by a nation/country influences the performance of its firms at home and abroad. The Global Competitiveness Report instituted by World Economic Forum (WEF) in 2004 studies competitiveness around 12 categories; it simultaneously differentiates the countries into three categories; a) factor-driven; b) efficiency-driven; and c) innovation-driven.

The GCR presents indices to illustrate competitive environment of a country in comparison with those of the others. The 12 categories or 'Pillars', as they are called, include the following;

Pillar I	Well-functioning public and private institutions
Pillar II	Appropriate infrastructure
Pillar III	A stable macroeconomic framework
Pillar IV	Good health and primary education
Pillar V	Higher education and training
Pillar VI	Efficient goods markets
Pillar VII	Efficient labor markets
Pillar VIII	Developed financial markets
Pillar IX	The ability to harness the benefits of existing technologies
Pillar X	Market size, both domestic and international
Pillar XI	Producing new and different goods using the most sophisticated production processes
Pillar XII	Innovation

Apart from OECD, the WEF has been studying competitiveness of world economies for more than three decades starting from 1979. The competitiveness measurement entails the level of productivity of an economy. The competitive economies can be described as those providing high and rising living standards, allowing all members of the society to contribute to and benefit from these levels of prosperity. In addition, competitive economies also have to be sustainable in terms of meeting the needs of the present generation whilst not compromising the ability of future generations to meet their needs.

The Global Competitiveness Report 2016-2017 assesses the competitiveness landscape of 138 economies, providing insight into the drivers of their productivity and prosperity. Complementing the importance of institutions in stirring growth, the report highlights that monetary stimulus alone is not enough if not accompanied by other reforms promoting competitiveness. The report also

emphasizes that updated business practices and investment in innovation are deemed as important as infrastructure, skills and efficient markets.

The innovation measurement process as formalized by the OECD and the extensive quantitative analysis conducted by WEF have provided valuable insights on the diversity of the innovation process. But it is evident that for a country to prosper an environment conducive to creative activity that is supported by both the public and private sectors should be created. In order to achieve this goal it is important to create high-quality scientific research institutions, sufficient investment in research and development, and protection of intellectual property. (The Global Competitiveness Report, 2016-17).

Citing one particular reference which reads as follows;

> "*Switzerland leads the innovation pillar, thanks to its world-class research institutions, high spending on research and development by companies, and strong cooperation between the academic world and the private sector," (The Global Competitiveness Report, 2016-17).*

The Global Competitiveness Report, 2016-17 highlights the importance of university-industry linkages and the quality of research institutes. It was observed that with all the leading economies including (e.g. Switzerland, USA, etc.) there was an emphasis on the role of universities in increasing innovation capacity of a country. However, bibliometric indicators like publications, patents, R&D spending and so forth do not capture the organic character and the role of academia within the broader institutional setting and as critics observe, such measurements merely serve as proxies to the robust and evolving role of, say (in light of the above-mentioned reference) higher education in the national innovation system.

It is interesting to note that until as late as early 80s, universities were not considered as major source of innovation. The linear models of innovation such as the ones like Bayh Dole Act, 1980 which assumes linear linkages between knowledge generation and its application though incentivizes knowledge application, they do not per se define the role of universities as important economic agents promoting innovation. Such roles vary among the developed and developing countries and even among these countries keep changing within the broader national institutional milieu. A study undertaken in a developing country context, as the one at hand, with special

reference to Pakistan, would attempt to articulate the practiced and intended role of higher education in the national innovation system.

2.8 Role of Higher Education in National Innovation System

Higher education is an important pillar of human development. It provides qualified workforce including scientists, engineers, doctors, technology entrepreneurs, etc. who have the ability and the competence to drive the local economy, generate knowledge through research and development, and has the ability to access existing stock of knowledge and adapt it to a particular context for use. This may, in turn, take various forms of engagement such as through community and extension services, contract research, training/capacity building, consultancy, opinion maker, planner, establishing a business enterprise, creating/co-creating hybrid organizations between academia/industry such as venture capital and so forth. Universities are an indispensable component of a higher education system and have aptly been referred to as,

> "*… not just a creator of knowledge, a trainer of young minds and a transmitter of culture, but also as a major agent of economic growth: the (site of) knowledge factory, at the centre of knowledge economy*" (The Economist, 1997, pp. 4).

The World Bank (2002) attributes economic growth to increasing inputs (e.g. labor, capital, etc.) or to the use of inputs in a more productive manner. The latter, when used as the 'Total Factor Productivity' (TFP) is regarded to be closely linked to the way in which knowledge is used in production.

The university engagement literature takes a developmental view of the role that universities perform in human capital formation, arguing that universities are making their teaching and research programs more responsive to regional knowledge needs, in a broad sense. In doing so, it is suggested that universities undertake a number of activities: paying greater attention to student recruitment and graduate retention at a regional level; developing programs that engage with regional knowledge needs and introducing learning approaches that are more regionally focused, drawing on the

characteristics of the region to aid learning (OECD, 1999a; Holland, 1999, 2001; Chatterton and Goddard, 2000).

Withstanding the importance of higher education, investments in higher education, until of late, were thought to have diminishing returns or dubbed for promoting wage inequality. However, the experience of developed and newly industrializing economies suggested that acquiring, assimilating and adapting technologies is directly related to the number and quality of highly skilled and qualified workforce. Subsequently, an economy's absorptive capacity depends heavily upon the level of education and training (Mytelka, 2001). The absorptive capacity helps improving the understanding and skills set of the workforce i.e. augments tacit learning and hence cause improvements at the shop floor (Meek, 2003).

The above notwithstanding, the absolute amount of spending on research and development or the number and availability of knowledge and qualified workers do not translate into an economic good by itself. The experience of large countries like India, Brazil, Pakistan, Philippines, etc., which have fairly significant amounts of investment made in research, design and development, and possess considerable number of qualified people are few examples. The scientific and technological knowledge is required to be nurtured, incubated and guided through a set of interacting, mutually supporting and ever adapting sets of institutions viz. NIS. This means that there is a need, "… *for strong scientific, engineering and socio - economic capabilities as a base for policy making, especially in sectors undergoing a radical change*" (Mytelka, 2001, pp. 3).

The traditional view regarding role of the universities as distinguished seats of learning and research has elaborated to embrace the 'third mission' (Laredo, 2007) or the economic pay-off, with universities being required to participate in the application and commercialization of knowledge. The universities, as ~~an~~ important actors in knowledge dissemination and research have also embarked upon a critical role in promoting application of knowledge, realizing and influencing dynamics of institutions thus contributing to the national and regional economic expansion (Shane & Stuart, 2002; Etzkowitz et al. 2000). Rather than 'ivory towers' of yesteryears, devoted to the pursuit of (academic) knowledge i.e. knowledge created for its own sake; a significant number of

industrial - economy and developing - economy governments presume universities as a strategic asset for knowledge - based development and mustering economic change (Göktepe, 2008; Mowery & Sampat, 2006).

The universities play a considerable role as a source of fundamental and applied knowledge. Though the primary constituency of basic research is the university laboratory; given that the developing countries need first to adapt, assimilate and then generate technologies, the applied research and its linkage with industry forms a core function of the university research. Most important facet of the universities in the NIS is their ability to provide steady flow of human resources to the firms, government and the universities themselves. Specifically, the universities role is profound to impart learning, building absorptive capacity and technological capability, adapting technology to suit local conditions, bridging technology gap, improving competitiveness, diffusion, incremental improvement, etc. Simultaneously, being large repositories of intellectual resources, universities both influence and guide government regulations towards strengthening of linkages and regulating knowledge flows that connect them with other actors in the NIS. Nelson and Dahlman (1995) note that university provides, "… qualified personnel who can monitor technological and other trends, assess their relevance to the prospects for the country and individual firms, and help in developing strategy for reacting to and taking advantage of the trends". Another important facet is the knowledge spillovers that take place from universities, which coupled with risk capital and an entrepreneurial zeal is responsible for creating new businesses and industries.

2.9 Concluding Remarks

The theoretical antecedents of the national innovation systems relate to governance rather than allocation issues, the latter as applicable in standard economics. The concept seems to have initially emerged in studying developing economies and for emulating 'catching up' strategy as in cases of Germany (List, 1841) and Japan (Freeman, 1982[5] & 2002). The exposition by the two scholars were aimed at explaining the prospects for and history of the economic growth and

[5] It was an unpublished paper by Freeman, C. that he developed for a Conference of the OECD expert group on Science, Technology and Competitiveness held in Paris in 1982 but was published some two decades later in 2002 (Freeman, 2002).

development of the two countries (Germany and Japan) through linking these to a broader set of institutions and adaptive research complementing international trade and indigenous production respectively. The cumulative knowledge base was then helpful in further undertaking applied and more so fundamental research for improving competitiveness of the two economies. Innovations mainly result from the interaction and mutually constitutive roles of different actors and institutions. It is organic in character and is context oriented; it calls for an interdependent and close interaction between the producers and users of knowledge (or technology). The interactions promoting use of new knowledge or new use of knowledge by organizations and individuals are strongly influenced by the country's institutional environment and exhibits a systemic approach either promoting (or inhabiting) innovation which is distinct for each country's economy. The increasing recognition of 'systemic linkages' and its bearing on promoting competitiveness has attracted attention of the developing country planners. The developing countries have made attempts albeit with varying levels of success in instituting physical constructs of the 'innovation system' through establishing organizations and organizational frameworks, laws, procedures, programs and linkages, training personnel, etc. in their bid to imitate 'benchmark' models.

Withstanding above, setting up the 'benchmark' models through establishing discrete elements of the system may not suffice, as it is far more challenging to emulate the complex interactions among actors and institutions promoting innovation (Hirschman, 1958; & Stewart, 1977). The moot point is that the systemic linkages portray social embeddedness wherein modeling the behavior of one agent requires the inclusion of others as individuals rather than an undifferentiated whole (Edmond, 1999).

The tenets of neoclassical economics in assuming the agents possessing complete information to be able to always maximize utility and/or profit is too good to be true and is not practicable. The institutional approach (to possessing information) recognizes that the historical contingencies and context characterizes differences when it comes as how do agents interact and learn? The approach thus distinguishes between information and 'knowledge'. An innovation systems approach recognizes that knowledge is more than information and it resides in the minds and bodies of agents, in practices of firms and in how the individuals and organizations interact (Dosi, 1990). It further recognizes that the elements of knowledge important for economic performance are not destined to

be replicated at another location. Efforts in emulating a well- functioning innovation system has the propensity to fall short or even surpass those being emulated but still simulation may not be possible or even feasible.

The preference for unit of 'national' in studying innovation systems, in an age of globalization, owes as well as responds to the glaring gaps in development across national borders. This owes to the reason that less mobile factors of production and coincidentally more crucial for innovation; such as 'knowledge' mainly those embodied as human capital, the institutional infrastructure comprising of culture, social norms and taboos, laws, procedures, practices, organizations and other formal institutions (role of state, education system, rule of law, business environment, etc.), natural and other national resource (population, education, health, geography, etc.) endowments are unique within a particular 'national' border and hence premise exclusivity. Within the domain of 'national innovation systems' scholars have though prescribed classifications for better understanding.

Among different classifications of the innovation systems, one relates to defining them in the narrower and the broader sense. The narrower definition circumscribes institutions that are directly responsible for the generation, dissemination and diffusion of knowledge and mainly include universities, research institutes, government and business firms (Schoser, 1999). The narrower definition of innovation systems defines the network relations among the key actors to innovation on lines similar to what have been prescribed in the Triple Helix Model or the Mode 2 in the new production of knowledge (Godin & Gingras, 2000; Hicks & Hamilton, 1999; Mowery, 2006) albeit with varying emphasis on the role of university, government and the business firm. The broader definition is more encompassing and in a way illusive in having agreement on its boundaries. It nonetheless includes a broader set of institutions, both formal and informal (see pre paragraph), having a stake and a bearing on promoting generation, dissemination and diffusion of knowledge. Universities being sanctuaries of learning, promotion and generation of knowledge and home to the entrepreneurial agents seeking application of new knowledge are an important actor in both the narrow and broader sets of institutions in an innovation system.

Universities and institutions of higher learning have several functions. These range from academic teaching or broadly stating, dissemination of knowledge; undertaking research - both applied and fundamental, and so to say assuming the third mission, which calls for universities' role

in promoting application of knowledge; either for commercial gains and/or for the societal good. The significance of teaching, research and service to society either for or not-for-profit, vary according to the preference and ability of the university and dictates of the national milieu i.e. the broader institutional context.

The institutions of higher learning have several other roles besides teaching, research and diffusion of knowledge. Such roles include but are not limited to, providing training and consulting services, acting as think tanks to opinionate civil society, national planners, administrators, business entities, and so forth. Since the universities are intended to be the nursery of new knowledge and the creation of new knowledge in itself reflects upon the quality of teaching, therefore the universities are a key contender for part of the public and the private research funds.

The incentives to find applications for the new knowledge has many facets; it may simply reflect a preference of the researcher to repay to the society the investment made in his/her work, pursuit of financial returns or realizing prospects for professional recognition. It is also effected in response to the public scrutiny getting stringent overtime in asking for returns for the investment made through public exchequer or the private investor seeking returns to his/her investment through securing intellectual property rights of the new knowledge produced through their financial assistance, etc.

The transfer of knowledge from the university or the research institute (RI) environment or from within the business firms R&D set-up for that matter are not without (incurring) cost; it rather genuinely entails costs (Mowrey and Rosenberg, 1989; Mowery, 1995). The neoclassical economics seem to ignore the fact that the transfer process involves any costs while treating the information equivalent to knowledge. Such costs are reflected in building networks and coordinating mechanisms, in codifying new knowledge, training of personnel or in transferring artifacts of knowledge (or technology) being transferred. The knowledge transfer which is rooted in the social processes affects continual learning, accumulates into more knowledge, increases productivity and competitiveness and promotes innovation.

The transfer (of knowledge) process itself owes to the entrepreneurial zeal of the agents. The lone entrepreneur seeking a new invention (Schumpeter I) and somewhat devoid of the market

mechanics has been replaced by an organized effort in either responding to the changing market needs or to create new ones. Schumpeter II and Mode 2 of New Production of Knowledge are more close to the endogenous technical change in which the firms themselves create new knowledge (and technology) and through instituting internally coordinated mechanisms help in its diffusion.

The recognition of knowledge as an organizational asset (Smith, R. 2006) has re-configured the role and expectations of society from one of its key producers, a 'university'. The creation of demand driven knowledge (e.g. Mode 2) is akin to the social context which is valuable in that it places the new knowledge closer to (getting into) practice. The role of 'knowledge' in this sense is termed as 'postmodern'; since it responds to a purpose which is altered from the primary purpose (or discourse) of knowledge in assigning it a new meaning i.e. (creating) knowledge which is commercially (and socially) exploitable.

The research and generation of new knowledge has a positive bearing on the development of human capital for improving absorptive capacity and an increase in capacity to craft and implement economic policies designed to compel competitiveness Undertaking research and generation of new knowledge have a positive bearing on the development of knowledge as it increases propensity to learn and hence in improving the absorptive capacity (Nelson & Rosenberg 1993: Smith, 2006). The increased absorptive capacity enhances propensity to incorporate science-based knowledge into decision making (MASIS, 2012) Various overt and express measures introduced by countries in incentivizing production and diffusion of knowledge include measures such as setting up business and technology incubators, setting up venture capital, angel and seed funds or instituting statutory measures such as the ones analogous to U.S. Bayh-Dole Act of 1980, that is widely cited for improving university-industry collaboration in the U.S. national innovation system.

The NIS approach departs from standard economics as it is mainly concerned with diffusion of knowledge, and not on allocating scarce economic resources (Etzkowitz & Leydesdorff, 2000). The diffusion of knowledge is affected through interactive, interdependent and reflexive relations among agents and institutions that facilitate economic growth and expansion. The universities role assumes paramount importance in promoting closer relations between academics as producers of

knowledge and firms as users of knowledge through a series of intermediate processes often stimulated by government (Callon, 1998).

Withstanding a general agreement on the generic role of higher education / universities in dissemination, generation and diffusion of knowledge; universities are influenced and in turn influence the social, economic, and cultural context, scientific and technological developments, etc. The higher education sector takes shape and evolves within the broader national institutional milieu. The study, in hand, makes an attempt to offer an insight from a developing country perspective, viz. Pakistan. The next chapter brings out the state of higher education in Pakistan in its historical, social and administrative context in continuation with this chapter and as preamble to the analytical framework and exposition of methodological choice for data collection and its interpretation for the study, in hand.

Chapter 3

3. Higher Education in Pakistan: A NIS Perspective

As defined earlier, the National Innovation System comprises of a set of institutions, which are jointly and severally, responsible for the dissemination, creation and diffusion of knowledge (Lundvall, 1992, 2007). Higher education institutions and those relating to the governance, regulation, standards setting, quality control, funding organizations, therefore, qualify to be part of the National Innovation System. Such institutions constitute a sub-system of the national economy and connect with a number of research and other knowledge exchange communities (Mowery & Sampat, 2006). Over the preceding decades, the higher education (sub) system has undergone a great deal of dynamic change in the wake of new role ascribed to 'knowledge' i.e. a new factor of production besides land, labour and capital, recognized as such earlier. The new role of knowledge necessitated changing policy rationales and instituting mechanisms for its gainful exploitation. The emergence of new types of institutional arrangements, new forms of governance structures, nurturing actors and so forth both complemented as well as disrupted the established configurations within the national economic policy. Anderson et al. (1994) observed that more compelling structural configurations though are not the ones triggered by the supply side (i.e. by the actors) alone; rather more through increasing demand for new linkages. Accordingly, Lundvall (1992 & 2007) & van der Steen (1999) observed that interaction among individuals, institutions and organizations depict open systems which are influenced by the context, evolve through their interaction with technology, and through historical contingencies.

Therefore, in order to understand the role of higher education in the National Innovation System in Pakistan, review of historical, social and economic context as driven by the sectoral policies and national economic development plans was made to get an understanding of the evolving role of higher education in the National Innovation System.

3.1 Independence & Colonial Imprints: The Basis of South Asian Higher Education System

The establishment of modern higher education system in the sub-continent owes to the arrival of British in India. East India Company[6] under the British royal charter succeeded the Mughal Dynasty (1526-1857) initially as de facto rule 1757-1858 (by the East India Company[7]) and later taken over by the British Crown itself through promulgating the Government of India Act of 1858 enunciated by the British Parliament.

During one of the renewals of the royal charter due in 1815, which were accorded 20 years at a time, the British Parliament obligated the East India Company to allocate funds[8] for the uplift of natives' education in India. The money remained unspent for a number of years, following which debates ensued both in the Indian Dominion and the British Parliament as whether the money should be spent in imparting Occidental or Anglicist education. Lord Benedict, the then Governor General invited Lord Macaulay[9] (while looking at latter's keen interest exhibited through his participation in debates in the British Parliament on the subject) to render advice. Lord Macaulay in his Minute on Education, 1835[10] favoured spending money in imparting Anglicist education. He recommended for making English as medium of instruction and a preference for mathematics and science as against the teaching of vernacular languages.

He recommended that:

"*I feel...that it is impossible for us, with our limited means, to attempt to educate the body of the people. We must at present do our best to form a class who may be interpreters between us and the millions whom we govern; a class of persons, Indian in blood and colour, but English in taste, in opinions, in morals, and in intellect. To that class we may leave it to refine the vernacular dialects of the country, to enrich those dialects with terms of science*

[6] The British Parliament accorded royal charter to the East India Company, 20 years at a time to administer affairs of the state in the Indian Territory.
[7] Constituted under a British Royal Charter accorded in late 1600 and at its high point carried one half of the total world trade
[8] i.e. Rs. 100,000/- (were) to be spent each year on the uplift of literature and education in India.
[9] He was earlier an MP and Legal Member of the British Parliament's Council of India. He was later made the President of Committee on Public Instructions constituted by Lord Benedict, the Governor General of India.
[10] Later promulgated as English Education Act, 1835 by the Governor General of India

borrowed from the Western nomenclature, and to render them by degrees fit vehicles for conveying knowledge to the great mass of the population". (Cutts,1953)

Providing opportunities to few made the education (and it was equally true for higher education) accessible (only) to those who already had a higher social status. It went well with the caste structure[11] prevalent in India (Khilnani, 1999), and accordingly the higher order religious sections of the society became the preferred choice to take control over the reins of governance of the society. This made a class of population superior, as a matter of birth right, insulated and unaffected from the political upheavals (Khilnani, 1999).

Macaulay's elitist and utilitarian approach endorses his stance in favour of knowledge as 'realist' as against 'idealist'. This impliedly resonates with what we call today as the 'codified knowledge' and a better candidate for producing a technically savvy workforce adept to learning (Abramowitz and David, 1996). Macaulay's preference for the codified (as against the tacit) knowledge is illustrated in a reference albeit a racial sarcasm by today's standards (ibid), as;

> "I have conversed both here and at home with men distinguished by their proficiency in the Eastern tongues. .... I have never found one among them who could deny that a single shelf of a good European library was worth the whole native literature of India and Arabia. Honours might be roughly even in works of the imagination, such as poetry, but when we pass from works of imagination to works in which facts are recorded, and general principles investigated, the superiority of the Europeans become absolutely immeasurable."

The reforms triggered under the English Education Act, 1835 favoured elitist education, strengthening the class/caste structure, were Marxist but nonetheless liberal, in character. These reforms paved the way for the people of the (United) India to connect to the world through getting education in modern subjects of science, engineering, medicine and so forth. Concurrently, these reforms severely constrained mobility of people across social or economic classes thus depriving the country take benefit of its huge population.

[11] Which e.g. placed Brahamins and Kashtaris among Hindus in high social standing.

The political intent in producing a 'class of intermediaries' was realized through designing curriculum, which produced corps of clerks; half westernized, half native. This workforce would economically man offices of the British Raj but was devoid of critical and creative thinking (Hussain, 1997).

A cultural norm which put an asymmetrical burden on parents for financing higher education of their wards owes to the looking-down approach for manual labour by the society, at large. Unlike the western world, where students find themselves at ease to work part time to supplement their income; the tradition is not so practiced in Pakistan. Notwithstanding the pecuniary fall out, the habit deprives them in gaining practical experience and seeing first hand application of knowledge they learn at their institutions. The origin of this attitude, incidentally, is not Islamic. It is understood to have developed through long association and living alongside the Hindu caste system, where the socially higher order castes find it demeaning to take up manual labour, and in part due to having a large semi to illiterate group of surpluses of labor (Robert J. Kibbee, 1962).

The creation of the two dominions, India and Pakistan related to the mass exodus of people from both sides of the border including teachers. The immediate dearth of faculty caused by the migration of Hindu and Sikh teachers had more serious implications for areas (now) comprising Pakistan than for India due to Muslims migrating to Pakistan. Robert J. Kibbee (1962) notes that the loss to the HEIs in Pakistan (mainly colleges) was more severe both in quality and quantity.

Macaulay's Minute gives an insight into the formation of the current day Higher Education System of the subcontinent, having its foundation embedded in a utilitarian model destined to achieve minimal life skills as per the needs of the time. Overtime, the system infused with the prevalent caste system and the access of higher education got linked with status quo ensuring access only to the upper classes hence making it elitist. Khilnani, S. (1999) adds that being superior as a matter of birth right insulated a class of population unaffected from the political upheavals creating a divide.

The adoption of 'English' as medium of instructions alienated the Muslims in the Sub-Continent in opting for higher education in modern subjects like science and mathematics, thinking these (subjects) averse to the Islamic traditions of learning. The pessimism to opt for modern education did not let Muslims get 'education' in numbers proportionate to the size of their

population, landing them in the trap of economic degradation. The reformer like Syed Ahmed Khan[12] started a campaign to convince the Muslims that there is no wisdom in losing economic and social ground forever by disavowing western education. Sir Syed Ahmad Khan established the Anglo Oriental College in 1875 at Aligarh imparting western education alongside Islamic religious education. The College was later upgraded to Aligarh University in 1920 (Cutts, 1953).

The formation of Pakistan in 1947, resulted in the mass migration of the Muslim population to the newly formed state. Being burdened by the burgeoning challenge of (vastly illiterate) population, the reigns fell into the hands of those who were themselves a product of the utilitarian system of education. In contrast to the needs of the (new) country and to set-out the priorities (afresh), the education system continued to mimic the British System of education.

3.2 Formation of Pakistan: Inherited Challenges

The education planners in the Post-Independence Pakistan seemed in favour of nurturing (Heward, & Bunwaree, 1999) altruistic character traits and hence were idealist, they could (though) not get away from the education system instituted by the British. Over the years, a struggle seems there among the policy planners in Pakistan to alter the character of education from being utilitarian to altruistic it though seemed not getting much success.

The Education Conference held on 27th November – 1st December 1947 at Karachi laid down guidelines for 'education' such as infusing the values of honour, integrity and selfless service to the nation. The Conference favoured access to higher education for the meritorious and hence was to remain elitist in character; it defined the purpose of 'education' as addressing the spiritual needs, building social cohesion and imparting vocational training to the population. In order to provide focus and evolve recommendations, seven committees were created focusing on a) Primary and secondary education; b) Scientific research; c) Adult education; d) Technical education; e) University education; f) Women education; and g) Cultural relations. The enormity of educating the vastly illiterate population can be gauged from the assessment of the Committee on Adult education

[12] He was later conferred upon the title of 'Sir' for his relentless services for the education of people in the Sub-Continent especially the Muslims.

that given the resources available with the newly liberated country, where the illiteracy was as high as 85%, it would take 140 years unless drastic steps are taken to tackle the problem. The Committee recommended that to educate 500,000 people in the next six (6) years and thereafter 300,000 people each year during the next five years (Proceedings of Education Conference (1948), Nov. 27-Dec. 1, 1947; Ministry of Education, Government of Pakistan, Karachi). Emphasis was given on science and technical education alongside inculcating Islamic values into the education curriculum. However, the influx of the sheer number of migrants from other side of the fence into the nascent State created administrative problems and the recommendations could not be implemented.

Initially, the Government of India Act, 1935 was adopted as the Interim Constitution (1947-1956) of Pakistan. It provided three legislative lists; i.e. Federal, Concurrent and Provincial Legislative Lists. The Act placed 'education' under the responsibility of the provincial government (Entry 17 of the Provincial Legislative List). Nine years on, the 1st Constitution of Pakistan was promulgated in 1956; it also contained three legislative lists similar to those in the Government of India Act, 1935. The Act made 'education' responsibility of the State; however, tertiary education including university and the technical education and professional training remained the Provincial subject (Entry 20, Provincial Legislative List, Fifth Schedule).

In order to bring coherence in the long-term objectives, initially (an) institution of 6-Year Plan (1950-1955) and (it was) then replaced by 5-Year Plans. Formally, the Plan for 1955-60 is termed as the 1st 5-Year Plan. The Plan referred to the role of higher education in the advancement of knowledge and for preparing leaders and professionals in diverse disciplinary areas of ~~for~~ agriculture, industry, business and as government officials (Hussain, & Ahmed, 2012). The Plan called for improving management of tertiary education through affording it more autonomy albeit asking for more accountability, as well. The higher education sector comprised of six universities. The Plan had an allocation of 16% of Rs. 7500 (Rs. 10,800[13]) Million for education including higher education.

[13] This is the total figure. Its break up was as follows: Public Sector = Rs. 7500 Million & Private Sector Rs. 3300 Million; however, the releases from the Public Sector budget were to the tune of 9% of the total (i.e. Public Sector budget) (Isani & Virk, 2003)

Under auspices of the 1st 5-Year Plan, there were recommendations for setting up, 'University Grants Committee' functioning at the provincial level, to be set up for coordinating and liaising the long-term needs of the universities, while a 'Central University Grants Commission (CUGC)' was to be set-up at the Federal level to liaise with its provincial constituents.

The central entity had additional roles of strengthening linkages among the universities, guiding them on research programs through co-opting eminent scientists/academics from overseas, avoiding wasteful duplication, instituting foreign and local scholarships, assisting the universities through the provincial 'University Grants Committees' in formulation of their plans, policies and targets and in the assessment of their needs and pass these back to the (Central) Government along with its recommendations. Several of the recommendations of the provincial and the Central entities could not be taken up for implementation due to lack of resources and political instability.

The political instability was marked by the change of some six (6) prime ministers in quick succession between 1954-58 (Khan, & Saqib, 2011). It (the political instability) preceded promulgation of the 1st martial law in the country in 1958[14]. The then Army Chief, General (later Field Marshal) Ayub Khan was appointed the Chief Martial Law Administrator and sent the then President, Maj. Gen (Retd) Iskandar Mirza packing in just 13 days after assuming his new office and declared himself the President of Pakistan. The Constitution of 1956 was abrogated.

The political upheavals had their toll for all sectors of economy including higher education. Sensing the state of affairs, President Ayub Khan's government appointed a National Commission on Education which presented its report in 1959. The Commission's recommendations included; strengthening science and technical education, adoption of 3-Year as against the 2-Year bachelor's degree programs[15], establishment of University Grants Commission and delegating the responsibility to universities to carry out research.

[14] Earlier, the government of Khawaja Nazimu ud Din was dismissed by Sir Ghulam Muhammad Khan in 1954 and the Constituent Assembly the next year for the latter fearing his own removal from office as the country was still a dominion under the rule of Queen Elizabeth (Winegard, T.C. (2012).

[15] The decision though had to be reversed in 1962 in view of the strong protects by students

Following recommendations of the National Commission on Education, 1959, the 2nd 5-Year Plan (1960-1965) maintained the teaching and research as main functions of the universities. Since the 2nd Plan was 60% financed through international development assistance, it is considered by far the most successful plans in terms of implementation (Shami, 2005).

Few notable interventions of the era include establishing the Institute of Business Administration (IBA) at the University of Karachi (1969), elevation of two engineering colleges one each at Karachi and Lahore into engineering universities, and the agriculture college, Faisalabad (then Layallpur) into Agricultural University, incentives for university research including research grants and social elation of faculty, a comprehensive system of scholarship funding to nurture talent and so forth.

In order to provide a constitutional framework, a new constitution was developed and promulgated in 1962. The 1962 Constitution introduced Presidential form of government. It mentioned 'education' as a fundamental right of the people (Article 12(3) and Article 7 Chapter 2), had one legislative list. None of the 49 items on the list dealt with 'education' implying that 'education' would continue to remain a provincial subject.

3.2.2 War of 1965: An Economic Backlash

The 3rd 5-Year Plan (1965-70) got a blow right in its first year of implementation due to 1965 war between Pakistan and India. It had to undergo major downward budgetary revisions in 1966.

A distinct character of the 3rd 5-Year Plan was that it was part and a preamble to the (1st long term i.e.) 20 Year Perspective Plan (1965-85) and built on the lessons learnt with implementation of the two previous plans. The primary objective of the Perspective Plan was to increase the per capita income over the 20 years' (plan) period.

The 3rd 5-Year Plan assigned universities the role of preparing leaders for various soci-economic walks of life. The Plan seconded setting up of University Grants Commission (UGC), as the central entity providing coordination in matters relating to university education including assessing their funding needs and making recommendations to the Ministry of Education,

Government of Pakistan for fulfilling such needs. The (national) development plans, inter alia, also emphasized taking measures for improving the quality of (the then) existing universities/research institutes, setting up new ones, strengthening research programs in the subjects of science, engineering and medicine, etc. A notable mention includes recognition by the national development plans, of the need to strengthen a weak institution i.e. of applied research - thereby providing ~~a~~ linkage and transition to the university research to reach industry. A number of organizations were set-up during the 1950s and after; e.g. Pakistan Council of Scientific and Industrial Research (1953), Pakistan Atomic Energy Commission (PAEC) in 1956, Space and Upper Atmosphere Research Commission (SUPARCO) in 1961, National Institute of Electronics (NIE) in 1979, National Institute of Oceanography (NIO) in 1981, etc. The program for awarding overseas scholarships was continued including launch of scholarships for students securing top positions in university examinations. Provision was also made in the human resource policies for performance linked promotion of the research active university staff.

Besides an overall Plan realization of 44%[16], higher education sub-sector could get and utilize nearly 62%[17].

During the later years of the Plan period, the need for a new education policy was realized, which would strengthen the ideological orientation, science and technology education, decentralization of educational administration and formation of national educational set-ups of repute (Bengali, K. 1999).

[16] Rs. 1328.3 million were spent as against the planned expenditure of Rs. 2374.55 million.
[17] Rs. 173.745 million as against the planned expenditure of Rs. 278.57

3.2.3 Separation of East Pakistan: Restoration of Democracy I

New Education Policy, 1970 and the 4th 5-Year Plan (1970 – 75) could not come on ground in the wake of 1971 war between Pakistan and India. The war resulted in the separation of East Pakistan to form Bangladesh in Dec. 1971. The education policy was revised in this backdrop to craft a new one, Education Policy, 1972-80[18]. Highlights of the Policy included increasing the enrollment by 100,000 in universities by 1980, to establish new universities in Multan, Saidu Sharif, Sukkur and to upgrade the Jamia Islamia, Bahawalpur to a fully-fledged university, establishment of University Grants Commission (UGC), to establish centers of excellence in universities, shifting focus to science and technology, instituting national research fellowships to promote research by outstanding academics, and nationalization of technical colleges.

However, it was a difficult period due to low national morale on account of separation of East Pakistan over 90,000 army personnel been taken in captivity by the Indian Army, etc. Political and administrative decisions either taken or confronted by the (then) newly elected government included nationalization of industry and private businesses, disaster risk management in the wake of devastating floods occurred in the country in 1973, etc.

The democratic government of Prime Minister Zulfiqar Ali Bhutto in its efforts to stabilize the country first promulgated the Interim Constitution in 1972 to be superseded in quick succession by adopting the unanimously approved Constitution of Pakistan (by the Parliament of Pakistan) in 1973. The latter mentioned Constitution though amended in the subsequent years is valid as of this date.

Like the 1935 and 1956 constitutions' drafts, the Interim Constitution, 1972 had three legislative lists i.e. Federal, Concurrent and Provincial. 'Education' including higher education remained the provincial subject (Fourth Schedule, Article 138). The 1973 Constitution brought a major shift in that 'education' was included in the 'federal' legislative list and the 'concurrent' list. Respectively, it was mentioned as Entry 15, 16 & 17, Federal Legislative List, Fourth Schedule and Entry 37 & 38, Concurrent Legislative List, Fourth Schedule. Article 37 (a, b) defined the purpose of education; (as) to be responsible to promote economic well being of people. While assurance to

[18] Education was not in the legislative list or the executive mandate of the federal (i.e. central) government, the federal government did remain involved in the macro planning ever since 1947through administering control on provincial income (collected by the federal government as taxes and later disbursed as per the constitutionally agreed arrangements)

provide free and compulsory education between the ages 5-16 within the minimum possible time, albeit with no timelines defined, was mentioned, the 1973 Constitution mentioned that higher education should be accessible to all on the analogy of the 1962 Constitution.

Although 'education' was not falling under the legislative domain of the federal government until 1973, still the federal government played a pivotal role in macro planning through announcing a number of education policies (1947, 1951, 1959, 1970, 1972). The reasons mainly owed to her exercising control over the provinces' income.

The oft recommended University Grants Commission (UGC) was formed through an Act of the Parliament[19] in 1974. The UGC played the role of a quasi-regulator besides laying down curriculum and standards for higher education and taking up the role of a grants disbursement entity for an on behalf of the Ministry of Education, Government of Pakistan. Furthermore, an Interprovincial Ministerial Committee was formed which helped in coordinating a uniform system of education in all federating units and also had a role in approval of schemes of studies. The latter mentioned entity remains to this date, the overarching institutional arrangement to bring coherence, coordination and uniformity of curriculum and standards across all tiers of education.

The period between1975-77 is considered as 'no plan' period before the 5th 5-Year Plan (1977-1983) was brought out. In terms of education and training; although the plan highlighted it as an integral element but the same was not mentioned in its objectives. This clearly showed a lack of understanding of its framers in terms of realizing the role of education as a tool to develop qualified human resource.

[19] The period follows cessation of East Pakistan (to form Bangladesh) and as such the Government was to allocate resource to the (erstwhile West) Pakistan; alone.

3.2.4 Second Martial Law

After the general elections were held in 1976; owing to the allegations of rigging, the political turmoil worsened and it paved the way for military intervention. The political government was dismissed in July 1977. Gen. Zia ul Haq imposed the 3rd martial law in Pakistan. Soon thereafter, the Afghan war started in 1979 making Pakistan a hotbed and confluence of many competing and conflicting interests. The US backed pro-Islamist fighting in Afghanistan triggered a new wave of right wing approach in political decision-making in Pakistan.

The Education Policy, 1979 was announced aiming at improving quality of higher education in existing universities. The Education Policy, 1979 did not favour setting up new universities[20] except for women only universities. The Policy was elitist in character, as it favoured stringent admission criteria that would be selective and restrictive to ensure students with the right aptitude[21] and ability to benefit from the national meager investment on higher education. The Policy focused on strengthening the role of the UGC, through provision of quality staff, more funds for the universities; improving coordination with the provincial education and finance departments and through instituting studies to identify problems warranting university research.

The 6th 5-Year Plan was announced after the announcement of Education Policy, 1979 and was thus confided to further the latter's objectives. Like 5th Plan, the 6th Plan also linked the funding for universities on the basis of improvement of quality rather than the expansion of infrastructure (Jahangir, 2008). Again, on the pattern of 5th Plan, there was no provision for setting up new universities in the public sector; however, a provision to the tune of Rs. 1000 Million was provided for the private sector to set up universities. The Plan had provision for strengthening science and technology related programs in the public-sector universities for setting up centers of excellence.

[20] Still – new universities were set up between 1978-83 (the 5th 5-Year Plan Period)
[21] Meant to demonstrate right wing leaning

3.2.5 Restoration of Democracy II

Soon after the death of Gen Zia ul Haq in a plane crash in Aug. 1987, general elections were held paving way for the restoration of democracy[22]. Ms. Benizir Bhutto, daughter of former (Late) Prime Minister Zulfiqar Ali Bhutto was elected as the first Muslim female Prime Minister and she took office in 1988.

The 7th 5-Year Plan (1988-2003), which was part of the 2nd Perspective Plan (1988-2003) was launched. The 2nd Perspective Plan was aimed at growth of economy and achievement of higher standards of living for the people. The 'education' sector was allocated Rs. 23. 11 Billion (releases amounted to Rs. 19 Billion) from a total Plan outlay of Rs. 642 Billion to be spent both by the public (Rs. 350 Billion) and the private (Rs. 292 Billion) sector.

The Plan provided for establishment of public sector educational institutions as well as not-for-profit foundations, the latter for encouraging the private sector participation in the establishment of new educational institutions. A programme called 'Tameer e Watan' (literally meaning 'Construction of the Homeland') was launched where legislators identified immediate needs at the grass roots level.

The identification of needs led to the formulation of the Education Policy of 1992. Inter alia, the Policy acknowledged dismal situation in the higher education sector in the country. It noted that the higher education sector had failed to keep pace with the advances in knowledge. The Policy also acknowledged weakness of the universities at not producing quality scientific research or initiating disciplines for producing quality human resource to fuel the compelling needs of development.

The Policy set forth principles for the university culture as; (to be) liberal, free, democratic and competitive while complying with the Islamic values of knowledge.

The Policy further underscored the following:

[22] The elections in 1985 were held on non-party basis. Subsequent to declaring the results, a bunch of independents were asked by Gen. Zia ul Haq to form a party (satirically called the king's party) under the de-jure rule of Prime Minister Muhammad Khan Junejo, while Gen. Zia ul Haq himself remained the de facto ruler (http://gallup.com.pk/bb_old_site/election/1985ElectionStudies.pdf) accessed on July 31, 2016

a) The universities needed better leadership practices to be financially sustainable so as to be able to exercise independence and autonomy.
b) A revision in the universities' Act was needed to ensure effective management, be able to hire and in turn produce quality manpower thus accelerating pace of economic activity through generating new knowledge. The UGC was entrusted to prepare a 10-Year Plan to realize the intended objectives while focusing more on the science and technology oriented programmes and setting up new universities offering especially by the provinces to initiate such programmes.
c) Financial remuneration and research grants for the university teaching faculty were awarded to incentivize them to participate in and strengthen post-graduate research programmes.
d) Academia industry linkages were to be promoted through establishing science parks in consultation with the private sector. The policy further promoted special programs to improve the entrepreneurial role of the university and a committee comprising of industrialists and educationists was to be setup to develop plans for the strengthening of industry academia relationship.

The education sector preferences in the 8th 5-Year Plan (1993-1998) were planned to realize the targets set in the Education Policy, 1992. However, like 7th 5-Year Plan, the 8th Plan was more focused on primary education rather than the university education. The share of higher education was reduced from 8.6% to 5.4%. It is interesting to note that the reason cited for lowering the share of higher education was the deteriorating standards of the universities, which otherwise called for more funding for universities. The meager funds allocated for the higher education sector were allocated more for brick and mortar than on other facets for the improvement in education quality.

The Education Policy, 1998 was crafted with realization of the abysmally poor state of higher education sector in the country. The participation rates of less than 3% of the eligible cohort of 17-23, bespoke of the gravity of situation until as late as turn of the millennium. The Policy intended to raise the participation rates to 7% by 2010 below;

> "*Provision of quality education requires a mechanism for internal and external evaluation of quality parameters. In this regard, it is necessary to ensure that program and university accreditation mechanisms are instituted that are compatible with international best*

practices and provide complete transparency of operation leading to enhanced provision of quality education" (The National Education Policy, 1998; Para 136, p. 55)

It further stated that,

> "*In order to ensure adherence to minimum standards of quality by all universities/degree awarding institutions, the UGC shall develop a process for periodic re-assessment of various programmes offered by institutions with regard to renewal of their degree awarding status. This provision shall be applicable to both public and private sector universities*" (ibid, Para 140 (25), p. 60)

This would be realized through establishing more universities, establishing university campuses through public private partnerships and through promoting distance education. It was further envisioned that the ratio of Arts and Science subjects which stood at 71:29 in 1998 would be made even i.e. 50:50 by the Year 2010.

3.2.6 Third Martial Law: Reformation of Higher Education

The 9th Plan (1998-2003) was prepared but could not be effectuated due to change in government through a military takeover in 1999. This was followed by Medium Term Development Framework (MTDF) a new name coined for the 5-Year Plans. The MTDF was part of a reform programme, Medium Term Budgetary Framework, itself partly sponsored and guided by the UK Department for International Development (DFID) and the European Union covering the period 2003-2012. A high note of the reforms included establishing the Higher Education Commission in 2002.

The Higher Education Commission (HEC or Commission) was established in light of recommendations of the Pakistani diaspora[23] and in light of the decision of the Government of Pakistan through promulgating the Higher Education Commission Ordinance, 2002. It is the principal and autonomous organisation established to oversee and administer higher education in

[23]Higher Education in Pakistan: Towards a Reform Agenda (A Contribution to the Task Force on Improvement of Higher Education in Pakistan) – Draft (2001); The Boston Group.

Pakistan. It reports directly to the chief executive of the country i.e. the Prime Minister. It has a wider mandate to improve and promote higher education and research in the country. Among its many tasks, the Commission has the responsibility for policy formulation and setting-out programs in accordance therewith. The HEC submits budget proposals on behalf of the public universities and the ancillary institutional infrastructure to the federal government and exercises control over the distribution of these funds.

The Commission also functions as a link between higher education institutions and the society, making efforts so that the institutions work in harmony for the general good of the industry and employment markets. Quality assurance of higher education in Pakistan is another very important task assigned to the HEC under its Charter. This includes accrediting institutions of higher education and prescribing the conditions for establishing higher education institutions in the private sector. Between 2002-2016, prominent accomplishments of the HEC included; over three-fold increase in the number of universities[24]; over 30-fold increase in the budgetary allocations[25], 6-8 fold increase in the salary/remuneration of academics[26], provided grants to over 7,500 scholars[27] under the faculty development program to pursue their MS/PhD studies both within the country and abroad. With completion of studies and joining back their respective institutions, the faculty development program has greatly helped universities in overcoming an acute dearth of faculty. Availability of qualified faculty is path creating in that it has ushered in prospects of offering more number of program specializations and undertaking research; which hitherto was unimaginable phenomenon earlier.

The award of scholarships is not limited to the 'faculty' itself, rather looking at the prospects of a huge and young population, nearly 2/3rd of which is under the age of 30, need-based scholarships are offered at the undergraduate level to several thousand students each year to study at the selected national universities.

[24] To reach 180 universities (public and private in almost equal numbers)
[25] From Rs. 2.5 Billion (2001-02) to Rs. 75 Billion (2016-17)
[26] Depending on the seniority level; the average salary of an Assistant Professor has risen from Rs. 0.3 Million per annum to Rs. 1.8 Million per annum while that of Associate Professor/Professor from Rs. 0.5-0.6 Million to Rs. 4.0-4.8 Million per annum (Basic Pay Scales & Tenure Track Pay Scales, Government of Pakistan).
[27] Talk by Prof. Ahsan Iqbal, Former Minister for Planning, Development & Reforms, Government of Pakistan (2013-2018); Wharton Business School, July 2015 (www.youtube.com) accessed on Aug. 16, 2016

In order to allow universities offer quality service, the HEC accords grants to public sector universities for; capital expenditure (construction of building/infrastructure, purchase of equipment), international travel, research, patent filing, and several other facets of academic activities like convening of workshops/seminars, inviting faculty from abroad on short to long term assignments, etc. The HEIs have reciprocated in benefitting from increased level of support and facilitation by the HEC. There are significant increases made in the enrolment, which has grown almost fourfold increase i.e. from 2.1 to 8.4 in years 2002-2016, the number of program offerings vary from university to university but have significantly increased, the publications have increased some seven-fold[28], filing international patents have increased, number of PhDs[29] produced in last decade and half and more than those produced in the 55 years since creation of Pakistan (i.e. 1947-2002). The universities have been provided support in; initiating graduate and post graduate research programs through offering more number of funded scholarships, setting up centres of excellence, area study centres, strengthening research facilities including improvements in library, laboratories, IT infrastructure, provision of high-speed Internet; instituting policies facilitating mobility of personnel across organizational boundaries (sabbatical and extended leave, hiring of visiting faculty from industry, etc.), fostering linkages with universities and research institutes both within the country and abroad, and so forth.

Simultaneously, as 'Quality Assurance' watchdog, the HEC is actively exercising its right to audit the universities, both the public and the private sector, and asks them to comply with the standards. It works alongside the professional bodies (Pakistan Engineering Council, Pakistan Medical & Dental Council) and professional associations to enforce regulatory and quality standards[30]. In order to improve access to education, the HEC has helped the Allama Iqbal Open University and the Virtual University to strengthen their programs by providing necessary funding for purchase of equipment, content building and with their respective student management and quality assurance systems. The enrolment at these two institutions alone accounts for nearly 1/5th of the total enrolment in higher education in the country. The private sector was allowed to establish universities in the 1st half of 1980s decade and proliferated under the aegis of Post 2002 reforms.

[28] From approx. 800 in 2001-02 per annum to over 5500 in Year 2015-6 (HEC, 2016)
[29] Quote actual number (approx. 3200 between 1947-2002 and 4000+ since 2002)
[30] Program approvals are issued by the professional bodies in consultation with the HEC.

Their number is nearly one half of the total 180 universities in the country and their enrolment is to the tune of 25% of the total enrolment in higher education in the country.

In 2009 a new education policy was formulated, which explicitly mentioned that the major function of education in general and higher education in particular, is to play a pivotal role in the economic growth and social development of the country. It mentioned that research should conform to be one of the fundamental roles of the university. Education should also increase the earning potential of the individuals/ graduates. The policy further noted that the universities and research institutions are the major source of innovation and should emphasize more on promoting research for its contribution to the economy. The governance of the universities and research institutions should be effective enough to support and foster innovation in the economy and facilitate national and international funding.

The 2009 policy identified major challenges as equitable access, low allocation of per capita expenditure on students, internal and external evaluation and the administrative issues. Furthermore, in response to the identified challenges, the policy presented a twenty-six (26) point strategic vision which focuses on equitable and enhanced access, faculty development, realization of the role of universities as repositories of knowledge, think tanks, innovation, research and commercialization, and the infusion of ICTs for enhancing the quality of education.

In order to achieve the strategic vision proposed in the policy, a thirty (30) point action plan was also presented. The action plan asked for increasing the allocation to the tune of 7% of the GDP by 2015, and to increase the share of higher education significantly and upto 20% of the total budget allocated for ‘education’. Moreover, it called for disbursing competitive grants to universities to allow them undertaking faculty development programs, for upgradation of physical infrastructure, adoption of computerized university management and financial control systems, etc.

3.2.7 Restoration of Democracy III, 18th Amendment & the Process of Devolution

The popular uprising against the military ruler mainly led by the legal community paved the way for restoration of democracy in the country. The murder of Ms. Benazir Bhutto in Dec. 2007 during her election campaign in the run up for the election helped her otherwise popular (political) party win the sympathy vote to seal the deal for success in elections held in 2008.

The new government set her priority, among other issues, in restoring the 1973 Constitution and its spirit of devolution of power to the federating units (provinces). Accordingly, the 18th amendment was incorporated in the 1973 Constitution through unanimous resolution of the Parliament of Pakistan in 2010. Through this Amendment, forty seven (47) functions including 'education' were devolved by abolishing the Concurrent List and were transferred to the provinces. After the 18th amendment, the key roles of planning, policy, curriculum, standards, etc. have been moved from shared jurisdiction of federal and provincial governments to only to the provincial governments. An Article 25A was inserted, which obliged the State responsibility to provide education as may be determined by law to children between the ages of 5-16 years. An interpretation of Article 25A as made by experts makes distinction between the State treating education as a good/service amenable to laws of demand and supply and education as a basic right amenable to political and legal analysis. The intent of Article 25A seems to relate 'education' as a basic right while 'higher education' to a good/service amenable to the laws of demand and supply.

Certain provisions of the 18th Amendment to the 1973 Constitution stipulate a role for the federal government, as follows:

a) Federal Legislative List Part I

The Federal Legislative List, Fourth Schedule Article 70(4) Part I Entry 16, 17 states that federal agencies and institutions would be responsible for research, for professional or technical training and for the promotion of special studies and education as relates to Pakistani students in foreign countries and foreign students in Pakistan shall remain the federal subject.

b) Federal Legislative List Part II

Furthermore, as per Part II of the Federal Legislative List, following would be included in the jurisdiction of Council of Common Interests (CCI):

i. Entry 6 which states that all regulatory authorities established under a Federal Law;
ii. Entry 7 swhich tates that national planning and national economic coordination including planning and coordination of scientific and technological research;
iii. Entry 12 which states that standards in institutions for higher education and research, scientific and technical institutions.

Owing to above, there is understood to be some confusion there about the jurisdiction of federal vs. the provincial government in matters relating to higher education and by analogy the Higher Education Commission. As per the Federal Legislative List Part I and II, the regulatory authorities and institutes of higher education and research fall under the jursidiction of Council of Common Interets.

Still, at least two provicies (Punjab and Sindh) have moved forward with establihsment of the Provincial Higher Education Commissions. In a writ filed by the founding (and former) Chair, Higher Education Commission, the Supreme Court of Pakistan (HEC, Press Release, 2014) has interpreted that as per provisions of the Federal Legislative list, mandate of the Higher Education Commission has not devloved. The Government, in the meantime, referred the matter to the CCI, which in turn formed a high-ranking committee to opine in the matter. The committee did not present its report for a good two (2) years; pending which confusion exacerbates as to the constitutional jurisdiction on higher education between the federal government/centre and the provinces.

An education policy was developed by the government in office in 2017. However, owing to the fact that the government was completing its term in 2018, it was neither formally announced nor adopted for implementation.

However, the salient features of the policy included; improving quality through establishment of offices (as Quality Assurance Cells-QECs) in universities , upgradation of curriculum through national curriculum review committees, fostering research for economic development, development split degree programs (for purposes of building capacity in local universities and for lowering costs with periods of study split between universities abroad and universities in Pakistan), development of sabbatical and faculty exchange programs, promoting collaborative research with the industry, establishing and strengthening business and technology incubation centers in universities, funding applied research in the disciplines of sciences, establishing new science and technology universities, setting-up technology parks, intent to increasing enrollment in higher education from 8% to 15% in next ten years, using ICTs for quality teaching and transitioning to knowledge based economy so as to ensure national take-off as per the Vision 2025 of the Government of Pakistan.

3.3 Concluding Remarks

In the 70 years history of Pakistan, there have been several education policies[31] and development plans[32] announced from time to time. The gradual expansion, strengthening, extension and out-reach of higher education portray an evolution of the role of 'higher education' in economic development of Pakistan.

Table 3.1 shows a comparison of the status of 'Education' as treated in various constitutions that remained/are in vogue, in Pakistan:

Table 3.1: Education: Comparison of Constitutional Provisions in Pakistan

Subject	GOI Act 1935	1956 Constitution	1962 Constitution	1972 Interim Constitution	1973 Constitution	18th Amendment
Higher Education	PLL	PLL	PLL*	PLL	CLL	FLL

**Education is not mentioned per se; hence its position impliedly remains unchanged, as before*
Legend: PLL – Provisional legislative List; CLL – Concurrent Legislative List;
& FLL – Federal Legislative List.

In summary, Pakistan started off in 'higher education' and 'research & development' with an inordinately weak base. Each successive government, despite odds, contributed to building the basic infrastructure but their efforts mostly remained fragmented and without pursuing a holistic approach. The development of universities to prepare human capital remained at the periphery, with financial compulsions taking precedence. Another factor which contributed to the thinning out of resources relates to the exponential increase in population. The burgeoning increase in population which is over 207 million (2017), did not allow allocation of resources commensurate with the

[31] Government of Pakistan , Education Policies of 1947, 1951, 1959, 1970, 1972, 1979, 1992, 1998 & 2009

[32] 5-Year Development Plans in Pakistan served as a vehicle for implementation of the recommendations of the different 'education' policies. Development Plans of 1950-56 (the first 6-YearDevelopment Plan precedes the subsequent 5-Year Development Plans), 1955-60, 1960-65, 1965-70, 1970-1975, 1978-1983, 1988-1993, 1998-2003, 2005-2010, 2011-2016 (a quasi-Plan which not officially announced but often referred by the national planners as per their convenience)

requirements. More severe was the fallout on the number of qualified faculty and researchers which always remained in short supply.

As can be seen from the background information provided above, the higher education has remained a component and a sub-sector of 'education' and was accorded varying levels of importance by various administrative dispensations in power. E.g. the 1st 5-Year Development Plan (1955-60) allocated 13.5% of the total allocation for education to the higher education sub-sector, which is by far the highest so far; while the MTDF 2005-2010, (equivalent of the 10th 5-Year Development Plan) - the last implemented Plan, had a share of 9.5% of the total allocation for higher education.

Making more allocation for the higher education sub-sector during the initial plan period manifests planners understanding of the higher education's capital-intensive nature of investment; however, the data on actual releases portrays a grim picture and a mismatch / conflict among the planners and policy administrators. Generally true for all other sectors of economy, each Government in Office altered investment priorities from the one pursued by the previous Government and this is true for education. Almost each successive government in office demonstrated contrasting interests in making allocation for education and consequently the 'higher education' sub-sector.

With total allocation for the 'education' sector remaining around two (2) percent of the GDP, its allocation remained a zero-sum game, i.e. an increase for one sub-sector of 'education' was loss to others. In general, 'education' sector in Pakistan could not play role of a potent public policy tool in the growth and development of the country nor could garner enough political and administrative support to be able to change the status quo.

Chapter 4

4. RATIONALE AND CONCEPTUAL FRAMEWORK

4.1 Rationale of the Study

It occurred to my interest whilst working in the higher education sector in Pakistan. I have been serving as head of Planning, Development & Human Resource Development for over a decade and half at a large public sector, ranking university in Pakistan. Incidentally, this period has been marked by policy reforms, as referred earlier. Such reforms had been the harbinger of significant change in making the higher education sector connected with the national economy. Considering myself an ardent student of science and public policy planning and administration and with the professional background as explained, consequently an interest was developed to understand the role of higher education in the national innovation system of the country as part of a lifelong learning agenda. I understand, globally learning and teaching activities have moved away from ~~a~~ the linear model of transmission of knowledge based upon the classroom or the podium teaching to more interactive and experiential learning, drawing upon new approaches that are grounded in traditions of science, ~~and~~ technology and society (Arvanitis, Kubli & Woerter, 2008).

The literature cited in the previous sections reflects the serious dearth of theory relevant to the indigenous context allowing investigating the NIS processes in the wake of higher education sector and the ancillary institutions in Pakistan. Nevertheless, Western theorisation and constructs dominated the efforts to develop National Innovation Systems in the country.

Pakistan provides an especially appropriate context for the present research, because it provides a marked contrast to the developed economies in which the NIS models were developed and tested.

Accordingly, I realised that it is imperative to understand NIS and the role of higher education in building and strengthening the NIS from an indigenous perspective in order to bring about positive interventions to develop (it as) an important pillar of the knowledge economy. Nevertheless, the institutional diversity influencing economic exploitation of knowledge or the

technological advancement has always been an area of interest for the economists. Such linkages between new knowledge and its significant contribution in economic growth have been formalised in the 'National Innovation Systems' concept (Dosi et al. 1988; Freeman, 1988; Lundvall & Nelson,1988). As literature suggests Innovation systems were envisioned as dynamic complexes of interaction among industry, government, business support institutions, knowledge creating institutions, and labour, capital and product markets, for the creation, diffusion and adoption of knowledge (Edquist, 1997a, 1997b; Freeman & Soete, 2000; Lundvall, 1992; Lundvall et al, 2001).

However, these strands of economics remain short of explaining the role of institutions, in particular, educational institutions in a country's development. Universities have long been recognised as providers of basic scientific knowledge for industrial innovation through their research and related activities (Smith, 2000). There is a substantial evidence suggesting that the higher education institutions provide a steady flow of qualified (knowledge) workforce and are considered potent source of 'knowledge' and 'technology' and hence contribute in enhancing economic opportunities (Etzkowitz & Leydesdorff, 2000). This study therefore, intends to look into the (less explored) role of higher education in the national innovation system of the country i.e. Pakistan, and aims at identifying the factors that (aid or) obstruct the role of higher education in making its due contribution in the National Innovation System. Moreover, an aim is to propose policy recommendations in understanding the role of higher education in NIS and possibly replicating the system itself in the developing country, i.e. Pakistan.

Mainly identified from experiential learning, the thesis has intertwined the theoretical and methodological perspective with the historical and contextual setting in Pakistan to (possibly) produce a body of knowledge hereinafter helpful in understanding the higher education sector's role in spurring innovation and technological advancement with specific focus on Pakistan.

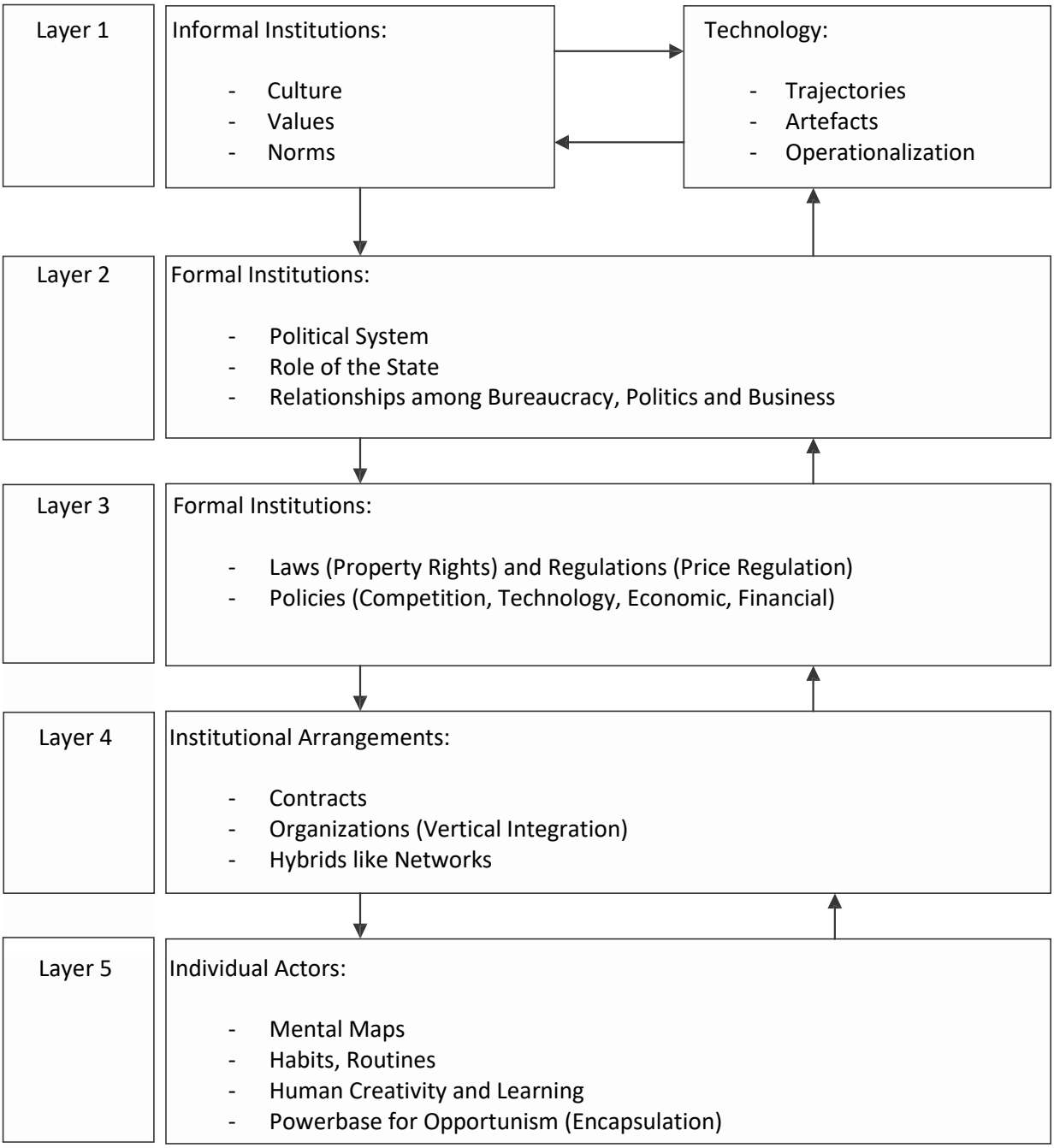
There are varied perspectives encompassing National Innovation Systems including country comparative study, analytical models, historical trajectories, and quantitative studies. Interestingly, it is argued that the NIS-concept is not a theoretical concept, since it takes on different meanings in different contexts (Lundvall, 2005). For this thesis the foremost interest is to find out ways through which 'innovation system' concept can be connected to economic growth and economic

development taking into account the role of higher education institutions. This thesis primarily draws upon an analytical “Layered Institutional Model” (see Figure 4).

The model closely reflects the organic and evolving character of interrelationship and inters dependence among institutions and actors to innovation. More precisely, this model brings out the significance of linkages among individual agents and the institutions and is applied primarily to understanding of role of higher education in the NIS in Pakistan.

Therefore, this thesis aims at understanding policy interventions and formulating guidelines, both for the higher education institutions themselves as well as for the government responsible for providing framework conditions for the economic exploitation of knowledge.

Fig. 4: Layered Institution Model



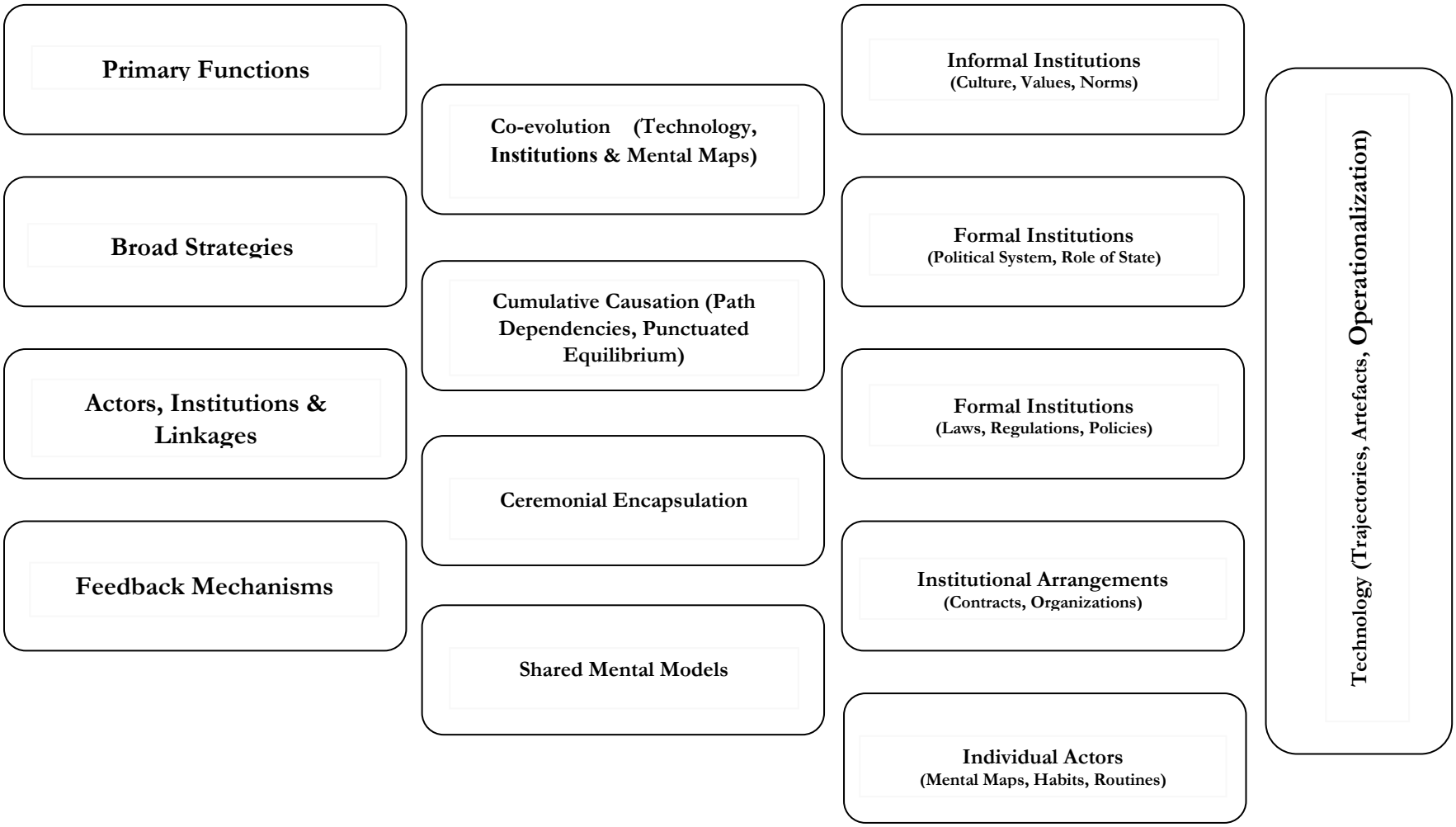
Source: Gronewegen & Van der Steen (2006)

4.2 Conceptual Framework

This thesis is fundamentally concerned ~~in~~ with understanding the role of higher education in National Innovation System in Pakistan. Notwithstanding the benchmark models; ones which are dominated by the supply side measures, the theoretical conjectures of the National Innovation Systems call for studying socially embedded and historically grown contingencies of the national economy. This defies 'one size fits all' approach, yet the comparisons made across different countries (Altenburg & Lundvall, 2009) attest having systemic accounts of national idiosyncrasies that help in developing a basis for theoretical analyses and consequently in designing the national innovation system, one which is a sub-system of the national economy. In order to evince data, a conceptual framework was used. Briefly, the framework is the one presented by Gronewegen & Van der Steen (2006). The framework places institutions in a hierarchical order, with the three upper layers called the 'institutional environment', while the two layers below them, the 'institutional arrangements'. The first layer (Layer 1) comprises of informal institutions like, culture, values, norms, etc.; the one below it (Layer 2) comprises of different systems in vogue in a nation state (e.g. political, executive, judicial, administrative, educational, etc.). Among the three layers comprising of 'institutional arrangements', the upper one (Layer 3) comprises of legal and administrative instruments like laws, rules, policies, etc.; the one below it (Layer 4) comprises of institutional arrangements like public and private organizations, networks, contracts, hybrid entities (business councils, industry associations, think tanks), etc. The bottom most layer (Layer 5) comprises of habits and routines which form the basis of strategic behavior of actors determining, to a large extent, their power base and their efficacy to influence / (be) influenced upon by, the upper layers. The model analyzes interactions among different institutional layers as well as their interaction with technology (Gilsing, 2005; Lundvall, 1992). Following the institutional logic (Searle, 2005), it is understood that the higher layers not only influence but as well restrain the lower ones; simultaneously the lower layers also influence the higher ones albeit over longer time horizons. Drawing from evolutionary economics standpoint, interaction among institutions and mental maps of actors unleashes a process of technological and institutional co-evolution resulting in newer combinations of knowledge i.e. innovation. Besides co-evolution (institutions, technology and mental maps), the study uses other peeping holes suggested by Gronewegen & Van der Steen (2006) for the examination of interaction among actors and institutions in the national innovation system.

Besides, a) “co-evolution” of technology, institutions and mental mental maps) – referreded hereinabove, these include b) Cumulative causation – the development of idea is attributed to Gunnar Myrdal in the mid-1950s. It explains both learning and development as multi-causal approach in which the change in one form of institution causes changes in other institutions. The continuing changes may strengthen the systems or work to their detriment and as such explain the “virtuous” and the “vicious” cycle(s) in developed and developing countries respectively. The relevance to the study framework asserts that consistency among different institutional layers and logic of the system gets strengthened through the learning processes which drive the system along a specific development path. c) Punctuated equilibria – the term originated in biological sciences and later found its way in the social sciences. Eldredge and Gould (1972) while challenging the degree of gradual evolution as was commonly attributed to Charles Darwin argued that it is virtually nonexistent in the fossil record, instead stasis i.e. state of little or no morphological change dominates the history of most fossil species. They explained that the morphological discontinuity owed in major part to the ‘sudden jumps’ found in the fossil record. Mayr (1992) later complimented Eldredge and Gould’s findings stating that punctuated equilibrium had a major impact on paleontology and evolutionary biology. On a similar analogy, several of the social processes are evolutionary and path dependent i.e. they refer to a property of contingent, non-reversible dynamic processes; i.e. ~~still~~ the social processes are disrupted or punctuated through the creative destruction induced by profit-maximizing entrepreneurs. The entrepreneurial success is secured through interplay of institutional and organizational support mechanisms (Nelson & Winter, 2002), and d) Ceremonial encapsulation – the term has its origins in the discipline of Chemistry, where the confinement of an individual molecule within a larger molecule is termed as ‘encapsulation. A meaning in social sciences, as they are also closely denoted in computing, refers to a process of adding control information as it passes through the layered model. In reference to the context, the ‘ceremonial encapsulation’ refers to the inefficient ‘evolution’ due to interests, often conflicting, of the power groups, etc.

Fig. 5: Conceptual Framework



Adapted from: Groenewegen, J. and M. van der Steen (2006), 'The Evolution of National Innovation Systems', Journal of Economic Issues, Vol. 40, No. 2, pp. 277-285

Briefly, this conceptual model presented in Figure 5 consists of multiple (five) layers of institutions; the first three layers may be termed as the '*institutional environment'*, and the other two as '*institutional arrangements*' as follows;

- Layer 1, the informal institutions (culture: values and norms);
- Layer 2, the political system, education system, etc. and
- Layer 3, the formal rules of the game (laws, regulations, and policies).
- Layer 4, the institutional arrangements (public and private organizations, contracts, and hybrids like networks),
- Layer 5, creative, innovative learning that is embedded in habits and routines including strategic behavior and the power base of actors, which can block innovative developments (see ceremonial encapsulation below).

All these institutional layers interact and c-evolve through their interaction with each other and with 'technology'

The layers are connected by arrows, which indicate that higher layers not only influence and have the propensity to constrain the lower ones but that the lower layers, within a certain range can influence higher ones. The layered framework can also be applied at the sectoral level (i.e. to study sectoral innovation).

The interactions among different institutional layers can be analyzed using concepts of;

- Co-evolution (technology, institutions and mental maps);
- Cumulative causation (path dependencies, punctuated equilibria)
- Ceremonial encapsulation (inefficient evolution due to power of interest groups), and
- Shared mental models (incremental vs the radical change)

Chapter 5

5. METHODOLOGY

This chapter entails justification of the research design and methodology. More specifically, it discusses the methodological choice as the epistemological and the ontological stance. This is followed by the subsequent choice of research methods and data collection techniques deemed suitable for the study. To do so, requires an in-depth understanding of the role of higher education in National Innovation System. This study thus, primarily relied upon qualitative semi-structured interviews. One of the key motivations to qualitatively explore the role of 'National Innovation Systems' (NIS) is to develop an understanding of how countries build 'knowledge' and 'knowledge infrastructure' at the national level that stimulates competitiveness and innovation for economic development.

This chapter further describes the issues circumscribing the research participants' (population), sampling, and access to (research) participants followed by explaining the researcher's position in observing ethical considerations. This chapter also describes in detail the processes followed in the development of a questionnaire used in conducting the interviews and its pilot testing. Finally, the chapter describes the method used in analysis, interpretation, and representation of data. The following sections describe each of these in detail.

5.1 Research Questions

As explained in Chapter 2 & Chapter 3 of the present thesis, there appears no prior research earlier undertaken on the role of higher education in the National Innovation System in Pakistan. However, the two chapters highlighted significance of understanding the role of higher education in building and strengthening the NIS. The literature review presents works by prominent theorists explaining conceptual underpinnings that have contributed to the evolution and development of the NIS approach (c.f. Lundvall, 1992; Gronewegen & Van der Steen, 2006). Briefly, the research questions tend to seek answer as to the functions and role of higher education in the national innovation system in Pakistan. The follow-up questions relate to exploring strategies; identifying actors, institutions, linkages and the feedback mechanisms that help in creating and re-creating the referenced functions. It hinges on NIS answering a classical question as to the 'role of state' *aka* the

framework conditions (Ringo, 2002; Edquist, 1997; Nelson, 1993; Torun & Çiçekçi, 2007; Reinert, 1999) and the ability of HEIs in creating such functions. The literature review re-capitulates that the treatment of 'technology' in classical and neoclassical economics as an exogenous resource does not *per se* incorporate the role of institutions on economic development. However, the NIS approach allows for understanding the role of cumulative learning and concurrently the roles of market forces and role of 'state' (OECD, 2012; NSF, 2012; Alan, 2012; Teubel, 2000; Skousen, 1992) in fostering technology, entrepreneurship and innovation in economic development. The works by Veblan (1898), Schumpeter (1942), Abramovitz (1979, 1986), Nelson (1993), Lundvall (1992, 2007), Freeman (1987, 1995a), Niosi (2000, 2002), North (2003), et. al. help in understanding the role of technology and institutions in fostering 'innovation' and in shaping 'innovation systems'. Since 'innovation systems' have the ability to move towards higher states of order, the distinction between the 'open' (social) systems and 'closed' (physical) systems is explained with the help of Bertalanffy's General Systems Theory. Furthermore, the ability of such systems to be able to recreate them to keep the system-ness intact is explained through recourse to Luhmann's Theory of Social Systems.

This study therefore aims at exploring ways in which the role of higher education is understood for its significance in the dissemination, generation, and diffusion of knowledge in Pakistan. More specifically the study aims at answering the following four research questions:

a) What are the critical functions of higher education in NIS?
b) What are the broad strategies that can be employed to effectively create and manage those functions?
c) What are the actors, institutions and linkages within the system that collectively implement the strategy? and
d) What are the monitoring and evaluation mechanisms that bring feedback and the consequent repositioning of the higher education system in the NIS?

Answering these questions include but is not limited to the higher education (sector's) ability to respond to the changes overtime and hence correspond to the (evolving and) changing institutional milieu. Consequently, answers to these questions cannot be reduced to some statistical numbers or ascertained through quantitative techniques; these need to be investigated and

understood through in-depth exploration which necessitated locating the study within the social context deserving qualitative explanation.

5.2 Methodological Options

The methodology elucidates the way one sees the world; hence, the choice of methodology has a casting impression in the way research is carried forward. Since different ways of viewing the world shape different ways of researching the world, therefore, different methodological perspectives were considered in this research. Seemingly, the social world is believed to have particular meaning and relevance structure for the human beings living in it. Likewise, the choice of methodology is informed by assumptions about knowledge, i.e. the nature and origin of knowledge defined more broadly as 'what constitutes knowledge i.e., 'ontology', and how knowledge can be generated i.e., 'epistemology'. Epistemology considers views about the most appropriate ways of enquiring nature of the world (Easterby-Smith, Thorpe & Jackson, 2008). Objectivism portrays the position that "social entities exist in reality external to social actors concerned with their existence" (Sauders, Lewis, & Thornhill, 2003, p. 29). Consequently, objectivism is an ontological position that asserts that social phenomena and their meanings have an existence that is independent of social actors (Bryman, 2012).

Among the two extreme positions in qualitative research as to lay the claim on 'knowledge' are 'sociological positivism' (Hassard, 1995) and the '(German) idealism' (Beiser, 2009). The former tends to apply models and methods to the social sciences as they are applicable to the natural sciences, while the latter is rooted in the premise that ultimate reality lies in the 'spirit' or 'idea' rather than in the data of sense perception (Burrel & Morgan, 2017). These two archetypes relate to the social world; one which is external and have an objective reality and the other in which the social reality bears subjective experiences of individuals. Based upon this, research encompasses a multitude of ontological and epistemological positions allowing for four inquiry paradigms including positivism, post positivism, critical theory, and constructivism (Guba & Lincoln, 1998). The choice of inquiry paradigm thus guided the researcher in narrowing down the theoretical perspective and the philosophical stance informing the subsequent methodological choice.

Since the social theories are understood to lie in between the two extremes of 'positivism' and 'idealism', they depict the 'relativistic' nature of the social world. The qualitative research thus offers a range of relativistic positions imbued with proliferation of research paradigms, orientations, and methods through which it seeks to explore answers to the research questions. Guba and Lincoln (ibid, p. 208) contended that out of four inquiry paradigms, stated above, it is 'constructivism' which espouses relativism, while the others advocate realism. Such diversity, on the one hand offers the qualitative research an immutable strength due to methodological pluralism, nonetheless, it also challenges qualitative research for its scientism, technical rationality, and reliability (Denzin & Lincoln, 2005).

The National Innovation System is a socially embedded arrangement circumscribed by the territorial boundaries and historical contingencies (Nelson, 1993; Niosi, 2010). In order to ascertain whether or not, each set of national milieu is unique and distinct in its socio-economic structures, institutions and organizations; it is required to understand what (already) 'exists' or as loosely phrased 'what is the reality?'. Crotty (1998) contends that knowledge is shaped by social, political and cultural milieu and is evolutionary in character. According to Crotty (1998), such understanding would not be complete, if it is not set in a genuinely historical and social perspective. Since realities are constructed, and as constructions are multiple, so are realities (C. Lee, 2012, p. 407). Stating it slightly differently, the interpretive flexibility, which allows different individuals and social groups to bring alternative interpretations and perspectives possibly depict reality in their own right. The multiple interpretations relating to the tenets of social construction of technology (Berger & Luckmann, 1966) therefore necessitates culturally derived and historically situated interpretations of the social world (Crotty, 1998; Douglas, 1990).

Consequently, the choice of 'social constructivist' approach as research methodology is sought to explore answers to the present research questions. The constructivist paradigm assumes relativist ontology, one with multiple realities and where the knower and the respondent co-create understanding (Denzin & Lincoln, 2005a, p. 24 in C. Lee, 2012, p. 406). The 'multiple realties' here tend to mean an interpretation signifying that the understanding or the reflection of one cognitive agent would be different from that of the other. i.e. its philosophical stance fares well with the tenets of social constructivism (Vygtosky, 1962).

5.3 Choice of Methodology: Social Constructivism

It is not long that the higher education institutions have assumed a new role in the knowledge application and hence the knowledge infrastructure of a country. Moreover, there is stratification in the roles of higher education institutions, e.g. in offering different disciplinary / subject areas, being located in different parts of the country, at different stages of evolution, and so forth. The stratification in the roles of universities was also expected to reflect in the diverse interpretations to the research questions by the participants. This understanding was aligned with the methodological assumptions of 'social constructivism' viz. the knowledge is socially constructed, an epistemological claim; the social reality is constructed, an ontological claim; and that the knowledge and social reality are mutually constitutive, a reflexive claim (Pouliot, 2007).

Therefore constructivism as a methodological choice holds special significance in three main ways; first, the constructivism holds that knowledge and meaning in general are socially constructed; second, the social reality is constructed instead of (being) exogenously given; and third is that constructivism stresses the reflexive relationship between the social construction of knowledge and construction of social reality (for reference see Guzzini's, 2000, 2005; Pouliat, 2007). Additionally, the principal characteristic of constructivism is its view that the knowledge, both every day and scientific, is a construction shaped by its context (Delanty, 1997, p. 129).

It is important to note that, there is variety of constructivist perspectives; such as the ones developed by Vygotsky (1962), Berger & Luckmann (1966), Piaget (1953 & 1967), Glasersfeld (1984, 2001 & 2005), Astley (1985), Lincoln & Guba (1985 & 1989), Cannella & Paetzold (1994), LeMoigne (1995, 2001 & 2002) as cited by Cecan (2015), Mir & Watson (2000), and Charmaz (2003 & 2006), to name just a few. They all hold in common the epistemological belief that a totally objective reality, one that stands apart from knowing the subject, can never be fully known. Erwin (2007) contends that the reality cannot be fully known as would be accepted by all sides of recent epistemic controversies. Accordingly, different varieties of 'constructivism' while resting on potentially different foundational assumptions, at times generate confusion, which even if not favorable to the knowledge development offers methodological pluralism. This state of affairs accords a valuable diversity to the constructivist epistemologies (Avenier, 2010). They reject the positivist stance as in the correspondence theory of truth, which postulates that our mental

representations mirror an objective reality, 'out there', as it truly is. Rather, knowledge, and the meaning we imbue it with, is a construction of the human mind (Rosen, 1996).

Two of the relatively broad varieties of 'constructivism' include cognitive (also known as individual or radical) constructivism (Piaget, 1953 & 1967) and social constructivism (Vygotsky, 1934 & 1962); the distinction between the two is that the former focuses exclusively on the meaning-making activity of the individual mind while the latter emphasizes the generation of meaning–making by an individual in the social context, i.e. through generation of meaning as shaped by conventions of language and other social processes.

More explicitly, (social) constructionism is distinct from (radical) constructivism in that the focus here is not on the meaning making activity of the individual mind but on the collective generation of meaning as shaped by the conventions of language and other social processes. The similarities between the two include building concepts on existing knowledge which is relevant and meaningful; while the differences mainly lie in that the thinking precedes language in the former while language precedes thinking in the latter (Powell & Kalina, 2009).

More so, the 'social constructivist' approach is more appropriate for this study as it tends to locate meaning in an understanding of how ideas and attitudes are developed over time within a social and community context. Lee (2012, p. 208 & 407) calls it a strong form of social constructionism (SSC). However, as briefly been introduced, a distinction between the two is that since each individual is capable of and is privileged to construct his / her own world on the basis of his / her lived experience, we tend to refer it to as 'social constructivism'. From the perspective of constructivism, knowledge is the product of cognitive processes which result from an individual's interaction with his / her world (Jha, 2012). Accordingly, there exist multiple realities, since same social phenomenon is interpreted (or understood) by individuals differently from one another (Lincoln & Guba, 1985). Crotty (1998) contends that '*constructivists emphasize the instrumental and practical function of theory construction and knowing'*. Re-phrasing slightly differently, constructivism primarily brings forth an individual's understanding of constructionist's position (Lee, 2012; Schwandt, 1994 in Crotty, 19988)

Constructivism taken in this sense suggests that each one of us is capable of and is endowed with making sense of the world, just as anyone else has this right, opportunity and freedom that one

genuinely deserves. In comparison, social constructionism, gives a community's collective world view. On these terms, it can be said that constructivism tends to resist the critical spirit, while constructionism tends to foster it (Crotty, 1998).

The epistemological foundations of constructivism are rooted in the principle, that humans harbour inherent tendencies to think, categorize and process information. These tendencies rather than external features of the world are of paramount importance in fashioning knowledge (Gergen, 1985). Fashioning or the creation of knowledge thus relies on social processes which include communication, negotiations, rhetoric whether in tandem or in conflict, portraying expressions, perspectives and views of individuals (Garfinkel, 2003; Gergen, 1985 & 2003). That is to say, knowledge is generated through individuals' interaction with each other and with institutions in a particular social context. Therefore, knowledge is inter-subjective within the precincts of particular communities. The notion of inter-subjectivity denotes importance of shared language and understanding throughout knowledge transmission within specific social contexts (Searle, 2005).

The methodological practice in constructivism follows a three (3) step process in moving along a subjectivist-objectivist continuum (Pouliot, 2007). The first step uses subjective i.e. experience-near perspective (intended) to recover the subjective meanings; then an objective or the experience-distant perspective about social life and finally understanding the context including (having) the historical perspective. Thus by implication, constructivist methodology is inductive, interpretive, and historical and accordingly the philosophical, definitional and methodological congruence of National Innovations Systems dovetail well with the tenets of social constructivism (Vygtosky, 1962).

5.4 Method Choices

After eliciting the choice of methodology adopted for research, it would be appropriate to discuss the choice of research methods. However, before a choice of research methods is made, it would be apt to re-capitulate distinction between the two; the research methods consist of concrete tools of inquiry, while the methodology is an encompassing term referring to "….*those basic assumptions about the world we study",* while same methods may be shared by various methodologies, a methodology comprises a set of epistemological and ontological assumptions or

as in Hacking's (1982) words, 'the style of reasoning', that prescribes its own scientific standards and truth conditions. Research methods, on the other hand, are required to be aligned with researcher's style of reasoning i.e. ontology and epistemology (Hall, 2003).

While making choice for research methods, the moot question was what alternatives were on offer to elicit data conforming to the (social) constructivist approach. The available modes for data collection included; experimental, quasi-experimental, correlational, and survey research strategies (Schwandt, 2003, p. 293). The choice of 'qualitative interviewing' allowed a method capable of underscoring the social constructivist approach characterizeing social embeddedness, i.e. one in which modeling behavior of an agent requires inclusion of other agents as individuals/entities rather than as an undifferentiated whole (Edmond, 1999). Equally important is that the chosen method be the one which would be able to relate to the consciousness of the researcher and the participants, and further, able to relate expositions to culture, society and all the metaphysical entities that are difficult to define but would be taken for granted when the participants contribute through their own, and as understood by them, the explanation of others around them (Jha, 2012).

Keeping above in view, qualitative interviews offer an effective technique to evince primary data (Britten, 2007). It was therefore used through conducting interviews. The selection of participants (explained in the succeeding paragraphs) allowed evincing data through capturing reflections of feelings, faith, empathy, emotion, insight, sensitivity, intuition, imagination, subjective judgment, (understanding, making connections and narrating the) historical evolution, introspection, triangulation, and so forth thus offering a potent medium to capture character of social embeddedness of the higher education institutions revealed through the lived experience of the participants. The reflections of participants attempted to bring to the fore relationships, interconnections and interactions, under examination.

As briefly described earlier 'qualitative research' is not without its criticism challenging its scientism, technical rationality and reliability (Denzin & Lincoln, 2003). Equally, so there is denunciation as to the constructivism's ability to complying with the scientific standards such as validity, falsifiability, and generalizability. While the latter two do not hold ground for 'qualitative research' being respectively relativistic and socially embedded in character, the diverse expositions of the social world are rather the high points of the constructivist epistemologies (Avenier, 2010).

Briefly re-capitulating, they postulate that the mental representations do not mirror an objective reality; the knowledge and the meaning we imbue it with, is rather a construction of the human mind (Rosen, 1996).

Withstanding above, in order to ensure integrity of the collected data, use of the triangulation strategy was made for its validation through introspection and interspersing it with data obtained from other multiple sources. Such sources comprise of published reports, education and other sectorol policy documents, national development plans, statistical data, independent reviews and so forth. The triangulation was made through collating and validating, where possible. The data obtained from multiple sources i.e. 'interviews' and through the 'documents' provided independent validation to the participants' dispositions therefore adding reliability to the research process.

5.5 Research Participants

As outlined above, the major research aim is to seek information about a specific arrangement i.e. the role of higher education in national innovation system in Pakistan. This subsequently de-limits the choice of participants. Therefore, the prerequisite is to recruit those most knowledgeable about the higher education sector in Pakistan. Most importantly these questions require recruiting those participants who can comment on its historical roots, evolution, interconnection with and reflections (on it) from diverse socio-economic sectors; as well as have familiarity with issues relating to planning, financing, and its administration.

As briefly described in Chapter 3, the higher education sector was and partly still is embedded in the colonial past. The reforms were introduced in the sector in the Year 2002 and after. The selection of participants therefore warranted that the participants be aware of the happenings and developments during this time. Thus, having a holistic overview of the sector from a position sufficiently high in the administrative hierarchy to have an appreciation of the higher education sector viz a viz other socio-economic sectors delineates the qualification of the survey population. Consequently, the prospective 'survey population' comprises of senior academic administrators & planners; mainly those who have worked/ are still working at the helm of their respective institutions or so to say the academic elite in Pakistan.

More specifically, the prospective participants of this study include senior academics, heads of higher education institutions, and economic planners having insight in education, higher education, science, technology, research, its commercialization and their interface with other socio-economic sectors. Due to the qualification criteria in non-random sampling, the size of population of my research is relatively small. Therefore, participants were shortlisted on the basis of position and reputation of the academic elite based on their ability to contribute to the study in line with research objectives outlined above.

5.6 Process Tracing and Elite Interviewing

Process tracing is foundational to the within-case qualitative research tradition. The very definition of process tracing indicated that in process tracing, the researcher examines histories, archival documents, interview transcripts, and other sources to see whether the causal processes allude towards a theory and hypothesize or imply, sequence and value to the intervening variables (George & Bennett, 2005).

Tansey (2007) has frequently argued that interviewing, and especially elite interviewing, is highly relevant for process tracing approaches. Withstanding the primary data (to be) collected through qualitative interviewing, the area of my research is expected to benefit from the information and data gained through archival records. Therefore, the process tracing approach is inevitable as it would help to explain the causal processes of how higher education can effectively contribute to NIS as well as in identifying the causal mechanism within qualitative data. Elite interviews will thus serve as critical sources of information about processes of interest, under study.

5.7 Elite Interviewing

Interviews are one of the key tools in qualitative research (Britten, 2007). However, the effectiveness of interviewing depends upon the researcher's choice of most appropriate technique in interviewing so that they can be used more effectively in cases where they are the most appropriate data gathering tools (Potter & Hepburn, 2005). Process tracing approach suggests using a combination of reputational and positional criteria, as well as the use of both purposive and snowball sampling techniques. Therefore, the use of interviews to study those at the 'top' of

stratification system, such as higher education in my study represents an exclusive elite sample that is referred to as elite interviewing. Recently, research in qualitative methodology has increasingly used elite interviewing as a means of data collection. The benefit of such elite interviewing in my research is to recruit participants who have significant influence in their respective positions.

It is therefore assumed, that such participants would be able to;

a) synthesize information from a host of multiple perspectives viz. social, cultural, historical, administrative, personal, and so forth;
b) possess information generally not available, say due to embargoes, information being too sensitive to have been recorded, other accessibility issues or the information simply (being) lost due to missing archival records;
c) account for interpretations when the dataset is too large in volume, to allow the researcher an exhaustive consultation keeping in view the time and resource constraints; and
d) corroborate information which would otherwise appear either not related or not relevant[33]; and
e) allow the academic elite offer their reflections, (say) by adding a piece of information; not available with others, that would either clarify better or simply alter a generally established explanation[34].

However, 'elite interviewing' is not without its criticism to which one must exercise safeguards. Some such weaknesses that are pertinent to my research objectives include;

First, a propensity on part of the participants to either inflate or diminish their roles depending whether the initiative (or the program) being successful or not can have a substantial influence on their opinion. Second, the participants portraying consensus in decision making while in practice the decision making might owe to political expediency or administrative ease. Third, academic elite functioning at the boundary of political and administrative interface, tends to disavow

[33] A little support by the participants would tend to significantly improve the comprehension of the researcher as suggested by Vygotsky (1962) in his definition of Zone of Proximal Development (ZPD) in his social constructivist theory. For reference, ZPD is the 'range' of tasks/information that are too difficult for an individual to master alone but can be mastered with the assistance or guidance of others who are more knowledgeable.

[34] The rise of Taliban phenomenon was attributed to the lack of justice in the Afghan society by one of the research participants

a role in decision-making to portray the political leadership's independence and autonomy. Fourth, human errors including memory losses or inadvertent overlapping of certain reflections tend to distort the narrative. In order to overcome such challenges, process tracing approach suggests validating the participants' exposition by comparing it to those made by other participants on similar issues. More specifically through triangulation, the validity of evaluation is established in the light of information and data available through alternate sources such as archival records.

5.8 Sampling

Keeping in view the nature of research questions and the probable size of the population, the choice of participants was made in light of their ability to contribute appropriate data, both in terms of relevance and depth. Hence the participants were selected through non-probabilistic purposive sampling (Kerlinger, 1986). The non-probabilistic sampling is one in which the selection of participants is made on the basis of study's purpose. Besides the researcher's knowledge, recommendations of key participants were invited in identifying other suitable participants. Kidder et al. (1991) suggested that with good judgment and an appropriate strategy, researchers would be able to select participants that represent the targeted population. One of the better known strategies in following non-probability sampling is the snowball sampling also referred to as chain referral sampling (Babbie, 1995). This method involved identifying an initial set of relevant participants; narrowed down in the light of recommendations of few initially selected participants and in the light of researcher's (myself) knowledge of the potential participants whose profile matched characteristics relevant to the objectives of the study.

Moreover, the sampling criteria also accounted for the time and resource constraints, in selecting and approaching the most important actors for interviews. The major goal was to seek information rather 'testimony' from the individuals, who were most closely involved in the process of interest. Therefore, the purpose was to reduce 'randomness' so as to represent the sample closer to the (research) population (Kidder, Judd & Smith, 1991).

The initial set of plausible participants was interviewed first. They were then asked to recommend names of other potential participants deemed suitable to the study purpose. The process was iterated until; a) the names recommended as a choice of first merit order started getting repeated

and b) the preliminary research results started showing signs of data saturation. The views expressed by the participants brought to the fore diverse opinions and interpretations.

More specifically, the sample of present study comprised of 15 participants representing national higher education administrative and sectoral planning elite. For purposes of clarity, the participants' were selected from among the following:

a) National higher education policy planners and administrators;
b) Heads of the higher education institutions i.e. Rectors/Vice Chancellors;
c) National science & technology and higher education planners/advisors to the Government of Pakistan; and
d) Higher education sector persons of eminence.

The participants' profiles are presented at Annex. B

5.9 Interview Schedule, Procedure, & Ethics

Further to this, the interview schedule addressed topics including functions of higher education and questions asking strategies to create such functions. It also required participants to reflect upon their understanding as to the actors, institutions and any linkages within the system that contribute in implementing these strategies. It further probed monitoring and evaluation mechanisms that contribute in repositioning of the higher education system in the NIS. The interview schedule was structured to provide coherence with the interview and, more or less, the same questions were asked from each of the participants albeit with flexibility to allow participants' making dispositions as they would think relevant to their reply. The personal rapport of the interviewer (i.e. me) with the participants made them at ease in candidly expressing their (respective) points of view while describing their experiences and thoughts. In this sense, the qualitative interviewing was semi-structured.

The semi structured in-depth interviews with each participant of the sample lasted between 60 and 120 minutes in a single setting albeit one which interview was conducted in two extended (almost 90 minutes each) separate sessions to suit the convenience of the interviewee. Interviews were conducted at each interviewee's respective office except for two (2) which were conducted at

the residence of the participants. The interview sessions were held in a comfortable environment and remained almost un-obstructed barring few minimal obstructions like (the participants) attending a short phone call or personal staff of the participants presenting them some papers/information, etc. Participation was voluntary; interviewees were initially contacted initially through a phone call followed up by an email, seeking their permission to participate in the project. After receiving their consent, interview particulars were shared with them through an e-mail containing brief recital and interview questions (Annex-A). Prior to this, the research ethics received approval was sought from and granted by the University Research Ethics Committee at the University of Leicester, United Kingdom. At beginning of the interview, participants were briefed about the purpose and scope of the study and the broad areas that were to be covered during the interviews. No compensation was provided for participation in the interviews. A written informed consent form as approved by the University Research Ethics Committee at the University of Leicester, United Kingdom was presented to the interviewees for seeking their concurrence to participate and allow using data gathered during the interview session. Signatures of participants were obtained to mark and keep a record of their concurrence. Anonymity and confidentiality of results was guaranteed. Moreover, respondents were assured that the data obtained from them would be used only for research purposes. All participants were informed that they could withdraw from the process (i.e. data collection) at any point in time. Before conducting interviews, participants were briefed about purpose of the research study. The respondents were given choice to ask for a copy of the research study, upon its completion and/or summary of the research findings.

5.10 Analytic Approach

To meet the objectives of present research and to make most out of the data gathered, a foremost challenge is to decide upon analytical approach. A process tracing approach described earlier is indeed appropriate in exploring causal processes and analyzing complex decision-making. However, in order to examine and record data patterns, the interview transcripts were thoroughly analyzed using a phenomenological-focused Thematic Analysis (Braun & Clarke, 2006). Following NIS approach (and) to map its effectiveness in higher education, thematic analysis helped in

capturing the unique and distinctive aspects of participants' opinions, views and experiences while responding to the research questions. The conduct of 'Elite Interviewing', followed by process tracing approach allowed access to the lived experience of the participants. While analyzing interpretations of participants' accounts of their respective understanding of the role of higher education in NIS; it allowed relating context to various decisions, as well as filling in the gaps in the recorded literature that were there (Smith, 2000).

5.11 Positionality in Qualitative Research

In qualitative research, it is imperative to acknowledge one's reflexivity or *positionality* as a researcher while approaching, analyzing, and interpreting the data (Blyde & Volpe, 2014). The interview conduction, transcription and preliminary data analysis are done by myself. Therefore, it is imperative to acknowledge and provide a brief account of how my, positionality, has or might have influenced the collection and subsequent interpretations of data. My personal, academic and professional background might have affected data interpretation in following main ways:

First, my master's degree in the discipline of 'management of technology' has provided me insights for better understanding the NIS. Second, for over a decade I worked in the higher education sector in Pakistan in various administrative roles. This association with the higher education sector in Pakistan has enhanced my understanding of higher education as a discipline as well as an economic enterprise which is understood as an important component of the NIS. Third, considering myself an ardent student of technology policy planning and administration and with the professional background as explained, consequently an interest was developed to understand the role of higher education in the national innovation system of the country which translated in conceiving the project, in hand. Fourth, there is a personal motivation to intertwine the theoretical and methodological perspective with the historical and contextual setting in Pakistan to produce a body of knowledge hereinafter helpful in understanding the higher education sector's role in spurring innovation and technological advancement of the country. Therefore, the interpretations and conclusions drawn from these data might have been influenced by my own past personal and professional experience in this sector. However, there is likelihood and an understanding that another researcher with a different personal or professional background would come up with a different analysis just in line and in sync with the social constructivist tenet of explanations as

diverse as the interpreters of the data. However, to maintain transparency of the analytical process, a lot of verbatim quotes are stated. This would provide readers an opportunity to examine and draw interpretations of their own depending on their experience and its context.

Chapter 6

6. RESULTS AND ANALYSIS

The analysis is undertaken with a liberal approach to understand the participants' accounts of professional and personal experiences through their association with the higher education sector in Pakistan. Nonetheless the data brought to the light the unique dynamics of National Innovation System and the diverse ways higher education can contribute to building and strengthening the National Innovation System. As described in the previous section, the data for this study was collected from the research participants who served at the helm and were directly linked with the issues raised in this research and have been very closely involved in the relevant policy making and its administration. The sample particulars have been discussed in the previous chapter. The results capture participants' experiences in their own words while privileging the uniqueness of their experiences. Themes and sub-themes are labeled in the way that best describe the data in its own terms, rather than using theoretical labels *ab initio*. Theoretical interpretations of the identified themes are briefly discussed in relation to each respective theme and more extensively in the subsequent section viz. 'Discussions on Results'. The data is organized under the themes drawn from the research questions, which in the first place was collected following the conceptual framework, presented earlier. The major themes and sub-themes that were identified through the analysis are presented in the succeeding exposition.

Each theme is illustrated through verbatim quotes and attention is paid to the unique dispositions made by the participants. An interpretive approach is exercised in understanding the research participants' narratives, while relying upon and reflecting their understanding of the role of higher education in building national competitiveness and in influencing social and economic development. Following process tracing approach, the unique dispositions or the nodes were identified, grouped and clustered to correspond to an analytical structure of sub-themes and themes. In the subsequent section, the data is organized in accordance with the themes drawn from the primary data following the conceptual framework as presented in Chapter 2 and answering the research questions. The themes are clustered around the research questions as presented in Chapter 1. For example, the first two themes as stated below directly address the first research question and the next three addresses the second research question and so on. There were very detailed and

informative responses from the research participants which are discussed in the succeeding pages. The research questions and the themes follow:

Question 1: What are critical functions of higher education in National Innovation System (NIS)?

- *Functions of Higher Education in NIS*
- *Setting Priorities Right*

Question 2: What are those strategies that can create the critical functions of higher education in NIS?

- *Building Human Resource*
- *Improving Academia Industry Linkages*
- *Entrepreneurship*

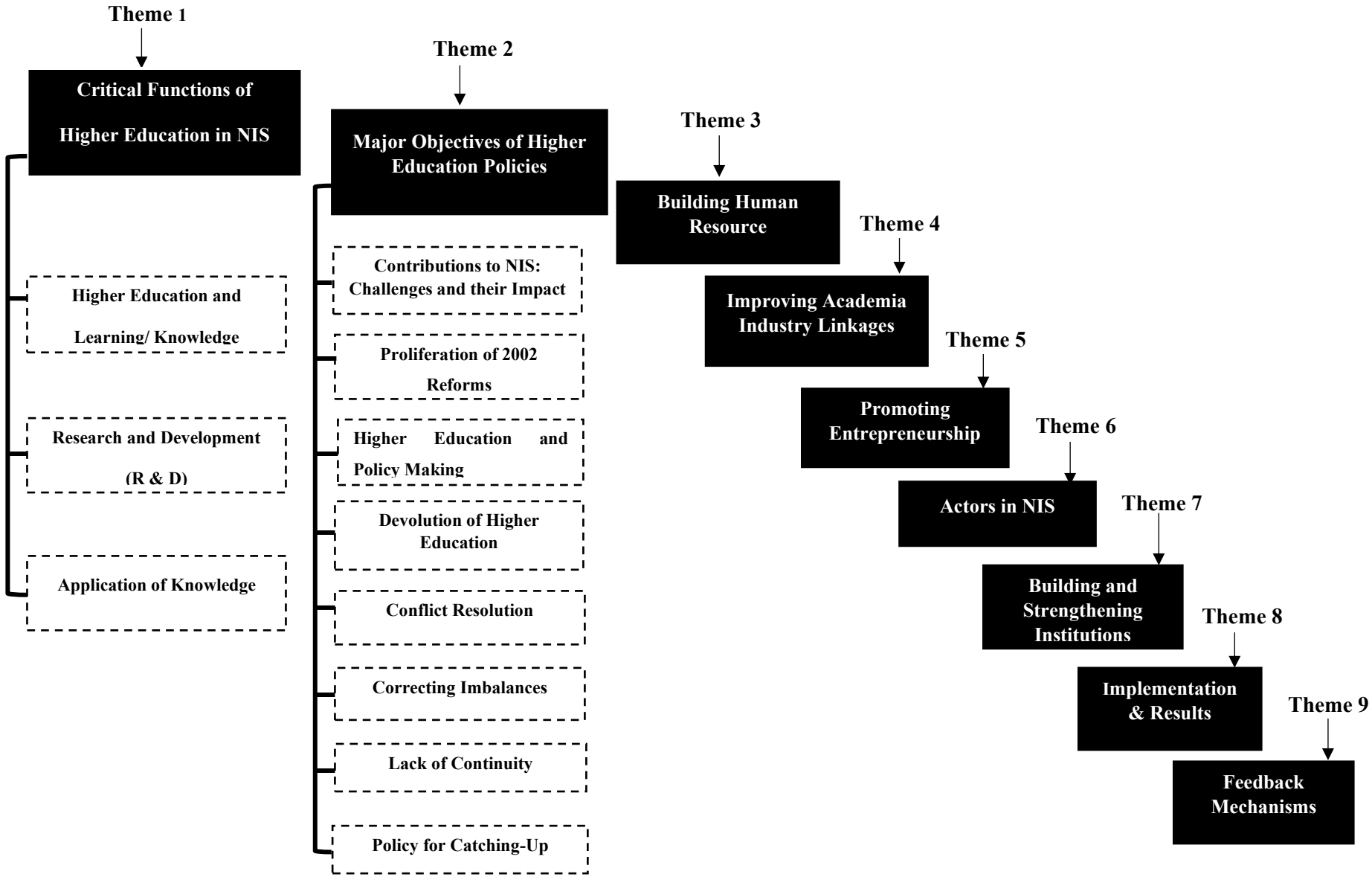
Question 3: What are the actors, institutions and linkages which can implement strategies for creating critical functions of higher education in NIS?

- *Increasing Interaction and Interdependence among Actors/Institutions*
- *Building and Strengthening Institutions*
- *Implementation and Results*

Question 4: What are those mechanisms that can bring feedback and help in repositioning the role of higher education in the NIS?

- *Feedback Mechanisms*

Fig. 6: Major Themes and Sub-Themes



Chapter 7

7. Critical Functions of Higher Education in the National Innovation System in Pakistan

This chapter presents two themes that are drawn from the data with focus on identifying and recognizing the main functions and objectives of Higher Education in the National Innovation System in Pakistan. The first theme describes key functions and the second explains and explores objectives of higher education as brought out by the research study participants followed by discussion.

7.1 Theme 1: Critical Functions of Higher Education

A growing body of literature focuses exclusively on innovation in developing countries (Lundvall, 2007). Pakistan is grouped among technologically marginalised and innovation deficient developing countries in the global rankings (Silja Baller, Soumitra Dutta & Bruno Lanvin, 2016)[35]. Literature suggests that NIS comprises of institutions, actors and linkages that individually and collectively contribute to the dissemination of knowledge, its creation and application in the economic mainstream (Freeman, 1987; Edquist & Lundvall, 1993; Lundvall, 1992; Metcalfe, 1995; Nelson & Rosenberg, 1993; Niosi et. al., 1993).

Higher education institutions (HEIs) are considered the principal springs of inquiry and knowledge creation. Therefore, a relevant initial research question relates to identifying the functions of higher education in the National Innovation System. Implied here is a reference to the technological marginalization of the country (Silja Baller, Soumitra Dutta &Bruno Lanvin, 2016) and a hypothesis that the critical functions of higher education as to assuming role in the National Innovation System comparable to those in the developed countries have not been developed in Pakistan.

Besides the core functions (*see above*), several ancillary and derived functions of higher education are identified by the study participants that directly and indirectly, help in strengthening

[35] The Global Information Technology Report, 2016.

the NIS. A number of nodes emerged from the primary data comprising of accounts of participant's qualitative interviews.

Successive data reduction allowed clustering to arrive at sub themes and themes that illustrate and reflect upon the character of various functions of higher education in the National Innovation System presented in Table 6.1 below:

Table.7.1: Critical Functions of Higher Education in National Innovation System

Themes	Sub-Themes
1. Higher Education and Learning / Knowledge Economy	*a. Evolution of Higher Education System in Pakistan Renouncing of Colonial Imprints on Higher Education* *b. Low Enrolments-Elitist Character of Higher Education* *c. Setting up of infrastructure - Expansion and Filling in for the Missing Links in the National Innovation System* *d. Private Sector Participation in Higher Education* *e. Virtual and Distance Education*
2. Research and Development (R & D)	*a. Creation of knowledge never remained a priority* *b. Investments in Science & Technology and Knowledge Generation* *c. Instituting and Incentivizing University Research* *d. Private Sector Participation in R&D*
3. Application of Knowledge	*e. Linking Research to Applications* *f. Universities' function as Think Tanks*

7.1.1 Higher Education and Learning/Knowledge Economy

The literature has long emphasized the importance of institutions, in particular higher education institutions as markers of knowledge economy (Groenewegen & Steen, 2006). By their character, institutions providing higher education[36] directly contribute to the dissemination and generation of knowledge. Universities are widely considered as key drivers in the knowledge economy with new knowledge findings and newer applications becoming the source of competitiveness for individuals, organizations, and for the nations (Olssen & Peters, 2005). More so, the higher education institutions have started to contribute in realizing economic gains (Apple, 2006) through developing links with industry and business and developing new venture partnerships (Olssen & Peters, 2005). The recognition of economic importance of higher education and its necessity for enduring economic viability are seen in promoting entrepreneurial skills as well as the development of incentive structures to enhance competitiveness (Memon, 2007). This study attempts to look at the evolving trends in Pakistan both as a political philosophy and an economic theory.

The role of higher education in the NIS is relatively an unexplored area of study in developing countries including Pakistan. Pakistan, at its inception in Aug. 1947 had fewer higher education institutions and the ancillary infrastructure in place. Therefore, the foremost interest was to see how did the system of higher education evolve over time? It would then be possible to understand the role higher education institutions could play or otherwise, in the NIS in Pakistan. The results may have implications for other developing countries. Various facets of higher education are identified as described by the study participants and are presented in the succeeding discussion.

[36] 'Tertiary education' is an encompassing term used to denote Post 12th grade education. It is understood that tertiary education includes both streams a) higher education; and b) technical and vocational education. Similarly, at times, the term 'higher education' deems to include certain certifications issued by the religious seminaries (madrassahs). The study, in hand, however restricted itself to the education imparted at universities, degree awarding institutions, degree (community) colleges, to conform to the generally accepted stream of 'higher education' in the normative sense.

a) *Evolution of Higher Education Institutions in Pakistan: Renouncing of Colonial Imprints on Higher Education*

As described earlier, whilst exploring the role of higher education in National Innovation System (NIS), the foremost interest was to explore the evolution of higher education in Pakistan. Signifying this, one of the respondents stated,

> *"English were the first to introduce the modern system of education. We had Madrassa*[37] *systems and there was no formal system of education. They [British] were the one, who set up the University of Punjab, Madras, Mumbai and Kolkata Universities in the 19th century (sic) or something. University of Punjab was established in 1882, Government College even was earlier, perhaps during 1860s. So, it was a senior institution as compared to Punjab University. But, this was an Innovation System in the whole subcontinent that the entire setup of education is based on that and if you see that the British first what they did was, they in far flung areas, they established these, through the Provincial Governments*[38]*, institutions of higher education and colleges and colleges of higher education and they were affiliated for purposes of examination and purposes of award of degree to the institution to which they were affiliated."* AK [Extract 1].

The limited number of institutions and consequently the (limited number of) places in fewer colleges and universities did not allow many to get into the fold of higher education and accordingly it was hailed as 'elitist'. The successor sovereign government(s) that took office since 1947 came up with a number of (higher) education policies[39] in the 70 years since Independence.

[37] Literally means a school, generally connotes to a religious seminary

[38] Upon recommendations of Lord Rippon, reforms were introduced by Viceroy Dalhousie, Viceroy of India in 1884 through which administrative jurisdiction in the education sector, then vested with the Centre was partly devolved to the provinces; the school and college education was devolved to the provinces while the university education was retained with the Centre. The colleges were affiliated with the universities for purpose of examination and award of degrees in the university's geographical jurisdiction.

[39] Higher education had historically been considered a component of education policies

The initial challenges before the newly Independent State as succinctly been summarized by one of the respondents were,

> *"Initially, … the main issue was to increase access and also address issue of equity". AB* [Extract 2]

There was only one functional university[40], 40 Arts & Science, and 11 Professional Colleges including those for agriculture (1); medicine (1); engineering (4); law (3); animal husbandry (1); education (3); and Tibb[41] (1). The enrolment at these institutions was respectively; University (644); Arts & Science Colleges (13,500) and Professional Colleges (4,368). In a country with population of 32.4 Million[42], the higher education system was virtually non-existent (Khalid & Khan, 2006). The abject backwardness of infrastructure and abysmally low participation rates at inception are conceded by one of the respondents in the words;

> *"When we were liberated in 1947, we had only basically one university, i.e. University of Punjab. Karachi University was established soon after, but this was the only university and just imagine that the whole of Pakistan having one University and with very limited enrollment……. after 1947, the emphasis on the higher education has not been as it should be of an independent state, may be because then it was by and large the fact was that vast population was illiterate and facilities of education especially, higher education were almost non-functional, only one university for the whole of Pakistan. So, for that matter, in due course of time, gradually, the awareness came and people started realizing that we should develop our local higher education facilities, colleges, degree colleges, intermediate colleges and then the universities."* AG [Extract 3]

Consequently, the government of the newly established State pursued policy of establishing more colleges as much as resources would allow her in a country stretched over an area of 0.796 Million Sq. Km. Leaving acute scarcity of the qualified human resources aside, the 1st Five Year Plan 1955-60, even though had to address the compelling needs of looking after over 10 Million

[40] i.e. University of the Punjab (1882); other university viz. University of Sindh was established in 1947 but was not functional until 1951

[41] Indigenous (or as locally denoted, Islamic) medicine

[42] Population of Pakistan (then West Pakistan) in Aug. 1947

refugees (Government of Pakistan, 1st Five Year Plan – 1955-60 (1957) and other competing demand on funds to run the nascent State; allocated 13.5% of the education sector budget (which was itself 6.5% of the plan provision) for 'higher education'. This has by far been the largest share for higher education as percentage of the total allocation for education sector in any 5-Year developmental plan. The actual releases though stood at 69% (Isani, & Virk, 2003) of the total allocation for education.

The expansion in higher education system continued albeit slow until the turn of the millennium, when establishment of universities/higher education institutions picked pace under the aegis of higher education sector reforms of 2002 (see Table 2 below). This was accompanied by an increase in the numbers and places for higher education. As of end of June 2017, there were 184 universities[43] and 1600-degree colleges (Pakistan Economic Survey, 2016-17, p 171). The enrolment is approx. 2.35 million (ibid) in the ratio of 55% and 45% respectively in the universities and degree colleges. The significance of expansion of higher education in Pakistan is highlighted by one of the participants in the following words;

> *"The major changes, if you compare this recent decade with previous one – the access was increased, the equity issue is being answered. As far as the number of institutions is concerned, we have increased the number. At the moment, we have 158[44] universities in Pakistan – both in the private and public sectors.".* AB [Extract 4]

Figure 7 shows the successive increase in the number of universities.

Fig. 7: Increase in Universities over the years

Period	**'47-57**	**'58-67**	**'68-77**	**'78-87**	**'88-97**	**'98-01**	**'02-18**
No.	4	6	8	8	17	41	185

Source: Virk, L (2003, p. 163) & Higher Education Commission (Annual Reports '02-03 to '16-17), Government of Pakistan (2018)

[43] This number includes two (2) universities offering degree programs exclusively through distance/electronic learning mode

[44] The number of universities/degree awarding institutes stands at 185 Jan 2019.

As per the latest census, the population of Pakistan is 207.7 Million (2017). It is a 57% increase since 1998 (132.2 Million). Coupled with rapid urbanization, the urban population is 36.38% in 2017 of the total as against 32.52% in 1998; there had been increase in demand for the number of places in higher education institutions.

Even with fairly large number of new higher education institutions and concomitant increase in the number of places for higher education that have come up in the wake of higher education sector reforms of 2002, the participation rates in Pakistan (9.43%) do not fare well with other countries in the region, such as Bangladesh (17.33%), China (48.44%), India (26.9%), Sri Lanka (18.86%)[45], etc.

b) Low Enrolments-Elitist Representation in Higher Education

Due to fewer places available, access to higher education remained 'elitist'[46] in Pakistan. One of the respondents described it as,

> *"The British legacy gave us elitist institutions, where only the elite could go, only a handful of the masses could go, that is where the dichotomy came. Most of our general population did not have access to the higher education. I think, in the past ten years, even late, it was very good effort since the creation of Higher Education Commission, but still I think, that is far less than it ought to be".* AN [Extract 5]

As the official annals indicate, keeping the character of higher education system as 'elitist' was a willful construct of the colonialists. In the oft-cited 1835 Minute on Indian Education[47], Lord Macaulay stated:

> *"I feel...that it is impossible for us, with our limited means, to attempt to educate the body of the people. We must at present do our best to form a class who may be interpreters between us and the millions whom we govern; a class of persons, Indian*

[45] http://uis.unesco.org/en/country accessed on Jan 14, 2019

[46] Trow, M (2007) defines higher education systems with gross enrolment ratio as less than 15% of the population between 17- 24 years of age as 'elitist'.

[47] Upon instructions of Lord Bentinck, Chief Executive Officer, East India Company, Lord Macaulay made recommendation for the 1st Education Policy of the Imperial Masters in the Sub-continent. Accordingly, the latter is hailed as the principle architect of the modern education system in the United India.

in blood and colour, but English in taste, in opinions, in morals, and in intellect. To that class we may leave it to refine the vernacular dialects of the country, to enrich those dialects with terms of science borrowed from the Western nomenclature, and to render them by degrees fit vehicles for conveying knowledge to the great mass of the population". ([1835] n.d., n. p., emphasis added) p, 44.

Withstanding above, the early architects of education policies in the newly Independent State did not carry views any different than those practiced by the Imperial masters.

Fazlur Rahman[48] (1947, p.9) stated:

"In the sphere of higher education which seeks to create a class of the elite that will determine the quality of our civilization and will direct and plan our national life, there is urgent need for drastic reform. We must do all we can to prevent the present aimless drift of all and sundry to high schools and colleges and the colossal wastage which the absence of any selective principle involves".

The elitist higher education manifests itself in the form of inequality i.e. not allowing equal opportunities of access (for higher/education) to all. One of the respondents described it in the following words,

"The people those are not as fortunate as some of the masses … will be left behind and that will be a big loss." AN [Extract 6]

It is in this earnest that one of the respondents stated,

"A huge responsibility, big issues, because biggest issue is the population you know in Pakistan; and at the moment, even after doing so much in last twelve years, hardly we have reached 8% of access rate". AB [Extract 7]

Accordingly, the higher education sector reforms 2002 assumed 'access' (Higher Education Commission, 2002) as one of the cardinal principles of the reform process.

[48] 1st Education Minister of Pakistan

This was reaffirmed by one of the respondents in the following words,

> *"The access was increased; the equity issue is being answered. As far as the number of institutions is concerned, we have increased the number…"* AB [Extract 8]

And in the words of another respondent as,

> *"…a trend after the HEC (Higher Education Commission, Pakistan) has come into existence has been little different. Then, there has been real urge for higher education to be spread in different places, especially getting into the interior regions of the country and enabling universities to open their more campuses, you see, in the interior regions of the country."* AL [Extract 9]

The growth in the number of institutions and places for higher education is vindicated by the officially published statistics in Pakistan. The statistics transpire that during the preceding decade and half (i.e. 2002-2017), the increase in enrolment is of the order of 30% per annum (Pakistan Economic Survey 2001-02 & 2016-17).

c) *Setting up of Infrastructure-Expansion and Filling in for the Missing Links in the National Innovation System*

Starting with rudimentary edifice at Independence, the subsequent developments in the higher education sector in Pakistan are seen by the research participants as an interaction among actors (politicians, planners, administrators and the public at large) and other factors (economic, social, political, and so forth) and less developed by order, in the words of Intarakumnerd, Chairatana, & Tangchitpiboon (2002). Interpreting his understanding of the aforesaid, one of the study respondents stated in following words,

> *"In order to make progress, we need to keep in step with all the latest developments that are taking place throughout the world. These developments are taking place in all areas, whether they are science, technology, social sciences, media and if we want to be part of this wave of innovation and we want to contribute to that and apply the latest knowledge and technologies for the development of our country, then we need to have*

higher education. So, higher education is must, it's extremely essential in National Innovation System. AQ [Extract 10]

Withstanding that the availability of infrastructure improves access to education (Epstein & Jezeph, 2001), the economic compulsions seemed influencing the merit order of investment in favour of physical infrastructure as against higher education for a fairly long time after the creation of Pakistan.

One of the respondents confided as,

"...first phase was, ...say 1947-1965; where things were very slow going on and people were just more involved in the development activities, not much focus on the education." AH [Extract 11]

Nevertheless, organizational framework in higher education did expand as was the case for other sectors of the national economy. One of the respondents while referring to the institutions' development stated that,

"Science, technology, technological breakthrough, creativeness, innovation – all that was not at all the concern of the imperial regime. Even after partition, I mean, after 1947, the emphasis on the higher education has not been as it should be of an independent state, may be because then it was by and large the fact was that vast population was illiterate and facilities of education as I have said about higher education were almost non-functional, only one university for the whole of Pakistan. So for that matter, in due course of time, gradually, the awareness came and people started realizing that we should develop our local higher education facilities, colleges, degree colleges, intermediate colleges and then the universities." AG [Extract 12]

One of the respondents refers to two periods which distinct out in terms of physical expansion of the higher education sector as follows,

> *"…of course in 70s, there was a big push – Dr. Afzal[49] came here in the UGC; and even before that … there were few initiatives which created some difference in higher education sector but I will consider the prime time when this Higher Education Commission was created."* AB [Extract 13]

Also, in the words of another respondents,

> *"Higher Education Commission, when they came into being, they made a paradigm shift. Suddenly, it was realized that higher education is most, the best engine to take country on a socio - economic development path. Higher education not only works in the higher education sector, but people in the lower education also study in higher education institutions. So, a paradigm shift was made, funds were increased, and they also realized that since the funds are not enough to cover the whole spectrum, they choose certain areas and one of areas they choose was science and technology".* AR [Extract 14]

The creation of Higher Education Commission, Pakistan in 2002 was accompanied by a remarkable expansion in the number of new universities (been) set-up in the country in the preceding decade and half and a five-fold increase in enrolment in the same period.

Besides setting up institutions, technological infrastructure was improved. A notable example included setting up of Pakistan Educational and Research Network (PERN)[50]. This included an electronic infrastructure for providing fast speed Internet services to all public-sector universities and related organizations including the Higher Education Commission itself. Some of its several uses included; establishing a digital library in which electronic content comprising of books and research journals is constantly been increased by subscribing to the electronic databases and providing access to universities according to the programs of study and subjects they offer. It is

[49] Dr. Muhammad Afzal was the first Chairman University Grants Commission in mid 1970s.
[50] PERN is an IT backbone provided by the HEC, Pakistan to all public sector universities for providing fast speed Internet, video conferencing facility and access to repository of library resources.

also used for delivering lectures from institutions both within the country and abroad, provide video conferencing to allow academics to have face to face meetings with their counterparts worldwide and to facilitate Masters and PhD students' supervision, counseling and even the conduct of oral examination/viva voce.

The prospects offered by technology have accordingly increased the material and intellectual resources of the higher education institutions and have provided new forms of interaction, inter-dependence cooperation and collaboration. The significant reduction in cost through avoiding duplication of resources at multiple institution and cutting down on costs and the time spent in travel for interaction and meetings have opened up avenues and added to the facilitation of academics and academic administrators. It is affirmed by one of the respondents,

> *"…infrastructure was improved dramatically, Information Technology and Telecommunications foundation that were laid then, they became the basis of PERN which today provides every student in every public-sector university with 80,000 textbooks (sic) and 30,000 international journals with back volumes."* AC [Extract 15]

The availability of public funds was not commensurate with the scale rather enormity of the challenge i.e. to extend the reach out of higher education to a larger segment of those seeking it. This realization shifted planners' attention to seek alternative solutions. Since the private sector is hailed in developing and implementing enduring and sustainable solutions, its engagement in higher education is no surprise.

d) Private Sector Participation in Higher Education

The Sub-Continent had a strong tradition of philanthropy in education (Agarwal, 2010). Several schools and colleges were established by the private sector in the name of family run trusts and foundations. These institutions relied on agricultural land or commercial properties endowed to fund their operations and were run as not for profit institutions. The emergence of neo-liberal forces in early 1980s started to make their mark on 'education' as well as on the 'higher education' sector in Pakistan. The 6th 5-Year plan (1983-1988) recognized for the first time the role of private sector in higher education. This resulted in setting up of two universities in the private sector viz. the Aga

Khan University (1983) and the Lahore University of Management Sciences (1984). Highlighting this shift in the public policy, one of the respondents stated,

> *"…Traditionally, universities have been (functioning) in the public sector, … but when the public sector could not really foot the bill for all of this stuff, then private sector stepped in. This has happened in the school system as well and this is happening in higher education."* AJ [Extract 16].

More growth and participation of the private sector was witnessed in late 90s but was even more significant in the wake of higher education sector reforms of 2002. As of 2017, the number of public and private sector higher education institutions is almost equal with enrolments in the proportion of 70:30 respectively. The proliferation of private higher education institutions is in response to the huge unmet demand for places in higher education (institutions) as well as an understanding on part of the planners of a robust role that the private sector can play in lessening burden on the public exchequer and its ability in responding better to the changing patterns of the (human resource) market demand. One of the respondents though alerts that the preference alone to respond to the market demand negatively impacts the skills mix in the job market in the absence of vigilant regulation. The respondent concedes that,

> *"…the private sector again has limitations; they would see to it that they would go for subjects which sell in the market, …like physics, chemistry, botany, zoology, …(but not) mathematics, because nobody is willing to pay that much money which we charge as tuition fees".* AK [Extract 17]

There have been other negative externalities there with participation of private sector in higher education. The elite and expensive private sector institutions have tended to further deepen the already polarized society promoting class culture. On the positive side, private sector's participation in higher education is a noticeable contribution which has lessened burden on government exchequer in funding fewer rather than all higher education institutions. It has, over the years, sensitized the planners in treating institutions as cost centres, worthy of maintaining credible business plans and training graduates with employability rather than altruistic skills, etc. This realization reflects well on the planners' assessments while seeking performance from public sector institutions and allocating funds for such institutions.

e) ***Virtual and Distance Education***

The higher education participation rates in Pakistan are low in comparison with other developing countries and even those in the region (Memon, 2007). This becomes compelling as the population growth rates are high in Pakistan and any effort by the government to increase the number of places in higher education institutions is thwarted by the increasing population. The situation therefore calls for innovative solutions to bridge the gap in a foreseeable timeframe. In order to increase the outreach of higher education, the distance education programs have successfully been deployed in several countries. Realizing its significance, there are two universities mandated to run distance education programs[51] are established in Pakistan. There are other universities both of the local and foreign origin offering distance education programs in the country. One downside oft-cited relates to the quality of these programs; though one of the respondents while not agreeing to it, quite candidly stated,

> *"…we are able to offer very (very) high quality education at very (very) affordable rates across the country."* AJ [Extract 18]

The advantages of distance education programs include that they allow learning at a pace suitable to the student and help in undoing spatial and temporal bounds. The economies of scale associated with running such programs are passed on to learner making it affordable and a viable alternative to the conventional campus-based programs. The distance education programs therefore help in undoing economic and social disparities and especially favour the weaker sections of society e.g. women folk who have otherwise restrictions on their mobility on account of socio-cultural taboos in an eastern society like Pakistan.

7.1.2 Research & Development (R&D)

As the academia has risen in the institutional structures of contemporary societies, the relationships among academia, industry, and government have also been transformed in many ways (Etzkowitz & Leydesdorff, 1995). Not surprisingly, the effects of these transformations are the

[51] Allama Iqbal Open University, Islamabad (1974) and Virtual University, Lahore (2002)

subject of an international debate over the appropriate role of the university in technology and knowledge transfer. For example, it is established that research in socio-cultural and economic domains across different sectors of the national economy is crucial for development (Charmaz, 2003; Cooke, 2001; Nelson, 1993, 2004). Nonetheless, such an increased salience of knowledge and research in the economic development has located a central role of the universities in economic development in pursuing diverse research agenda ranging from the local context driven research such as preserving environment, contributing to expanding product and labour markets, extending frontiers of knowledge and so forth (Etzkowitz & Leydesdorff, 2000).

However, unlike developed countries, knowledge is yet to assume a central role replacing other factors of economic production such as capital, labour, raw materials, etc. Therefore, the subsequent sub themes entail challenges in establishing knowledge as a critical component of economy in developing country viz. Pakistan.

a) ***Creation of knowledge never remained a priority***

Referring to the colonial imprints on higher education, the objectives set forth by Anglicist education policies in (United) India, did not require the locals to be trained as thinkers and researchers. Rather they served as the interlocutors between the imperial masters and the local population as they were required to undertake mundane functions of the State. Accordingly, the low end secretarial work force was produced and not the ones needed by the dictates of knowledge economy i.e. those able to produce body of new knowledge, innovate and enhance competitiveness of an economy. It is in this vein that one of the respondents stated;

> *"….Then came waves in 60s, early 60s and then second wave in 70s, quite a few new universities were established, quite a few new institutions came into being and then the people started realizing that the higher education is more important, and then if we must get better job, we should get higher education. But at that time even in this early 70s, nobody thought of, that they would be going (sic) to the industry and producing new knowledge. It was only late in 80s when Dr. Mahbub ul Haq realized that Pakistan is deficient in the human resources and he launched very good program of human resource development, but even that was not enough*". AH [Extract 19]

Conceding to the lack of University research, Fazlur Rahman (1947, p.9) stated,

> *"The universities, in particular, should cease to function as mere purveyors of knowledge in the form of cheap degrees. They are essentially home for promotion of learning and … human development".*

He (ibid, p. 54) added that the "neglect of research work' (in the universities) as one of the problems faced by the university education for the government had come under criticism".

An elucidating remark was made by one of the respondents as;

> *"…what is happening in our universities (is) that we're basically transferring knowledge that has already been developed and we are not developing ourselves much of the knowledge*". AL [Extract 20]

The enunciation of reforms in the higher education sector in the country in 2002 and creation of Higher Education Commission made a break from the past as described by the study respondent as;

> *"…since 2002, when the Higher Education Commission was created and focus on university education … was improved, research was funded, so on and so forth, that … changed the direction of higher education in Pakistan.* AN [Extract 21]

Consequently, over time, the University research has started to make its mark as shown by output indicators. There is nearly nine-fold increase in the number of (ISI indexed /Impact Factor) research publications between Year 2001-02 (816) to Yr. 2013-14 (7966). The number of PhDs produced since Independence (1947) to 2002 was 3281 and 4,820 PhDs since then (until 2016-17). No Pakistani university was ranked among top 500 until Year 2002. However, there are Universities ranked among top 500 in the Years 2015, 2016 and 2017 (Times Higher Education University Rankings, 2015, 2016 & 2017). Furthermore, according to Thomson Reuters, Pakistan had shown a

proportionately larger share of publications than the BRICs[52] in realizing exponential growth in numbers (Hawksworth, 2008); One of the respondents stated:

> *"Universities are not just about teaching, but are thus measured in this modern age by their research output. Pakistan was publishing only 700 papers per year in the year 2000. These have now gone up to over 8,000 papers per year (sic), in the year which has just ended in 2013. So, this and I am talking about papers published in the internationally abstracted journals. So, we are now slightly ahead of the India in terms of the research publications per million population; whereas we were at least 15 times behind India on the same yardstick 10 years ago."* AC [Extract 22]

Likewise, independent observers like Michael Rode (2008)[53] have also attested the positive changes in higher education and have rather termed progress made by the country an International best practice.

b) **Investments in Science &Technology and Knowledge Generation**

An investment in science and technology contributes to value free knowledge that is independent of the social context and can thus be translated into products and processes having commercial value. States with better quality (i.e. more qualified) human capital can pursue ~~for~~ innovative activities that will result in significantly higher per capita GDP.

In a study by Cheung (2014), it is estimated that over 30% of the growth in per capita income is attributed to technological innovation.

[52] Brazil, Russia, India and China

[53]Higher Education Commission Affair (2012), Letter by Prof Dr Bernd Michael Rode, Chairman/European Coordinator of ASEA-UNINET published in the daily Dawn, Karachi, Nov. 9.

Realizing that generation and dissemination of new knowledge are among the key functions of institutions of higher learning (Siddiqui, 2007), one of the respondents stated;

> *"you can promote science and technology … if you are able to generate knowledge and that comes through such an effort, like … research … and that is in the higher education, when we talk about higher education …we are not only transfer(ring) knowledge, but we (also to) generate knowledge and that is … first step towards science and technology."* AL [Extract 23]

c) ***Instituting and Incentivizing University Research***

Delineating the futuristic vision, the National Education Policy, 2009 (Para 140(3), p. 58) presented ~~a~~ following two-fold strategy for R&D promotion at universities;

i) Through focusing on building capacity at universities and research institutions to conduct and absorb fundamental/cutting edge research;

ii) Through focusing on knowledge mobilization, that is, transmission of research knowledge through various forms of university-industry partnerships and incubator programmes and science parks to the business sector.

The latter process laid out commercialization strategy with wider aim in assisting the innovation process in the economy. This necessitates developing and successfully commercializing innovation processes. University research is a key component of ~~our~~ nation's innovative capacity. According to Audretsch et al. (2005) knowledge is the key filter that stands between investment in university research and its commercialization through innovation, thus leading to economic growth. This necessitates financial investments in University research with an aim to generate commercialization and innovation. However, the issues impeding research at universities in Pakistan include weaker user-producer linkages (an innovation studies perspective) and lack of resources (an economics perspective). A way to addressing both standpoints concurrently relates to universities' offering enrolment in industry sponsored research programs in facilitating the commercialization of university research. While referring to it, one of the respondents stated;

"…research productivity began to increase through several programs and one of them was indigenous doctoral programme (it) not only addressed research, but it would also address relevance" AE [Extract 24]

Consistent with the above, a study showed that 1% increase in national R&D spending could result in 0.61 % growth of the economy (Şahin, 2015). Opining on the probable set(s) of incentives enticing industry to increase spending on research and development, one of the respondents stated,

"then government can … have a policy that the industry allocates a certain part of its income on R&D; so, if they … set aside … money, then they would like to use that money productively." AD [Extract 25]

Examples from within the country include setting up of ICT R&D Fund, as explained by one of the respondents as,

"the exceptional example is creation of the ICT R&D Fund …in which the sector, … the (telecom) operators, give part of their earnings … and (the) Fund is used for … research in that area." AN [Extract 26]

In another example, another respondent referred to an experiment made in Turkey. In this case, taxes were reduced on earnings in the ICT sector. Amid fears of dwindling (tax) revenues, the results were astounding; not only the investment and new job creation increased but the increased revenues more than offset the tax collection for the government even though the tax rates were reduced (Annual Plan, 2013-14, p. 218).

d) ***Private Sector Participation in R&D***

National Innovation System (NIS) plays a crucial role in countries' efforts to catch up with those technologically advanced (UNCTAD, 2005). However, the official account delineates that almost all R&D in Pakistan is carried out in the public sector. This is contrary to the practice observed in developed and newly industrialized countries where the private sector funds significant share of the national R&D (Khattak, Baseer & Bajwa, 2010). Since the private sector is cost and profit conscious and would invest in well-conceived research projects with better prospects of commercial returns, as would be true in case of any other investment made by the private sector.

Therefore, the investment by private sector in R&D accelerates the wealth creation and catching up process. Whilst reaffirming this understanding, one of the respondents stated,

> *"People in the businesses are very shrewd people; they would like to get their money back in some form."* AD [Extract 27]

The same respondent while referring to the share of contribution in R&D from South Korea stated,

> *"What is surprising is that …70% of this (money) comes from the businesses and 30% from the government."* AD [Extract 28]

However, realizing business case in making investments in R&D, one of the respondents stated as follows;

> *"Private sector has taken (up) so many roles; and I believe that they should be taking this role by themselves. When they realize that there is a big money into that one and the responsibility of the scientists like us is to make them believe that there is big money available, provided you are willing to invest."* AH [Extract 29]

On a related note, the economic resource allocation standpoint justifies private sector spending on R&D in that it would relieve the public sector in making 'some' rather than 'all' expenses in a resource starved economy.

7.1.3 Application of Research

The research findings reveal some of the roles adopted and continuously been evolved by higher education institutions in strengthening the National Innovation System. It is imperative to note that while the concept of National Innovation System itself is new that can be traced back to early 1980 (Groenewegen & van der Steen, 2006), it started to echo in Pakistan even later. Therefore, application of NIS concept is relatively new in Pakistan.

a) Linking Research with Applications

The study participants highlighted the impact of British imperialism on higher education in Pakistan. Understandably, referred in hindsight, the participants pointed to the lack of realization for the so to say, 3rd mission of universities (Etzkowitz, 2000) or simply put the universities' role in

promoting application of knowledge. Whether through transferring the university research to industry (contract research, licensing of technology, and so forth) or through enterprise creation, the application of knowledge did not get a place in the roles assumed by universities' in Pakistan for a fairly long time after Independence. One of the participants admitted that:

> *"(Still) ...the universities are following ... 1947 model .... Universities are providing the education for the sake of education ... because we (understand that we) have to educate first our people and then ...(would) master ... into different areas."* AH [Extract 30]

In an economy pre-dominantly reliant on technology imports from abroad, and dependent on raw agricultural produce, there was no demand for local value addition. The Universities' did not have the pressure to incorporate the tenets of promoting creation and application of knowledge in the curriculum. The result was that there was lack of orientation for developing skills or building capacity for indigenizing imported technologies.

One of the participants stated,

> *"It does have a very strong influence of (the) colonial past and that is one of the reasons that why our universities have not shifted towards entrepreneurship. That is one of the very weakest areas."* AE [Extract 31]

As referred above, correspondence between establishing a university and it assuming the role in promoting application of knowledge or to develop industry around it did not appear in demand. However, the exceptions to this popular perception did exist. One of the respondents while referring to the statements of objectives for establishing the first university after Independence viz. University of Karachi in 1951 stated,

> *"When the Karachi University was being established, it was written in its preamble of objectives that the university (would) .... help (in) the growth of industry in Karachi."* AL [Extract 32]

The years of disconnect between academia and industry left little appetite in the industry for university research mirroring the adage that 'the twain that shall never meet'. The absence of communications and any noticeable mechanisms of personnel or the ideas exchange between academia and industry resulted in widening the trust gap between them. As stated by one of the participants,

> *"Before making that institution for providing a certain kind of expertise or products, we do not really see what is in demand? Who wants it? Which industry would like to have this? And if industry adopts it, would it find customers in Pakistan or abroad? So, demand driven research is lacking."* AL [Extract 33]

Though conveniently silenced for long, the unsaid accountability tenets did ask for establishing linkages between the universities' functions and the knowledge application of research there.

One of the participants stated:

> *"Society should get benefit, your industry should get benefit and we are encouraging our academia that they need to work in close collaboration with the industry to solve their problem, to solve societal problem and we are encouraging our universities that they should take the responsibility of territory in which they are and they should look in which territory what kind of problems the society is facing, so that they should provide them solution. So, indigenous problem - indigenous solution type of approach is another way of moving in the society".* AB [Extract 34]

The lack of demand for university research initially owed and then resulted in (further) widening the gulf between academia and industry. It now manifests as the two-pursuing different mental models; the industry believing in turnkey solutions backed up by loan syndication as against an indigenous research, development and research integration effort prone to risks and uncertainty.

Elucidating different research models as are followed in the West, one of the participants stated:

> *"You know how we developed our scientific and technological system here. We have universities, we have research and development organizations, now, both do research. In US, you do not have the research organizations as such. You have universities, which mainly, they have linkage with the industry. We had inherited (these) research organizations from pre-partition system that we inherited from Britain. British had research organizations, but unfortunately, role of our research organizations has been different from role of British research organizations. British research organizations get funds and they identify the issues and problems".* AL [Extract 35]

Underscoring one more time, that the missing connection between academia and industry, is an express realization that for any research or new knowledge generated either in a university, government or corporate sector lab., primary constituency for its application is the 'firm'.

As stated by one of the participants;

> *"So, they all interact with a final entity that we call firm, which produces innovation output".* AD [Extract 36]

Interpreting it slightly differently, the industry is a place where both material and intellectual resources are available i.e. it is a place where the value of new knowledge is realized, appreciated and rewarded. As one of the respondents aptly puts it,

> *"We are very focused in trying to remove these barriers, we are trying to teach our senior faculty … that industry is where things are made, and those things are made from the intellect that you have and prototypes that you have developed, and the research that you have done".* AR [Extract 37]

The academia and industry relations do not develop through a bang nor through serendipity; rather they have to be nurtured albeit overtly. A practical and tested way is through placing senior students for training at industry as 'Interns'. Internships have served as useful way in inculcating ~~a~~ practical orientation among the university students and to allow them a feel of the world of work. As stated by one of the participants,

> *"There can be little more of industrial internship, more of industrial tours, so that, before a person, after getting the degree; goes to the job, he is aware of the general domain of that industry or of that organization."* AN [Extract 38]

The higher education sector reforms initiated in 2002 re-invigorated those in vogue and new measures for promoting academia-industry linkages.

One of the respondents stated,

> *"The multi-faceted reforms have created several functions of National Innovation System in the preceding years, (including) access, quality, relevance, efficiency, creation of the Office of Research Innovation and Commercialization (ORICs), Quality Enhancement Cells (QECs), conferences/journals (publications), ranking of journals, ranking of universities, etc."* AB [Extract 39]

The reforms in the higher education sector had raised expectations of the people in seeking useful applications of the university research to solve societal problems. A number of programs[54] were initiated by the Higher Education Commission, Pakistan to encourage universities and reward academics to undertake research relevant to the society or industry needs. Examples include programs like University-Industry Technology Support Program, Technology Development Fund, Social Integration Support Program, etc.

[54] (https://www.hec.gov.pk/english/services/Pages/RnD.aspx).m Accessed on 15 November 2018

A key initiative included setting up of the Office of Research Innovation and Commercialization (ORIC) in different universities with policy and financial support provided directly by the Higher Education Commission, Pakistan.

As succulently put in by one of the participants:

> *"The effort that has been created/done by HEC in terms of creating ORIC, that is a step in the right direction, because people have to know that knowledge is useless on its own, unless it is applied in some ways and there is a certain path that you have to traverse from knowledge to economy."* AD [Extract 40]

The Higher Education Commission, Pakistan is the custodian and a principal conduit of the government funding reaching universities including that for research. While maintaining sanctity of fundamental research, the primary responsibility of academia, it has crafted programs ranging from funding applied research to helping researchers' in securing knowledge appropriation through filing patent applications.

While referring to the research funding provided by the Higher Education Commission, Pakistan, one of the participants stated:

> *"We are splitting it into two different shares, one part will go to basic research, other part will be focusing on the interdisciplinary problem-oriented research and we will be encouraging that, because we have given new slogan to our academia that of course, 'impact factor is important, you need to publish in good journal'. But we have to shift from impact factor to impact."* AB [Extract 41]

The study of scientific and social issues ought to be rooted in the complex social world. The groups and individuals identify and lay down research agenda and develop project concepts proposals which are ~~for~~ interdisciplinary. They groups and individuals are the ones who are able to appreciate complex issues faced by the society.

b) Universities as Think Tanks

Other functions of universities include they acting as knowledge repositories and think tanks. Such function improves universities' linkages with government and/or industry. The role of academia as an intellectual resource pool in matters relating to public policy are an established norm in the developed world but remains weak in the developing countries. Lately though, recommendations for inculcating this function (in the HEIs) have started ~~to~~ getting echoed in Pakistan, as well. There are think~~s~~ tanks working both in the public and private sector. Historically, recommendations to this extent were presented to the Government time to time. One such example includes those contained in the 'Technology Based Vision and Strategy for Pakistan's Socio-economic Development" presented by Prof. Dr. Atta ur Rahman to the Federal Cabinet in 2007. It recommended, inter alia, that think tanks be set up with each government ministry to advise the secretaries (executive heads) on various aspects of policy formulation and administration. The said Report and its recommendations stand approved by the Cabinet (of Pakistan); they were however not pursued any further, due to reason that the political party in Office completed its term soon thereafter and the new incumbent (Government) did not pursue the recommendations any further. The expectations from higher education institutions in understanding and undertaking community and social services was there as early as late 1950s, when the National Commission on Education (1959) was brought out which advised that every university should develop a program of community service in those areas in which it is competent to operate on the basis of an intensive survey of the community and its needs.

The current fad of evidence-based policy formulation is also finding its ways in Pakistan's policy formulation circles. Academia is rightly expected to conduct rather help in disseminating and diffusing research into economic applications. Muzaffar (2015) reports[55] that the academia and politicians routinely attend the panel discussions on thematic areas sensing themselves the expectations of civil society. Furthermore, the gap between research and practice is a subject of public debate in Pakistan. Unfortunately left unfilled by the universities, it is being filled-in by think tanks operating as non-government organizations. The success models though available in the

[55] Published in 'The News' on September 6, 2015 accessed http://tns.thenews.com.pk/snapshot-of-education-pakistan/#.XG_xgugzbIU on January 14 2016

country are too few. One notable among them include the Institute of Educational Development at the Aga Khan University (Institute).

Muzaffar (2015) described that:

> "*The civil society organizations and think tanks are doing an admirable job in filling an important existing gap in education policy research work. Their work will be even more useful if they can find ways of broadening (the) existing educational research agenda. One way to take a start may be to invest in developing research questions that can potentially expand the existing conceptual and empirical fields to encompass some of the above, and more*".

Lately though, under the aegis of reforms in higher education sector, several corrective measures have started to take shape. Some of these include; placements of students in industry for internships, setting up of incubation centres and technology parks in universities, creation of angel funds as precursor to establishing venture funds, extending assistance in filing patents, and so forth. Such measures are being expected to promote application of knowledge.

However, it appears that Pakistan has to go a long way in building an adequate infrastructure, ensure a steady supply of quality human resource, broaden the scope and extent of academic and research programmes, build multiple and interdependent linkages between users and producers of knowledge, build a culture of research and innovation and link it to economic applications, etc. As stated by one of the participants,

> *"The dilemma has been, that even if some new technologies have been brought in / transferred at times, during the time when you know that, we have been always using and following some catch words from time to time. For instance, we had heard about low-cost housing, we went for low cost housing, but never was a low-cost housing. We went for, we heard the word of technology transfer, we tried to do that, but we had never utilised these technologies that were even transferred properly for our economic development".* AL [Extract 42]

The findings evinced in response to interview questions relating to Question No. 1 recognize two that first, the study is exploratory, and therefore helps in understanding the role of higher

education in the National Innovation System and concurrently exploring the evolution of Higher Education as a path dependent process in promoting knowledge and technology through interaction between actors and institutions. Second, the results brought out the contemporary salience of National Innovation System and its role in Higher Education.

The subsequent discussion would build upon realization of processes that signify the need for building the role of Higher Education in NIS. The state of linkages between academia and industry is not robust at the moment as opined by several of the research participants. The causes and consequences are seen respectively in the lack of industrial orientation of curriculum and the weak user producer linkages. Factors contributing to the alienation of academics' lack of industrial orientation range from reasons such as the criteria for career promotion not according any reward for industry experience (i.e. the alienation of performance appraisal mechanisms) to the lack of trust in industry interested in purchasing turnkey solutions and not willing to rely on indigenous research efforts. The fragmentation in the building blocks of innovation systems such as lack of access to capital venture capital ~~both~~ for start-up or technology upgrade (i.e. mezzanine funding) and weak enforcement of intellectual property regime, weak regulation, lack of enforcement of quality and standardization parameters and more importantly acute dearth of skilled university graduates and technically savvy workforce constitute the reasons.

This '*paradigm shift'* as highlighted in Extract 14 holds significance in that the knowledge flows help in building "knowledge-based economies" (Lundvall, 2007). Accordingly, it signifies the role of higher education in NIS.

It was in this vain that each successive policy formulation exercise took stock of the situation. Such iterative exercises, inter alia, identified gaps in the institutional infrastructure and expressly provided for establishing new institutions (e.g. Inter-University Board established in 1959, which was later re-constituted as University Grants Commission in 1970 and further revamped as Higher Education Commission, Pakistan in 2002; Food and Agriculture Council established in 1949, Pakistan Patents Office in 1949, Council of Scientific and Industrial Research in 1949, later renamed as Pakistan Council for Scientific and Industrial Research in 1953, Pakistan Standards Institute in 1951, it was given statutory status in 1961, Pakistan Academy of Sciences established in 1953,

Pakistan Medical Research Council in 1953; Atomic Energy Research Council in 1956 later renamed as Pakistan Atomic Energy Commission, National Commission on Science and Technology in 1959 later renamed as Pakistan Council for Science & Technology in 1972, Scientific and Technological Research Division in 1964 later renamed as Ministry of Science & Technology in 1972, and so forth). Incorporation of these institutions were result of legislation, where required.

The present theme sought to capture the concept of NIS and its wider application in the higher education systems in Pakistan from an evolutionary perspective. The setting up of higher education infrastructure in the independent state of Pakistan is examined more broadly and appeared mired under the influence of colonial imprints. The emerging subthemes have revealed the structure of and main actors involved in creating and strengthening the innovation processes at higher education institutions. The insights gained from this theme provided a lead to the innovation processes in an indigenous context. The following theme takes on a broader evaluation of the state of affairs in suggesting bench marking techniques and policy recommendations for a more systematic approach towards innovation.

7.2 Theme 2: Major Objectives of Higher Education Policies

A second theme related to the first research question of the project, in hand, is aimed at inquiring and exploring the objectives, or alternatively rephrasing, the 'key incentives' in the design of higher education policies in Pakistan. More specifically it is aimed at exploring policy direction, periodic changes and their implications for the NIS.

Therefore, the themes identified from the interviews delve on several aspects that have a bearing on the results of study, in hand.

The prominent sub-themes as they came out from the study findings include; defining aims and objectives, shaping national vision, setting targets, undoing myopic perceptions, allocating resources, leadership & political support, continuity and sustenance (of policies), relating actions to the context, support for catching up and so forth.

An overview of the theme is presented in Table 7.2:

Table 7.2: Major Objectives of Higher Education Policies

Themes	Subthemes
1. Contributions to NIS: Challenges and their Impact	*a) Lack of objectivity and clarity in Higher Education goals* *b) Divide between Academia and Industry* *c) Programmatic Imbalances in Academia and Industry* d) *Financial Restraints/Private Sector Participation*
2. Proliferation of 2002 Reforms	a) *Exercising Foresight: Expansion of Research and its Challenges* b) *Internationalization Broadens Horizon: Foreign Scholarships* c) *Multidisciplinary Perspective Created Opportunities*
3. Higher Education and Policy Making	*a) Shaping National Vision* *b) Lack of Vision to set Targets and Myopic Viewpoints* *c) Context-Specific Responses*
4. Devolution of Higher Education	
5. Conflict Resolution	
6. **Correcting Imbalances**	
7. Lack of Continuity	
8. Policy for Catching-Up	

Following sub-themes presented in Table 7.2 describe such developments in more detail:

7.2.1 Contributions to NIS: Challenges and their Impact

Past research on innovation policies brings out developing countries' motivation in undertaking analyses and making comparisons with the developed countries so as to understand and possibly lessen the gaps in innovation systems (Balzat & Hanusch, 2004). However, to do so requires a dis**c**iplined insight as to understand the intricacies of socio-economic and technological systems in vogue in the country whose actors and inter and intra-dependent linkages constitute innovations systems. In other words, the task includes appreciating the particular developmental stage of the national socio-economic systems that is reached in a country. Keeping this into account, following sub-themes emerged:

a. Lack of objectivity and clarity in Higher Education goals

As the previous theme described, the higher education policies crafted in the Post-Independence era were not successful in altering the status quo in the higher education sector (The Boston Group, 2001). These policies were a continuation of the colonial legacy, (in them) disconnected with ~~the~~ market needs and hence a reminiscent of the unenviable past (ibid). More precisely, the policies failed to clearly define the role of educated workforce in a sovereign and Independent State other than their looking after mundane functions (Bengali, K., 1999).

The policies lacked objectivity, as highlighted by one of the study participants in the following words:

> *"… break was not obvious for very many years after the Independence. Gradually, people obtained a partial break, but still they could not define the target well enough, not as good as their colonial rulers did. So, they were not quite sure that (why) we are creating this manpower; we are educating them but exactly for what purpose."* AD [Extract 43]

The literary bias and the alienation of curriculum from seeking knowledge applications continued to marginalize the higher education institutions from assuming any noteworthy status in the society (Commission on National Education, 1959 & The Boston Group, 2001).

In light of the promise of higher education (Grossman & Helpman, 1993) established worldwide, successive corps of (national) development economists[56] did favour creating a critical mass of qualified personnel. The accompanying rhetoric asked for their role in promoting economic development (Bengali, 1999), but as stated earlier, without clearly defining the role of educated workforce in a sovereign and Independent State. All economic dogmas called for physical expansion of higher education sector. Such an expansion in Pakistan's higher education sector was imminent so as to provide more, if not ample number of places (to the prospective students); to address the abysmally low participation rates at Independence and even until this date. Besides making up for the huge backlog, the expansion in the higher education system was (and is) needed to catch up with the increase in population.

Although there have been proliferation of policies and plans in Pakistan, there was a serious dearth of identified objectives of higher education policies so as to utilize knowledge as an economic resource. Considering the centrality of higher education in human and economic development, the World Bank (1992) noted that the expansion in higher education system in Pakistan made in light of locally or institutionally perceived needs, was without clear aims and objectives.

One of the respondents portrayed this state of affairs as follows:

> *"The higher education system in Pakistan has been very aimless. They should have set targets that we need; a certain number of engineers, doctors, scientists, chemists, physicists, and so on and so forth. ..... The entire decision making was in the hands of bureaucracy; politicians were ... and still are pretty vision less."* AM [Extract 44]

[56] Through the institution of 5-Year Development Plans

At the macro level; lack of objectivity was the result of not having 'education' policies which would relate to the context, available resources or even the market demand. Even less attention was accorded to the stream of 'higher education'. The consequences of indifference towards education and higher education segments owed to the planners' inability to understand and consequently respond to the needs the two tiers of education would be required to serve. The higher education institutions established for more part of the history of the country, could neither evolve a narrative or the raison d' etre of their existence nor could assume their due roles in promoting collaboration and systemic linkages with other HEIs, research councils, funding bodies, quality and standardization institutions or those protecting intellectual property rights. The lack of coordination, often times, resulted either in several institutions performing similar functions thereby resulting in duplication or at times trespassing into other institutions' domains, and so forth.

In order to regulate working of such institutions, improve governance and institute accountability, one respondent highlighted the significance of having an economic vision which would provide centrality to and a way forward for collating the work of all sectors of the economy including higher education:

> *"what is lacking in our country is an overall economic vision for the country. When you have and countries have economic vision, which is closely embedded with the social vision, development vision, social development vision … then you have all other parts of the visions like the industrial vision, the science and technology vision, the education vision – they are all dovetailed, they all should be dovetailed to the overall economic vision of the country."* AD [Extract 45]

Collating the work of different sectors of economy constitutes setting out complementary targets (for different sectors of the economy) and is a prerequisite for bringing in unity of purpose in the national planning process. The need of a well laid out and agreed upon plan then serves as a communication tool in bringing coherence among the stakeholders to the technological change process.

While referring to multiple education policies and development plans announced since Independence, Shami & Hussain (2006) term them as rhetoric laden and full of verbose. A zealous historian may be able to trace gradual evolution, not much change has though come about in the way HEIs relate themselves to fulfilling the societal needs or to cast an impression on the life of a common man (ibid). These policies tended to remain purposeless as against those practiced by the colonial masters.

Besides lack of objectivity and vision to draw policies crafting a role for higher education, the higher education institutions, at large, could not provide enough number of places commensurate with the needs of a growing population.

b. Divide between Academia and Industry

Based on research about the role of knowledge in economic development (Solow, 1957, Dosi, 1996), the creation and flow of new knowledge has traditionally been accorded high status, and in turn it attracts policy attention and funding (Bercovitz, & Feldman, 2006). The deployment and re-deployment of the stock of knowledge is important for economic development. Since technical change and innovation drive the capitalist economy, creative imitation is a central process in economic development (Florida, & Cohen, 1999). The teaching of science and deployment of such workforce in various functional areas thus constitute more significant source of technical change and innovation than *per se* the generation of new knowledge and inventions. The role of universities in dissemination of knowledge and as providers of trained workforce is thus important, besides that they are creators of new knowledge. It is imperative to note that in such pursuit, capitalist economic development is influenced by the amount of national investment in higher education (Andersson & Karlsson, 2007). For a developing country like Pakistan, where creation of new knowledge has not yet taken shape, the higher education institutions, as providers of technically qualified workforce, (still) have the propensity to serve as engines of socio-economic development.

Relatively more focus of the HEIs on 'teaching' had a downside in that they lost policy attention and consequently funding. In turn, the HEIs did not remain vibrant and competitive entities. In the absence of indigenous research, the industry too did not develop appetite for new

knowledge and instead tended to rely more on the established set of knowledge. It though run the risk for them in terms of losing competitiveness. This appears implied in the following words as stated by one of the respondents:

> *"To my knowledge, in Pakistan… the exporters of conventional materials like textiles, leather and other things; they are totally content with what they have been producing. They don't feel the challenge that exists in the competitive markets of the world, where there are WTO limitations, where people are coming out with better designs and better materials. They think that their production lines are tailored for producing a certain product and in a certain magnitude. So, what I am trying to say is that there is no ambition to compete internationally."* AD [Extract 46]

The lack of research funding in the HEIs on the supply side had implications on the demand side as well. An example comes from the university human resource policy itself, where the performance and promotion of the university faculty was not adjudged on the basis of their research productivity/profile. In turn, this created alienation among the university faculty in taking up academic research and hence impliedly nurtured inability to appreciate and understand issues faced by the local industry and the economy. The widening gulf between academia and industry further nurtured mistrust due to inability of academic research in solving industry of society's problems, thereby further alienating the two (university and industry). The industry lacked faith in the capability of university research. The university faculty itself lacked confidence to be able to make contribution to the issues faced by industry and so forth. Overtime, the alienation between the two, turned 'university' into 'ivory tower' completely devoid of the community and society around it, further exacerbating the role higher education could play in the NIS.

The mistrust between university and industry had a reflection on the universities' ability in keeping the academic programs or the skills building among students in sync with industry needs; it rather resulted in developing different ethos or the mental models at the two sets of institutions:

"Universities do not produce what we require and this person from the Higher Education Commission told him that what you require is what your mandate is, what your production line, things like that and all skills that are specific to that;, we cannot teach them (all, the industry needs)." AD [Extract 47]

The divide between academia and industry manifested in nurturing more imbalances; few of them are highlighted in the ensuing discussion.

c. Programmatic Imbalances in Academia and Industry

The demands of a growing and robust economy necessitate curriculum that meets the industry's expectations in terms of seeking graduates having employability skills (Bercovitz & Feldman, 2006). To meet such demands a few programs were initially supported by the HEC. A specific example includes promotion of engineering especially the Telecommunication Engineering education in the country. However, the glut in production and not their quality being up to the industry's expectations resulted in its (industry's) disappointment as described by the following participant:

"it's the sector, that's pretty much running on its own. It is driven much more by market forces than by some planned long-term policy." AJ [Extract 48]

Having realized the glut in supply and the deteriorating education standards, the HEC furthered its efforts through revising Telecommunication Engineering (and several other) programs' curriculum so as to bring in the industry's perspective.

Periodic iterations of the curriculum would tend to help in improving the skills base and employability prospects of graduates, as highlighted by following participant.

"We have tried to address it by modifying the curricula in consultation with (the) industry." AC [Extract 49]

However, excessive supply and that too ill equipped viz a viz. demand did not improve employability prospects of the graduates, as illustrated by a study participant:

> *"And only touching on some conventional subjects having no co-relationship with what we talk today – the science, technology, technological breakthrough, creativeness, and innovation".* AG [Extract 50]

The above steers towards the role of private sector in addressing certain issues e.g. in having better demand orientation and availability of resource, etc.

d. Financial Restraints/Private Sector Participation

The extremely backward state of higher education with low financial allocations had a casting shadow on the successive phases of (higher education) sector development. Higher education got a share to the tune of 9-13% in the otherwise abysmally low allocation for 'education' that historically remained around 2% of the GDP[57]. In part, the inter-tier allocation of resources for higher education appeared to be driven in practice from placing low value on higher education.

The conditions for higher education were further worsened by too thinly distributing the scarce resources that are often provided intermittently and inconsistently.

> *"Last couple of years, we were in a difficult time – a kind of bumpy road due to political reasons, due to uncertainty in financial cash flow, and country due to so many crisis this country was facing like terrorism, like earthquakes, like flooding ... we had bad patches during ... those years, not consistent support coming from GoP, uncertainty in the financial resources and not timely getting releases; so kind of development slowed down".* AB [Extract 51]

[57] UNESCO prescribes the standard as 25% for higher education in the total allocation for education (Ref. Trends in Government Expenditure for Public Education, 2011-2013, Background paper prepared for the Education for All Global Monitoring Report, Development Finance International, UNESCO, 2015, ED/EFA/MRT/2015/PI/45; www.unesco.org/images/0023/002345/2324476E.pdf accessed in Apr. 2017

Furthermore, the neo-liberal shift in the middle of 1980s, in the higher education sector, partly addressed the erstwhile failure to capture significant financing from the private sources. The induction of private sector in higher education partly eased the severe constraints on the quantity and quality of educational inputs available to each tier of education including higher education in the country. The induction of private sector in higher education, in part, undid public monopoly thereby improving access, if not equity. The equity was still primarily being addressed by the public-sector universities network, albeit not exhaustively. The equity issues were later addressed through offering need-based scholarships instituted by the Higher Education Commission, Pakistan. Such programs were initially funded by the International donors (e.g. the Government(s) of France, Japan, US, UK and so forth) and then (supplemented) by the Government of Pakistan itself. The universities have instituted similar programs on their own seeking scholarship contributions from the corporate / business sector, civil society organizations and through contribution by the staff and faculty of universities themselves.

The public-sector banks are mandated to institute Qarze Hasna[58] (interest free loan) schemes for students who would not have the ability to pay the tuition fees.

> *"Pakistan was still allocating around 2% of its GDP for education and normally one third of that should go to the higher education; but that was not the case even in the Musharraf era."* AM [Extract 52]

One of the relatively fundamental differences in the work ethos of public and private sector is that the latter is cost and profit sensitive while the former has its own criteria of accomplishment. The not- and for-profit divide reflects upon ethos of the public and private sector HEIs. The moot point to understand is that while maintaining different ethos, the public and private sector HEIs can complement each other. The private sector may assume and discharge roles where it would earn commercial returns while the public sector would tend to focus more on social or societal return i.e. it would cater to that segment of market where commercial returns are not healthy or have not picked up well as yet.

[58] A interest free loan to be repaid over an extended period of time after the student graduates and is employed

"Pakistani universities in the private sector barring few, only few, the rest are not giving that quality of education and not the type of education that will prepare the skilled workforce for entering into the productive work or promoting the overall national productivity of Pakistan, which is actually the call of the day." AG [Extract 53]

There was and so remains to this date dearth of qualified human resource capable enough of handling the complexity of issues and the enormity of challenge facing the country. A possible way forward was to learn from those which have trodden the developmental path before Pakistan.

Realizing that,

"Whatever little has been done so far ...has been half-hearted, haphazard and ineffective. We have now available to us through the United Nations Educational, Scientific and Cultural Organization a common pool of experience and expert advice and I trust that our participation in the activities of this Organization for whose membership we are applying will provide the requisite stimulus to our drive for the abolition of illiteracy and ignorance" (Fazul ur Rahman, 1947).

Although the resources and the control over them reached the hands of the locals, yet the vicious cycle could never break from the impasse. As late as 2009, the National Education Policy (2009, p. 55) admits that,

"Low allocation of per capita expenditure on students in the higher education sector along with provision of adequate resources to provide infrastructure including libraries, laboratories, scientific equipment, teaching aids, and high-speed internet connection remains a challenge facing the sector especially for the rapidly evolving scientific fields".

7.2.2 Proliferation of 2002 Reforms

The slumber and indifference towards academia and research continued for some 52 years after Independence until reforms were introduced in the higher education sector in the country in Year 2002 (Osama et al. 2009). These reforms were related to changes in curricula, brought heavy investment in universities' infrastructure such as research funding, and in enhancement of university faculty qualifications, revision of faculty remuneration packages, assistance in securing intellectual property protection, mentoring for business startup and technology venture commercialization and so forth. Higher Education Commission (HEC) was established as an independent and autonomous entity in Year 2002. The Prime Minister being the chief executive of the country is its controlling authority and its policies are guided by policymaking board/commission represented by senior national academics, academic planners and administrators.

These reforms have been hailed as post-foundationalist in tending to restore the purpose of higher education as an agent of change, wealth creation, and social emancipation. Therefore, these reforms serve as a critical factor in unleashing new roles for higher education hitherto fore unknown before and in equipping corps of educated young men and women in assuming such roles. The inculcation of new roles of higher education has helped build systemic relations among different societal institutions. This era appears a harbinger of a clearer and holistic vision of the role of HEIs in instituting an economic transformation at the national level.

For example, the Planning Commission, Government of Pakistan has instructed the HEC (MTDF, 2005-10) to work with HEIs and prioritize research areas addressing the national needs in different sectors and called for recommendations for national research efforts. One of the respondents stated it as follows:

> *"The Planning Commission has already instructed us that we need to work together, for priority research – we need to work together, that we should address the need of Pakistan as far as the S&T is concerned*." AB [Extract 54]

These Post 2002 reforms are hailed as forerunner to the social re-awakening of the role and importance of higher education. These reforms in turn steered political processes to accord importance and lay hands on this new-found constituency viz. higher education.

Consequently, the changed mental models of the political strata have expedited the pace of reforms in the higher education sector, as one of the participants elaborated it as follows:

> *"Policy changes take place when the leadership at the highest level has a vision and targets in mind, which fulfill that vision."* AM [Extract 55]

The reforms brought changes in three main areas including; broadening horizons of research, instituting scholarships for studies abroad, and bringing multidisciplinary perspective into higher education as described in the following sub themes.

a. *Exercising Foresight: Expansion of Research and its Challenges*

The university research in Pakistan was and is still at a nascent stage. With reforms brought out in the higher education sector in the country, the aspirations of society and those of the national planners are mounting at rather fast pace. While the quality research is getting published in impact factor journals, people have started to expect such research yield social and economic payoff. The enunciation of tenure track scales providing social and pecuniary elation appears paying off as there has been manifold increase in research publications. The year on year increase (i.e. from 2017 to 2018) of research publications in Pakistan (15.8%) has even outpaced countries like China (15%) and India (over 8%)[59]. In order to see the commercial exploitation of research, one understands that there is time lag between research and its applications. The inculcation of the newer role of the HEIs needs an understanding of the knowledge transfer process from laboratory/publication to the economic mainstream. Putting it differently, understanding of the newer role of knowledge application is beginning to happen and too many expectations or its comparison with the developed countries may be counterproductive. Careful planning should precede the introduction of required

[59] www.nature.com: Accessed on Dec. 26, 2018

legislative measures, administrative rules, regulatory measures, etc. i.e. the enforcement of new regulations/standards should follow a carefully worked out action program rather than abrupt reforms in which the actors did not find enough time to understand and adjust to the new requirements. The process would thus be a directed evolution, and not revolution.

> *"We are at the takeoff stage; my only worry is that if we rush too much at the moment on impact rather than the impact factor, we will crash. We will have to go a little bit slowly, may be one year two years down the road, things will definitely come towards the economic activity."* AH [Extract 56]

This extract is noteworthy from the standpoint of understanding the need to keep pace of the reforms, in line with society's aspirations, in sync with the actors and institutions' ability to conform to change process.

b. Internationalization Broadens Horizon: Foreign Scholarships

Another way to expand the national commitment to building innovation systems is through working with foreign higher education institutions. Under the 2002 reforms, various opportunities to this extent were offered by the Higher Education Commission, Pakistan. These include, instituting programs for studying abroad through scholarships. The opportunities offered to the youth to study in the developed countries provided them orientation of education system that appreciates free thinking and inquiry. The ingenuity in using knowledge thus inculcates a quest for using knowledge, rather swallowing lumps of knowledge and for no gainful purpose. The pursuit of critical inquiry opens up opportunities hitherto unknown i.e. it translates either into an 'invention' or an 'innovation'. One of the respondents while explaining his experience of studying abroad compared the curriculum taught at the universities in Pakistan and abroad in following way:

> *"…the Atomic Physics is not what is written in the books, the classical books published in 60's; but, Physics has moved on."* AD [Extract 57]

Withstanding the shortcoming in updating curriculum, the advent of Information Technology has made it possible in bringing up huge learning resources and making them available

to students; these include MOOCs (examples include; MIT Open Course Ware, Udacity, Coursera and the Khan Academy, Virtual University Pakistan, etc.). The virtual learning programmes have tended to remove the geographic and spatial barriers, thereby bringing 'internationalization' in curriculum and access to the latest academic and research resources. One of the respondents while underscoring the importance of 'MOOCs' stated as follows:

> *"Last month, we have launched a huge website which contains hundreds of thousands of lectures and courses through the amalgamation and integration of MIT Open Course Ware, Udacity, Coursera and the Khan Academy courses as well as the Virtual University courses integrated website which offers school, college and university level courses in all major disciplines and it is easily accessible and the website address that is lej4learning.com.pk*". AB [Extract 58]

c. Multidisciplinary Perspective Created Opportunities

The user-producer linkages are considered the central tenet of the National Innovation System as they are at the heart of diffusion of knowledge (Edquist, 1997). Multi-disciplinarity broadens horizons and nurtures plurality of perspectives hence opening vistas for conceiving and exploiting newer combinations of knowledge (Etzkowitz & Leydesdorff, 2000). Any occasion, where the academia works with industry opens up opportunities in increasing such prospects.

Thus multidisciplinary perspectives create opportunities as highlighted by one study participant whilst giving example of National College of Arts (NCA) as:

> *"We have National College of Arts (NCA). We should link NCA students and the engineering students, for example for that matter. The Arts students, they can all go and design things and they have to move, you know in the value chain. What we need to do is look at the value chain in each industry."* AE [Extract 59]

A review of the official annals of higher education policies transpire that similar realization was there as early as three months after the creation of Pakistan, when Fazl ur Rahman (1947, p. 10) informed the audience at the Education Conference held in Nov-Dec. 1947 that,

"….*The Government of Pakistan had plans to appoint a high powered Commission which would undertake survey of the existing resources of Government (Research) Institutions, universities and private industry and suggest a coordinated plan for the consolidation and development of facilities for scientific research in Pakistan*".

The above highlights significance of the national policies in providing direction and in mustering coordination for building linkages between producers and users of research, in line with the tenets of 'innovation system' studies. The following sub-theme describes the effectiveness of the policy direction in instituting sustainability needed for success of the reforms process.

7.2.3 Higher Education and Policy Making

The enunciation of Year 2002 reforms in the higher education sector in the country and their buy-in by the society strengthened the resolve of the policy makers in their ability in bringing about change (Osama, Najam, Kassim-Lakha, Gilani, & King, 2009). The role of Planning Commission was important in providing a common ground for assimilation of multi-stakeholder interests and building systemic linkages among different socio-economic sectors. The Higher Education Commission (HEC) was entrusted role in its namesake discipline. The convergence of national interests was possible in having a representative body, which was HEC (i.e. the Commission comprising of multiple stakeholders) itself. Such representative body was to provide for, among others, institutional and administrative harmony within the sector and with respect to its relationship with other sectors having a bearing on socio-economic development of the country.

In order to set-forth objectives, crafting and periodic re-visitation is needed. However, since policy making is a continuing process, it's experiential and results in learning; as such it is evolutionary in character. A process sustained over time is ~~was~~ required where policies are devised, implemented, lessons learnt, and changes are made in those policies. Therefore, instead of sticking to serving interests of one or a select group, policy formulation becomes an iterative process, more so in a democratic dispensation, one which would accommodate interests of diverse groups.

As one of study respondents referred to this iterative process in the following way:

> *"Policy making isn't a onetime process, it's an experimentation process. Policies have to be learnt through experiments, and therefore, you have to keep on experimenting them. A policy may fail, but then you learn from it and you sort of come out with a new policy or you change the direction of the policy".* AE [Extract 60]

This implies that policy making is an iterative process, policy may fail, but then one learns from it. As they say, good decisions require experience, but experience comes from bad decisions. The subsequent theme talks about the possible policy formulation as I sought to examine how these policies can be implemented and converged into opportunities for instituting innovation processes.

a. Shaping National Vision

As elaborated previously in the literature review section the triple helix model of innovation refers to a set of interactions between academia, industry and governments, to foster economic and social development (Leydesdorff, 2010). This focuses on the role of university towards industry and local government. In case of Pakistan, Planning Commission is the framer and custodian, as well as pursues national vision of industrial and socio-economic development of the country (Economic Survey, 2012-13, p. 129). However, after 18th Amendment, a development framework was required to integrate initiatives taken by the Federal as well as provincial governments, first to set-out and then achieve to the targets (Economic Survey, 2013-14, p. 150). A national economic vision tends to collate sectoral priorities (Industry, Commerce, Energy, Communications, Education, Health, and so forth), set targets and bring-in coherence in thinking (of all those who are related and relevant), thereby helping in building synergy among all. The setting out of strategic plans/perspective through consensus building among stakeholders to the national planning and resource(s) allocation, on the one hand brings in coherence in thinking, helps in undoing internal conflicts, curbing narrow or short-term (read short-sighted) interests, it simultaneously helps in building an egalitarian approach towards issues. A national economic vision reflective of different sectoral visions would be one which would be democratic and serves diverse interests, as also highlighted by the following participant:

"Govt. need, like now, recently the Govt. is working on Vision 2025 – that might be a good platform where all the sectors are merging and then Planning Commission will determine and prepare a document where they will give, it is a 'Pull', now after this will be 'Push' strategy that the institution will work in the manner prescribed in the direction which is given in that document so that everybody should emerge somewhere in some places." AB [Extract 61]

The unity of purpose as signified in the above extract is a sine qua non for bringing all stakeholders together. This need doing away internal conflicts and developing an egalitarian approach to the socio-economic issues. A national or a (sub-) regional economic vision dovetails all other national (or sub-regional) visions like social vision, development vision, industrial vision, science and technology vision and so forth. Conforming to different and diverse interests, sets targets for the participating albeit diverse interest groups and for different time horizons. Pursuing the national vision collectively brings in coherence and synergy that allows in realizing the national, regional or sub-regional economic vision.

b. Lack of Vision to set Targets and Myopic Viewpoints

The past research (Alcorta & Peres, 1998) and research participants' responses refer to the policies as an instrument in setting out 'vision'. The 'vision' in turn becomes the decisive framework for laying down the foundations of higher education in the country's NIS. However, there remained lack of direction and appreciation on part of the policies of higher education to play a role in the knowledge economy. The higher education institutions in the country were not quite sure about their role and a clear sense of purpose of the manpower they were producing. The far too passionate planning policies for distant future did not let the national research efforts focus on contemporary and compelling issues. One of the respondents' points towards this lack of clarity in government policies in the following way:

"They [Government] should set targets for every key sector of the economy and work towards them. …they have to set targets and try to achieve those targets. And these

targets should be demanding, and everybody should be geared to meet those targets. There is to be constant screening of performance." AC [Extract 62]

The last sentence of Extract 62 points to the need for having accountability in the policy setting process itself. The research participant further states:

"So, this accountability is missing in the government. So that's a key. You have to have a very close scrutiny of how each Ministry is performing and how things are improving or not improving and keep on changing people unless you get better people." AC [Extract 63]

This above refers to the need for looking at the capacity issues of policy planners in designing and implementing policies by assigning the task to people having the requisite capability iteratively unless there are (higher education) polices which are more effective than before. In the absence of having a clearer vision and lack of performance criteria, decisions are prone to be driven by whims rather than scientific criteria. The parameters for decision making include those which create long term socio-economic effects e.g., creation of an organization, appointment of key personnel, approving the business plan of an entity or assigning resources to allow the institutions discharge their intended functions, etc. At times, the ill- to half-baked decisions arrived in manner, referred above, are trumpeted in the name of serving public interest. The short-term planning horizons, at times, relate to the political expediency and the desire to win over next public elections, resonate political expediency and as such override any scientific criteria of arriving at such decisions. Decisions taken in such manner not only block emergence of a national vision but also allow myopic considerations to prevail as against merit. Such decisions are neither understood nor owned by the concerned and consequently do not sustain as raised by study participant in following way:

"we ourselves unfortunately entangled in external debt, loads (sic) of external debt ... in the poverty and in the basic issues, there as so many competing priorities for Pakistan, ... and for political government ... this is ... to re-win the election and

therefore, they would want to go and spend money in short term gains rather than long terms gains, ...which are sustainable ... such as investment in education." AL [Extract 64]

At times, political policies do not get translated into action due to bureaucratic hurdles. The denial or excessive delays caused in implementing decisions of political authorities are mainly due to delay in fulfilling procedural requirements, combat internal polarization or the winning over the ideological differences. Moreover, the societal trait of 'mutual negation' does not let one regime continue with the policies and programs initiated by the previous government. Result is abandonment of policies and programs halfway through to start new ones with insignificant prospects left for getting pay off from the earlier investment. Programs started in such manner serve political considerations, often to get kickbacks, or simply to accommodate few cronies by placing them in lucrative assignments. The following sub-theme describes, how the context drives the decisions.

c. Context-Specific Responses

Over the years, major concerns for policy makers in Pakistan included building both physical and social infrastructure to battling terrorism, wars with India (1948, 1965, 1971, 1999, spate of continuous border clashes along the Line of Control), the Afghan war – the later besides having economic consequences had its social fallout in the influx of some 3 Million Afghan refugees and on occasions warranted internal displacement of sizable number of local population, natural disasters (floods, earthquakes, etc.), and so forth. The geo-strategic location of Pakistan and its relations with nuclear archrival India left little choice to divert resources away from attending the national security concerns. These concerns necessitated investments in building nuclear capability. As such, first developing and then adhering to a long-term developmental vision was bound enormous challenge. One of the participants stated:

"...India spends the largest amount of money on buying arms... it was not so much a matter of choice than a matter of necessity". AF [Extract 65]

Notwithstanding above, the democratic process, if continues, does discipline the political parties to adhere to their respective election manifestos, as they have to go back to the people for getting re-elected. Unfortunately, though, there had been interruptions on this count as well through military takeovers which have governed the country for almost one half of the time since Independence.

One respondent brought an insightful observation highlighting the systemic nature of the intertwined relations between the institutions and the context in which they function as follows:

> "*all these definitions even, these come up and these are based on the level of the development of those countries. If it was ten, twenty years before, might be the definition would not have emerged to that level or understanding. The dilemma with, we people in our developing countries, that we are following a path of development in S&T and other fields per almost or at the same level, where the developed countries have reached and what we see there or what we listen from them."* AL [Extract 66]

Etzkowitz (2007) argues that innovation can no longer be assumed to take a linear path, whether from research through development or from identification of market opportunities. Innovation, in this sense is more of a social and organizational evolutionary consequence, rather strictly being technological. Interestingly (Sawyer, 2002) while discussing in the context of African universities also states that innovation policy cannot be a top-down initiative of only government but should be seen as the cumulative result of interaction among government at various levels, businesses, academics, and non-governmental organizations. It is necessary to better understand these innovation processes and to identify and encourage improvements in the way they work. On a similar note, one of the research participants highlighted the significance of the current level of development in the country, and for devising achievable rather than unattainable goals, as:

> "*we developing counties like Pakistan, borrowed expertise / consultancies from developed countries and they came to help us, but then advised us only at their level of*

development, which we could not conceive, which we could not absorb, which we cannot take further again." AL [Extract 67]

A recent example in the country is the proposal for setting-up Science and Technology Parks by the Government of Pakistan. This initiative though aimed at improving academia-industry cooperation and thus providing a missing link between the two entities is under debate; as the very premise of such entities warrant availability of commercializable research, which is still weak in Pakistan.

7.2.4 Devolution of Higher Education

From the previous theme it is clear that since 1973 education in Pakistan was on the concurrent list of the Constitution. This means that both the federal and the provincial legislatures could legislate in matters relating to 'Education'. However, the Constitution allowed visitation of the concurrent list in 10 years' time when it was initially promulgated i.e. by 1983. This could however not take place due to imposition of the military rule in the country in 1977. Military rule continued from 1977-1985 and then from 2001-2008; in between there were successive and quick change over of various elected dispensations; hence the visitation of the concurrent list, remained on hold. After return to democracy in 2008, the 18th amendment (to the Constitution) was promulgated in 2012. Pursuant to this act of legislation, *inter alia*, the subject of 'Education' was devolved to the provinces. As such the 18th Amendment (to the Constitution) has altered the role of the federal and the provincial legislature in framing laws in matter relating to 'Education'. In order to assume role mandated by the said constitutional provision, the provinces, inter alia, have started taking steps to establish entities for overseeing 'Higher Education' in their respective jurisdiction. This was referred by one of the research study participants as:

"There is a concept and a talk going on of devolution to the provinces. Now, what that implies practically is that all the provinces have to internalise the same mindset and polices that were laid down centrally previously; and it is a hard task to say that this will happen". AJ [Extract 68]

As is evident from the above extract, a lot of skepticism prevails, first as to the wisdom and then efficacy of this decision, given the fact that provinces have, without exception, ruined the school and college education, on which they were (already) exercising control. It is feared that all the provinces would be able to evolve and conform a common vision for the role and functions of education including higher education. Given the proliferation and a lack of sense of collegiality and more importantly the different state of development in each of the four provinces, skeptics do not think it would happen any time soon. Expected result is further ruining of the higher education under provinces' control.

> "*now the parliament has taken post-18th amendment, provisional HECs; and I think, Punjab has almost decided to create HEC, then Sindh has already created, KPK has already created, Balochistan is the only one, not created yet. I think, probably, that is written on the wall, with that is going to happen; I think, in that case, there will be only a limited role of the Center. I wish, HEC could have continued another 10 years probably the way it was and properly funded, and that mechanism could have matured.*" AN [Extract 69]

In view of the above, a strong sentiment prevails against the devolution of higher education under auspices of the 18thAmendment. A resounding statement by the following participants says:

> "*The government issued a formal notification, breaking up the HEC into pieces. I then went to the Supreme Court of Pakistan."* AC [Extract 70]

While there is not much dispute on lower tiers of education (as said earlier, they were primarily been administered by the provinces even before the said (18th) Amendment, confusion however shrouds as to the fate of HE. The federal entities and even the provinces are questioning the constitutional amendment, for one in the name of not having capacity in the provinces to steer higher education and secondly (and self-consciously) for the reason that the resources being spent by the federal government would have to be contributed by the provinces from their respective share as agreed by the Council of Common Interests and not over and above it, as was the case, that

Federal Government was doing so from its share of the (common divisible) poll (of funds) prior to the 18th Amendment.

A relatively sane critique comes from those who advocate for doubts in provinces agreeing and pursuing national 'standards' in higher education all across the country. The critics expect that devolution would result in proliferation of standards among provinces. For this reason, they favour that the control both administrative and financial, should (continue to) vest with the Federal Government. In order to do away with such proliferation in standards among provinces in the Post 18thAmendment scenario, the federal government has plans for establishing a 'National Curriculum Commission' (Annual Plan 2014-15, Ministry of Planning, Development & Reforms, Government of Pakistan)

> "*Unfortunately, after the eighteenth amendment, that institution (referring to the Higher Education Commission) is under attack from all provinces and its authority and its programs, its direction are all being attacked from all sides*." AQ [Extract 71]

However, the proponents of the devolution process believe that there is need for better coordination at the federal level for policy making and its implementation across the country. They expect that the capacity at the provincial level would develop overtime and the provinces will be able to look after higher education much better as they would be able to better relate it to their needs.

7.2.5 Conflict Resolution

Besides regulation, which is a statutory function, alignment of mental models can be realized through deploying a combination of informal institution (building and promoting trust, rule and respect of law, and so forth) and by disciplining communities/society through enforcing policy and administrative measures. Main aim is thus to lessen the cognitive distance among individuals in a society, so as to develop centrality of objectives towards realizing a common goal (Nooteboom, 2006). However, Radej (2006) argues that policy evaluation approach is not appropriate in the

context of social complexity. He (ibid) argues that wheile positive and neutral impacts can also be problematic; a negative impact may (equally) be acceptable. He explains that prevalence of positive impacts does not suggest *per se* that the proposed policy is adequate, it rather highlights that the policy was d negotiated and accepted by the stakeholders while it was formulated.

Owing to the colonial imprints, the process of policy formulation in Pakistan is taken up in a manner as to avoid trespassing in (any) other entity's domain. Metcalfe (1994) terms it as 'negative coordination' where conflict is avoided and not that interactivity and inter-dependence is promoted. As a result, there is plethora of examples implying consensus, they rather are cases of 'turf guarding'. A study participant also commented on the overwhelming efforts to avoid conflict between the sectoral policies rather than creating synergy, interaction and inter-dependence among different sectoral policies:

> *"While scanning through these policies, we saw the internal conflicts, but ultimately, we decided that what we write in S&T Policy should not have anything that conflicts with a policy that has been approved by the government."* AD [Extract 72]

In terms of policy, coordination among policies is a huge challenge and a potent source of conflicts.

Another important source of conflicts, affecting coordination and interaction, relates to internal polarization in organization(s). Such conflicts did appear in Pakistan as well. These conflicts originated and were nurtured over the years owing to injustice(s), non-transparency in decision-making; due to political, religious, linguistic, ethnic, etc. divides; those on account of social and economic disparities among regions and/or social classes or even those having origin in the ego-centric behaviour of individuals or (those) on account of personal likes and dislikes.

Withstanding above, internal conflicts in higher education and supervisory organizations did influence commonality of objectives and over-arching vision crafted for the sector. One such

occasion[60] happened in 2012; when the tenure of the then Executive Director ~ ED (the executive head of the Higher Education Commission, Pakistan) was completed the entity itself was inclined to award him another term. However owing to the reason that the incumbent had already completed two terms and as a matter of convention, grant of 3rd term was not a norm, the Establishment Division, Government of Pakistan was not in such favour. However, there was a polarization in the organization with two groups taking up adversarial positions. The conflict was highlighted through extensive media coverage and invited public interest. A reference to it follows[61]:

> *'In a notice sent to the Establishment Division, Dr. Laghari maintained that the Division does not have the jurisdiction to appoint an ED as under Section-11 (1) of the HEC Act, only the Commission reserves that right.'* (Source: Daily Dawn, *Dec 13, 2012)*

The split divided and undermined HEC's reputation as well as brought the officialdom to a grinding halt for nearly a year. The situation only calmed down with replacing the incumbent with a successor by giving him acting charge until a new appointment was made. Commenting upon it, one of the respondents stated:

> **"***but I feel a bit disappointed because of the government interference within the HEC, there is a huge political problem within the Higher Education Commission amongst the people who are employed there; there are two major groups, who are always constantly fighting each other and an organization cannot succeed, unless there is cohesion within the organization*." AC [Extract 73]

Even though battling with its own internal polarization issues, the HEC has played a major role in implementing a reforms package. This is commented by one of the respondents as:

[60] Removal of HEC Executive Director Violation of SC's order: Rahman (2012), The Express Tribune, Pakistan, Dec. 5 & Removal of Executive Director Challenged (2012), The Daily Dawn, Karachi, Pakistan, Dec. 11.
[61] https://www.dawn.com/news/771123/hec-staff-forces-out-reinstated-officer-2: Accessed on 18 November, 2016

"*So HEC has worked very well during 2002 - 2008 and the credit of this goes to the whole team of people who are involved which included Dr. Akram Sheikh and Dr. Sohail Naqvi who were the Executive Directors of HEC during my time and the whole team of people and there were so internal troubles when I was there."* AC [Extract 74]

As referred earlier, the devolution of higher education under auspices of the 18th Amendment itself is creating polarization among the Federal HEC and the provincial governments in holding on/taking over reins of the higher education sector. The matter though is not new per se, as it has echoed in the past as well. Fazl ur Rahman stated as back as Year 1947, i.e. the Year of Independence of the country, in the following words;

"we have been far too prone in the past to think in terms of Bengalis, Punjabis, Sindhis and Pathans and it is to be deeply regretted that our education has failed to extirpate this narrow and pernicious outlook of provincial exclusiveness which, should it persist, will spell disaster for our new born State"

Such conflicts do not let the unity of purpose prevail and each respective interest group tends to protect purportedly their position. At times, such conflicts are promoted by the vested interests to realize their designs. When the democratic norms become weaker, the external influence seems to garner control and vested interest take over the commonality of though. Schein (1985) states that organizational culture incorporates fundamental views that institute relations between the firm and its environment, nature of relations among people (whether collaborative or rivalrous), attitude towards risk, etc. Such organization culture informs the content and process of strategy, give meaning to the organisational structure i.e. builds organisation ethos, and delineate styles of consensus building and decision making.

In terms of conflicts, disagreements can be productive. As stated by Sankey (1995), disagreeing questions arguments for their validity before such arguments/positions are accepted. The prospects of a consensus evolved after such deliberations is more likely to sustain and adhered to in future.

7.2.6 Correcting Imbalances

For Pakistan a number of imbalances existed distorting prospects for generation, dissemination and utilization of (new) knowledge. One major imbalance as discussed previously in terms of inherited challenges for Pakistan included a colonial legacy. United India had been a British colony (de fecto and de jure) for nearly 90 years. The access to higher education, under the Imperialist rule, was confined to the privileged few and that too with the intent and purpose of serving the interests of Imperial masters. Accordingly, the higher education system in United India was generally hailed as 'elitist'. Häyrinen-Alestalo (1999) describes an elitist university as being loyal to the state by concentrating on the reformist expansion of the education system. The 'elitist' character of higher education i.e. access to only few served interests of Imperial master in providing them 'interlocutors' to liaise between them and the local population. This was endorsed by one of the respondents in the following words:

> "*higher education institutions produced human resources merely to run the colonial system*" AK [Extract 75]

while another respondent stated that:

> *"(the) higher education (sector) … (had) been confined to the privileged few"* AC [Extract 76]

As against the need for having sufficient number of qualified personnel to run affairs of as large an economy as United India, the 'elitist' character of higher education produced too few knowledge workers and that too educated and trained to run the mundane secretarial function in the British Raj than to act independently and able to take decisions by themselves.

However, a review of the official annals show that the policy planners were aware of the challenge right in the earliest years after creation of Pakistan and intended to explore prospects of creating new resources and (were) not marred by the zero-sum allocation of funds, having compelling albeit competing demands on them. Fazl ur Rahman (1947, p.9) stated:

"Whether the financial resources of Pakistan can permit the undertaking of so vast an enterprise is a matter which needs to be gone into carefully, but it is vitally important that we must devise means to overcome within the shortest possible period of time whatever obstacles stand in our way".

The character of higher education remained elitist for nearly 55 years after Independence and to an extent continues to be so even as of the date hereof. However, under auspices of the Post 2002 reforms, a very ambitious program of university faculty/staff development was taken up. This included but was not limited to sponsoring higher studies of some 10,000 able youth for their PhD studies both at home but more importantly in some of the leading universities abroad. This was important to make available a threshold of qualified and research active faculty at each university. The next challenge was to equip them with research grants so that they would be able to continue and expand their research programs through forming research groups and so forth. While referring to these successive changes, one of the respondents stated that:

"*even if they came to a very weak university (say in Balochistan), they would have some funds to be able to setup a reasonable sized research facility*." AC [Extract 77]

Besides that universities had historically fewer places for enrolment on offer, a noteworthy reason for low participation rates owes to the social and economic inequalities. Financially weak families found it difficult to pay for the university education of their wards in a country where the GDP per capita is less than $ 1500/- per annum (2017-18). This is low even by the South Asian standards. Realizing this deprivation of the masses, the Higher Education Commission, Pakistan instituted 'need-based scholarship' programs to sponsor higher studies of meritorious and deserving youth. This program was complemented by universities' themselves through their own budgetary sources in the form of waiving tuition fees for the meritorious and even providing them financial assistance for their living, etc. Such efforts have had a positive bearing on increasing enrolment in universities/higher education institutions during the preceding decade or so.

While referring to this program, one of the respondents stated:

> *"…to offer a very large number of scholarships to students at an International level which would allow the brightest students to get admissions not only in government universities, but also in private universities, i.e. LUMS or GIKI, or other institutions where the fee structure was very high."* AC [Extract 78]

There existed imbalances on account of geographic disparities there. Lack of physical access to a university/HEI in the close vicinity did not allow weaker sections of the society and the womenfolk to pursue higher studies due to different economic and cultural taboos. Understandably, the larger metropolises offer better civic amenities than smaller towns and hence are able to attract better talent in the form of qualified faculty. Accordingly, universities even though that they were established at remote locations in the country, could not get preeminence. Students studying in larger cities had the propensity to settle there post completion of their studies for reasons of better quality of life and employment prospects at such places. Very few would return to their home towns. The consequences of internal brain drain had negative consequences on the prospects of development of industry and agriculture in the smaller towns and in rural areas. As such, the Post 2002 reforms set for them, improving access to higher education as one of the three cardinal principles of reforms, the other two being 'quality' and 'relevance'.

Opening up of more universities and university campuses in relatively remote areas and smaller towns have helped in increasing enrolment (i.e. access of higher education). The solution provided by technology through IT/electronically enabled distance education programs has further contributed in realizing the nearly 10% participation rate (Jan. 2019) among the 17-24 years age cohort eligible for higher education. Almost a goof 25% of the total enrolment is contributed by the distance education programs. Availability of distance education programs in higher education have provided opportunity to those for enrolment there which may otherwise had been marginalized owing to social, economic, or any other count. A respondent while referring to the exclusion of a sizable number of the eligible cohort for higher education stated:

"traditionally seats of higher education were always concentrated in the larger cities and therefore students had to travel and stay in the big towns to get an education and then very few returned to their home towns. I think that is the one area that Virtual University has made a major difference." AJ [Extract 79]

Another imbalance relates to universities maintaining a narrower focus i.e. 'teaching' as against assuming a holistic role as university, i.e. taking up 'research'. While understanding that this owes in part to the weak financial allocations for the higher education sector in the country, it owes in part to the lack of research appetite in local industry. One research respondent stated as:

"*Chinese insisted on, if you want to enter in our, for example, to the GM and Ford and all these big ones, if you want to operate in China, you have to create your R&D setups here, R&D institutions here. Unfortunately, you name any Pakistani organization, multinational functional in Pakistan which has, does the Siemens have R&D setup here? Unfortunately, 'No'. Does these large multinationals engaged in pharmaceuticals, do they have R&D setup here? 'No'. why they do not have their R&D setup here."* AN [Extract 80]

The experience of early-starters (Singapore, South Korea, Hong Kong, etc.) entails the role of regulation in enticing the corporate sector to invest in R&D through assimilating, adapting and then possibly generating technologies that better suit the local conditions. This would allow them in liaising and building collaborative arrangements with the universities, which is beneficial to both. There are examples to be followed from China, Singapore and several other countries even within Asia.

7.2.7 Lack of Continuity

There had been nearly a dozen policies for the education sector in the past 72 years' history of Pakistan. This speaks for itself, the frequent policy shifts and consequently the change in priorities. Frequent change or lack of continuity in policy or program is bound to create distractions affecting realization of longer term vision. Underscoring the ill, Realizing this, one of the participants stated,

"*Everybody wants to build his own parameters, although it is understood that the policies are for a long(er) period of time."* AD [Extract 81]

The frequent shifts in priorities have a fall out on governance issues as well. While premature abandoning the policies absolves the concerned from accountability, the practice is counter-productive from the economic and social standpoint, as well. It was referred to in the following words by one of the respondents:

"(the policies)…should have the blessings of the opposition parties as well, so that we don't have a major change or diversion in that, and a long term (say) 20 year plan can be implemented irrespective of which government comes in power." AC [Extract 82]

The change of people at the helm results in consequences similar to the changes in policy itself. The lack of preference for the priorities set forth by the predecessors and intolerance for others viewpoints tends to 'negate' their plans, which are half way through and still need time to produce results. Practiced collectively, it then becomes a societal trait, or in the words of one research participant as 'mutual negation'. The problem gets compounded, when there are frequent changes at the helm. Referring to such frequent changes of heads of higher education institutions, one of the respondents stated,

"*then there is somebody else; then after another two years, there is somebody else. You look at MIT, you look at Harvard, you look at Cambridge – how many years … Presidents of these institutions have been there*" AN [Extract 83]

7.2.8 Policy for Catching-Up

Taking steps to promote innovation has certain pre-requisites, undertaking research, instituting mechanisms for allowing appropriation of knowledge to create an economic incentives structure, and so forth or broadly termed as framework conditions. These measures require contribute to the creation of new knowledge, its dissemination and its application (Balzat &

Hanusch, 2003). To do so requires investments in human resources over extended periods of time and systematic integration of a number of actors and institutions in a national economy. Creating the framework conditions, referred earlier, requires instituting a systemic and multidisciplinary approach for production of knowledge worthy of economic applications. Evidence entails in the words of one of the study participant that

> *To catch up, the higher education could play very important role in S&T sectors and it could provide guidelines (for) the development of the country.*" AP [Extract 84]

A good example to follow can be taken from countries that have deployed innovation systems at the policy level. Liu and White's (2001) confide in their conceptual framework comprising of five main processes of the innovation systems. These processes include; research, production, end users, linkages and most importantly education. One of the respondents highlighted the need for learning from such strategies that were earlier employed by the newly industrialized developing countries as follows:

> *"If you look at the development strategies of the East Asians countries, which have really come forward and they are the only countries which have managed to catch up with the developed world in a very short period … their emphasis was (sic) more on science and engineering subjects."* AE [Extract 85]

Citing the case of Hong Kong, Sharif (2005) underscored the need for adopting the systemic approach to investments in science and technology by the Hong Kong Government while crafting its innovation and technology policy.

The data analyzed in this chapter highlights the functions and objectives of higher education policies and programs in Pakistan. The critical functions creating and strengthening the NIS include generation, dissemination and diffusion of knowledge by universities. The latter-mentioned function historically remained weak and needed direction by the state and support both by the public and private sector. Understanding that diffusion of knowledge, if so happens, has to be expressly facilitated, the universities' are only able to discharge such functions provided economic incentives exist for the purpose (such as availability of technology savvy workforce amenable to learning,

creation of new knowledge, protection of intellectual property rights, permission to privately appropriate the financial proceeds of knowledge/technology commercialization, availability of venture or risk funding, and so forth). Besides, assuming the traditional roles of creation and dissemination of knowledge, the universities can help in the diffusion of knowledge either acting as suppliers of technology (e.g. licensing technology to the commercial enterprises) or through creating business enterprises themselves (start-ups, etc.). The subsequent themes explore the ways forward and strategies in creating such functions as well as identify actors, institutions, linkages and the feedback mechanisms in creating and re-creating such functions.

Chapter 8

8. Creating Critical Functions of Higher Education in the NIS in Pakistan

Results analysed in the preceding chapter have mainly identified the socio-economic and historical context in understanding the role of higher education in the indigenous innovation system processes. These highlighted the significance of promoting 'research and development' in universities, and recognizing their role in creating and strengthening the NIS in building knowledge economy. The themes and sub-themes discussed below systematically explored and are analyzed in understanding the role of the universities in building the NIS in Pakistan and the ancillary challenges. Accordingly recommendations are derived to cope with such challenges. These include, building bridges between academia and industry, promoting enterprise creation, and so forth.

8.1 Theme 3: Strategies for Inculcating the Role of Higher Education in the NIS of Pakistan

The previous theme identified gaps in the innovation system due to lack of objectivity of higher education goals, lack of demand orientation, scarcity of resources and so forth. This research *inter alia*, aims at identifying broad strategies that help in creating and managing the critical functions of higher education in the National Innovation System in Pakistan. Prominent among these, as have emerged from the qualitative thematic data analysis are presented below:

Table 8.1: Strategies for inculcating the role of higher education in the NIS in Pakistan

Theme 3	Subthemes
Building Human Resource	• *Interaction among different tiers of education* • *Understanding the supply side* • *Understanding the demand side*

8.1.1 Building Human Resource

Investing in (different tiers of) education results in providing a steady flow of eligible human resource to each of the successive tiers of education and ultimately to different sectors of economy. As argued by Mytelka (2000) & Etzkowitz (2003), international competitiveness depends on the overall performance of three inter-related national environments, namely: the human resources development (supply side) environment; the deployment (demand side) environment; and the drawing-in environment (public policy and legislation). Furthermore, Etzkowitz (2007) argued that interaction among different tiers of education enhances propensity to learn and through the ingenuity of learners and users of knowledge, further identify new uses of knowledge.

a) Interaction among different tiers of education

Availability of human resource in sync with the national and regional needs is flag post of a strong economy (Xue, 2006). On the supply side, this would require sufficient number of places at different tiers of education.

The numbers in Pakistan (Table 6.3.2) show that there are far fewer places at each successive level of education to allow transition of different corps of students from primary to secondary to higher secondary and on to the university level education (numbers).

This is abysmally true for subject areas of science, technology, engineering, medicine and other professional disciplines.

Table 8.1.1: Number of Mainstream Institutions, Enrolment & Teachers by Level (Thousand)

	Enrolment			Institutions			Teachers		
Year	**2012-13**	**2013-14 (P)**	**2014-15 (E)**	**2012-13**	**2013-14 (P)**	**2014-15 (E)**	**2012-13**	**2013-14 (P)**	**2014-15 (E)**
Pre-Primary	9284.3	9267.7	9220.2	-	-	-	-	-	-
Primary*	18790.4	19441.1	19935.4	159.7	157.9	158.7	428.7	420.1	413.6
Middle	6188	6460.8	6772.6	42.1	42.8	43.2	362.6	364.8	375.7
High	2898.1	3109	3297.6	29.8	30.4	32.6	489.6	500.5	518
Higher Sec./ Inter	1400	1233.7	1249.6	5	5.2	6	132	124.3	146.4
Degree Colleges	641.5	674.4	801.3	1.5	1.1	1	48.8	26	23.5
Technical & Vocational Institutes	302.2	308.6	318.7	3.3	3.3	3.4	16.1	16.4	16.6
Universities	1594.6	1594.6	1828.3	0.147	0.161	-	77.6	77.6	83.2
Total	**41099.1**	**42089.9**	**43423.7**	**241.5**	**240.9**	**244.9**	**1555.4**	**1529.7**	**1577**

Source: Economic Survey (2014-15), Govt. of Pakistan, Islamabad

E: Estimated, P: Provisional, *: Incl. Pre-Primary & Mosque Schools

Source: Pakistan, Government of (2013-14), Economic Survey, Islamabad.

The school and college education[62] are governed and administered by the provinces while university education is primarily funded and de facto administered by the federal government[63]. The

[62] Colleges enroll degree students as well and comprise of approx. 20% of the total Higher Education students

[63] The functions administered by the federal government include funding, standards, quality assurance, accreditation and qualifications equivalence, international cooperation, etc. while few albeit governance related functions including the appointment of vice chancellors and deans are administered by the provincial government(s)

enunciation of 18th Amendment to the Constitution of Pakistan, 1973 (18th Amendment) and interpretation by the stakeholders (Adeney, 2012) has made the duality of legislative and administrative control on higher education somewhat fuzzy[64]. This requires defining and re-ascertaining the turf between the federal and provincial government(s) and devising new mechanisms of coordination as impliedly highlighted by one of the respondents:

> *"…the provincial governments have their own set-ups now. Earlier on, there have been sub-offices of the HEC or the UGC who were coordinating the needs of manpower, coordinating institutional needs and the government needs*" AG [Extract 86]

Notwithstanding the differences in understanding as to which authority is responsible and should hold reins of higher education sector in the country, the fall out of confusion about jurisdiction and responsibility to invest in people is an issue of crucial national concern. It is opined by one research participant in the following words:

> *"…our huge manpower has turned into a liability instead of being an asset"* AD [Extract 87]

Or in slightly different words by another participant as:

> *"In Pakistan, the problem has been that we have never had a long-term roadmap for development"* AC [Extract 88]

One downside for the holistic treatment and zero-sum (public sector) investment in 'education sector' manifests in the gain of one tier of education at the loss of other i.e. if, and as it is, the total financial allocation for the 'education sector' is decided first, its distribution among different tiers of education (primary, higher/secondary, higher education, technical and vocational education, and so forth) would follow. With historically low financial allocations[65], this resulted in a trade off in one sector getting more (or less) allocation depending on the political considerations and administrative compulsions of the incumbent government. Higher education, in such instances,

[64] Differing opinions exist as to the responsibility and consequently the authority of the provincial and federal legislature in certain matters ~ cite a good article that explains the issue in fair detail

[65] Which on the average remained around 2% of the GDP

may be over or under-emphasized viz. a viz. other tiers of education. It was sated by one of the participants as:

> *"There has not been as such higher education policy, we have had education polices, in which we had different level education policies prepared; primary, secondary and also the university level education."* AL [Extract 89]

A consequence of the duplicity in jurisdiction resulted into poor linkages among different tiers of education. Besides mismatch in the number of places, 'poor linkages' among successive tiers of education also result in mismatches in curricula and pedagogical issues, and in turn affect the 'learning' abilities or the 'absorption' capacity of students. This implies that the intake quality of students at higher tiers of education is a function of the quality of students and instructions at the lower tiers. Similarly, the produce of higher education institutions, while assuming faculty positions at the lower tiers of education (school and college) is affected. A reflexive relationship is therefore established among different tiers of education in the national education institutions. One of the research participants put it in the following words:

> *"...you cannot have good higher education without strengthening the foundations and vice versa"* AC [Extract 90]

Seidman (1974) observed that the absorption capacity at each successive tier of education in Pakistan remained weak and disconnected to the absorption capacity developed at the proceeding tiers. Owing to the lack of jurisdiction, on lower tiers of education the Higher Education Commission, Pakistan is not entitled to oversee lower tiers of education. The literature though supports devolution as Schrempf (2013) pointed towards the universities' focus on region needs and is therefore helpful in the higher education institutions role in explaining the regional differences in innovation capacity and economic strength. The 18th Amendment, once comes in practice, is expected to allow exclusive jurisdiction to the provinces on legislative and administrative matters thereby improving coordination among different tiers of education and linking universities better than before, in line with the provincial (and regional) priorities.

b) Understanding the Supply Side

The abysmally low number of places for higher education owe in part, to the long gestation time needed to realize returns even for the public sector investment. Normally it takes 16-21 years of study after a child enters school to complete university education and still another 3-5 years to get accustomed to the work rigors before one is able to make a positive contribution to the economy. The returns of investment in higher education though initially slow to realize, they become enormous, once they start accruing[66]. Still, the tenure of the political governments ranging from 5-5 ½ years are out-lived by the longer gestation times for returns in investment in higher education. Even for the private sector, there is tradeoff between quality and financial returns which tend to lean in favour of the latter in the presence of weak regulatory measures. Divulging upon the long-term return on investments in the higher education sector, one of the research participants stated that:

> *"ship of education is a very slow moving ship"* AJ [Extract 91]

Another reason for lower number of places and a narrower choice of the disciplinary preferences owes to the acute dearth of qualified faculty at universities. Accordingly, the Post 2002 higher education sector reforms made investment in faculty development a high point of the reforms agenda. The Government through the Higher Education Commission, Pakistan has sponsored nearly 10,000 youth to allow them earning their MS and PhD qualifications from some of the best universities within the country and abroad (Annual Report, 2014-15, Higher Education Commission). It was referred by few research participants as:

> *"The major development that took place were related to faculty strengthening"* AC [Extract 92]

and,

> *"Higher Education Commission has been focusing heavily on faculty development, on training people, on sending them abroad. Now, real again test, a test will come if these*

66 The basic framework for the analysis is the human capital earnings function developed by Becker and Mincer accessed at http://www.nber.org/chapters/c3696.pdf

people are coming back and getting into research system and then coming up with the new ideas and so on" AF [Extract 93]

and also,

> *"a very significant change 2000-2008, that the importance was given to the quality education, the importance was given to the quality faculty, because without the faculty, you cannot do anything. So, before that, as I mentioned earlier, there were no programmes for the faculty development. So, that was a very important change, that thousands of (hundreds of) students were sent aboard; and there were indigenous programmes, wherein students were encouraged for quality education, you should have the quality faculty* AP [Extract 94]

The investment and the commensurate increase in the highly qualified pool of academics has resulted in leveraging strategic collaborations both on cutting edge research and through inviting international experience and indigenizing research on local issues. Increase in the number of publications and international patents signals the payoff of the investment.

Another issue relates to the mismatch between lower and higher tiers of education whether in numbers i.e. places for enrolment at each successive level of education. The consequences of which lead to short supply in the production of quality human resource. Citing an example, the World Health Report (WHO, 2006)[67] seconded that owing to too few places for tertiary education in healthcare and allied disciplines, Pakistan was among the countries most vulnerable rather facing crises like situation in required number of human resources in the health care sector. The situation is not different for several other sectors of economy as a common attribute among the otherwise different policies and indicates a general neglect towards research and innovation (The Boston Group , 2001).

[67] World Health Report accessed 12 Jan 2015 at http://www.who.int/workforcealliance/countries/57crisiscountries.pdf

Equally dismal was the status of compliance of the targets set-out, e.g. enrolment, improving geographic disparity in the access to higher education, and so forth (Hoodbhoy, 2009)[68] with the consequence that a trickle-down effect in improving the body of knowledge, stock of qualified personnel and their propensity to economically deploy knowledge did not improve. Still, an understanding seems there and efforts appear continued in building capacity especially in areas related to science and technology. One example constitutes the Government's efforts in building capacity for indigenous research and development by setting up a number of research institutes in the country. The efficacy of such initiatives remained questionable in the wake of an adequate supply of trained human resources. It is highlighted by one of the research participants in the following words:

> *"the new institutions which were being created at that time, for example National Institute of Electronics (NIE) or Pakistan Council for Appropriate Technology[69]; these were established at that time and there was acute shortage of human resources and universities at that time in our country were not capable of producing the people there".* AH [Extract 95]

Realizing the significance of the role of higher education in producing qualified human resource for different sectors of economy, a research participant further highlighted another shortcoming as:

> *"At the moment, HE sector simply feeds into S&T manpower requirements; there is no strong academia-industry integration."* AJ [Extract 96]

The research participant's view impliedly pointed to the lack of universities' orientation to build linkages with industry and consequently with other socio-economic sectors of economy. This is acknowledged by the Government of Pakistan itself as follows:

[68] Pakistan's Higher Education System: What Went Wrong http://eacpe.org/content/uploads/2014/02/Essay-On-Pakistan-Higher-Education.pdf Accessed on: 20 July 2017

[69] The two named institutions were set-up respectively in the Years 1979 & 1981.

'a comprehensive human resource development policy is needed to be coherent (sic) with other socio-economic policies of the government' (Pakistan Economic Survey, 2013-14, p. 150)

A remedy was proposed by a research participant to combat acute dearth of human resources available at research institutes in the following words:

"*If you see the status at the moment in science and technology, the number of institutions in science and technology – twelve, thirteen, fourteen institutions and how many PhDs are thus there, … on (the) other hand, now the universities have got plenty of PhDs; now they are publishing a lot of papers but they are not converting those papers into processes and products … if the marriage between these R&D institutions and universities materializes, then probably, we will be able to see quite a few projects or innovation coming up*." AH [Extract 97]

The participant's observation refers to finding ways to link two important economic actors in spurring innovation. It is though not a recent phenomenon. Sometime back, in late 1970s there seemed realization there as well of the role of science and technology for a place in the national economic planning. A number of government research institutes and universities were then set up in the public sector (Shafiq A.K. 1993; Shafiq A.K., Anthony, N. and Nelofar. A. 1993; Shafiq A.K., and Anthony, N. 1993; Shafiq A.K., and Nelofar. A. 1993 and www.hec.gov.pk[70]). The purpose was to train human resources for the techno-economic shift in, until then, pre-dominantly an agrarian society. Such institutions were established to take up adaptive and indigenous research and build a technical workforce comprising of research personnel and allied professionals. Extract 97 underscores the inability of higher education institutions in the past in providing human resource for research centres like the National Institute of Electronics (1979). The political instability in the region and Pakistan's hosting nearly 3.0 Million Afghan refugees in the Post 1979 Soviet invasion of Afghanistan drew substantial financial resources away from higher/education and research and development. Incidentally, this was the dawn of technological revolution and resurrection of economic institutions in rest of the world. The political and imminent administrative shift

[70] accessed on July 16, 2017

predestined failure of the public policy and development plans then planned by the Government (Bengali, 1999).

c) Understanding the Demand Side

In order to take up positions across different sectors of economy and at different levels, the human resource pool has to be diverse and broad (Keohane, 2013). This was emphasized by one of the research participant as:

> *"if you have a substantial pool, then you will have people with different tendencies, people might want to do experimental work, people might want to do inventive work or people might want to do theoretical work, people might want to do applied work or pure work. But, if you have a very small pool, it will not work"* AM [Extract 98]

However, as mentioned previously the higher education system in Pakistan until of late, was small. It offered fewer places for enrolment and limited disciplinary choices. The higher education sector reforms brought out in the country have not only increased the number of places, but the scope and diversity of academic programs has considerably been enhanced; similarly, the curricular and pedagogical shifts introduced during the previous decade and half were intended to enhance learning experience of students (Shah, 2009). The Post 2002 higher education sector reforms not only emphasized expanding the human resource pool but more so in building scientific and problem-solving approach.

> It was underscored by one research participant as follows:
> *"you do the primary education but as an S&T policy, we want that you ensure that these children, they acquire essential scientific approach towards the problems"* AD [Extract 99]

Debates abound on the merits of central governance or whether the delegation of the *inter alia* human resource planning be left to the market forces (Simmie, 1998).

One of the research participants opined as follows:

> *"this manpower planning, there has been a big debate like Russian system of education, where there was a planning. They would say, we need so many scientists, engineers and all that, but the defeat of the Russian system itself, the Russian empire shows that it should be left to market forces; now you see American system, there is no federal level of policing or planning, ... so, I think, American system, now even in Russia, they have adopted, Eastern Europe has adopted it"* AK [Extract 100]

Leaving market alone at the mercy of demand might hold well in a competitive market economy but not so in an economy like Pakistan. The still nascent and under-developed market of 'higher education' does not appear ready to sustain the vagaries of market forces and sustain itself (World Bank, 2000) in the wake of various social, economic, technological and regulatory changes. Moreover, in developing countries and so is true for Pakistan, the acute dearth of qualified personnel translates into suppressed demand for various skills sets and quailed human resource. The government is then both obliged and privileged to open avenues through skills deployment in economic areas hitherto new to the setting. This is realized both through the supply side measures, such as through production of human resource as well as (through) demand side measures such as incentivizing private sector to open newer businesses that would create demand for the qualified personnel or even incentivizing researchers in setting up knowledge-based enterprises. The Government's intervention is needed to initially lessen the market risk, which support would be gradually withdrawn once taken over by the market forces. Recent examples from Pakistan include setting up the skill markets for medical and legal transcription. A discipline completely new to the local skills market and having no demand as well was created as a result of government policy and (financial) support. The Government sponsored production of a pool of human resource and providing fiscal incentives[71] to the private sector to bring in business from overseas markets helped develop a new market for skills. The healthy returns have translated into setting up of and expanding medical and legal transcription market in the country.

[71] Development project entitled, "Training of Legal Transcriptionists" funded by the Government of Pakistan in 2001-2, Planning & Development Division.

China's [72] experience also entails that central planning complements market development and does not substitute the later. Historical anecdotes reminisce recommendations of Fazl ur Rahman (1947), the key proponent of Pakistan's first educational road map that the preparation of text books could not be left to the market (forces). He recommended for setting up:

> "…special Government organizations to undertake the preparation of textbooks" and that, *"This will not only ensure the observance of approved educational principles on which textbooks are to be based but will also bring together a degree of objectivity and high scholarly merit not to be met with in ordinary commercial textbooks"* (Fazl ur Rahman, ibid)

The above transpires planners' understanding that expanding education and the ancillary needs cannot be left to the market force alone; it rather it needs active governmental support to steer, augment, and complement efforts of the private sector.

72 China's central planning is elucidated in her Five Year Plans, which are believed to have played an important role in China's progress accessed on 19 November 2015
at: https://www.forbes.com/sites/ckgsb/2015/10/26/central-planning-vs-market-economy-a-false-dichotomy/#1edc4ee719af

8.2 Theme 4: Improving Academia Industry Linkages

The erstwhile ivory tower universities working mostly on knowledge dissemination and at times undertaking research and creating new knowledge are now expected to deploy knowledge for gainful purposes. This calls for universities assuming a multi-pronged role in which they simultaneously take up position of a university, industry as well as take benefit from and influence upon the government's policy formulation role. The intent is to seek newer combinations of knowledge for spurring innovation through knowledge-based interventions. A possible way to explain this multi-faceted relationship is through the Triple Helix model. The model suggests promoting linkages among university, industry, and the government through assuming albeit partly their respective roles. The linkages between academia and industry facilitate a potent connection for utilization of new knowledge (Leydesdorf, 1997). It also necessitates finding prospects where each of the principal actors to innovation (academia, industry and government) might cooperate in a distinct socio-economic setting where they would be able to appreciate the role of other actors, institutions and processes. Research suggested a number of possible solutions to nurture coordination and reflexive relationship among the knowledge producers and knowledge users coming from different institutional spheres viz. university, industry, and government spurring economic growth and institute social transformation.

This is highlighted by following study participant:

"*The knowledge economy realizes on a close collaboration and interplay between the government, the universities and private sector*." AC [Extract 101]

The findings are organized and discussed, as follows;

Table 8.2: Improving Academia Industry Linkages

Theme 4	Subthemes
Interface between Academia and Industry	*a) Linking university with industry* *b) Understanding different institutional ethos*

8.2.1 Interface between Academia and Industry

The responses from the research participants highlighted 'university-industry linkages' as a plausible strategy for improving demand alongside social and economic pay off from higher education (institutions). Nelson (2002) stated that the university-industry linkages establish focus and provide a basis for application of new knowledge, a critical determinant of an efficient national innovation system. The premise of linking university and industry, in whatever ways provides interface to the university and industry as socially embedded actors while appreciating the role of other supporting actors and processes in the learning. Guimón (2013) argued that developing countries face great barriers in establishing such linkages, calling for an approach amenable to the level of development, resource endowment, institutional context and the national priorities in promoting university-industry collaboration.

However, in this project, the research participants' responses led to identifying three facets of linking university and industry; first linking, then promoting and concurrently (re-)invigorating various institutional mechanisms for academia industry cooperation.

a) Linking university with industry

Bercovitz and Feldman (2006) emphasized the role of research universities in economic development, and discussed ways for promoting research culture and of enhancing research relevance with a country's needs. Pakistan has had her own experience in this regard. Certain innovative steps were undertaken under auspices of the Post 2002 reforms in the HE sector in undoing the erstwhile alienation of academics with the industry's needs. An example where university research is incentivized in the country (Pakistan) includes initiating MS/PhD program

while working on indigenous issues and sponsored by the local industry. While referring to such interventions, one of the respondents stated as follows:

> *"Research productivity began to increase and this was done through several programs and one of them was Indigenous PhD Program, which we felt was very important, because not only it addressed research, lack of research in the local university but it would also address relevance*." AE [Extract 102]

On a similar note, one of the study respondents further added:

> "*The faculty engaged in higher education started doing research, enrolled Master students, enrolled PhD students – that is I think, it is important, innovation higher education related innovation research related, and I think it's a gradual process*." AN [Extract 103]

The above referred to inculcating research culture in universities as a gradual and slow process. The role of large public sector enterprises which tend to enjoy a monopoly status such as oil and gas, electric utilities, other regulatory bodies, etc. have a role to play in identifying research problems and allocating funds to support university research. One of the respondents referred to the role of such enterprises in promoting university research in the following words:

> "*I expect NEPRA and OGRA and PTA and let's say, … PEMRA, they will be funding PhD. Let say, NEPRA will fund 100 PhD scholars; OGRA can fund 100 PhD scholars and MSc scholars; similarly, OGDCL which has 50 billion rupees a year plus 50 billion as a profit, as a net profit can fund 15, 40, 30 PhDs and so on*." AN [Extract 104]

Getz, Siegfried, et. all (1997) pointed out that the ability to identify the industry's problems and a proactive approach to undertake research on them is an issue of the curriculum itself. Disconnect between academia and industry has to be appreciated in the curriculum itself. A practice being pursued in the country, until of late, related to adopting curriculum prepared abroad. Such adoption while saving on efforts to build an indigenous one, were hailed to follow ones prepared on international standards. One downside of blindly emulating university curriculums developed

overseas were feared alienating the graduates from the local issues and thus preparing them to serve the foreign job markets better rather than the local ones. Such curriculum unless indigenized and adapted to suit local conditions were bound to disorient the graduates with the local needs.

It was highlighted by a study participant in the following way:

> "*We have been making institutions for, you know, training more and more people basically for foreign markets*." AE [Extract 105]

This other alternative called for developing home-grown curriculum. This would require preparing it through multi-stakeholder consultations for equipping students with sound understanding of the subject fundamentals as well as imparting a wider knowledge base (besides technical knowledge, it would require knowledge about company/enterprise creation, marketing, accounts, HR management, and so forth). Lee (2005) stressed upon improving university-industry linkages through employing interdisciplinary approaches creating skill sets needed by industry as well as providing solution through research. One such initiative undertaken in Pakistan in Year 2002 included constitution of curriculum review committees with wide and diverse representation both from academia and industry as referred by one of the study participants as:

> "*We have established the curriculum review committee for each subject where we've representation from different institutions – experts from those subjects; then we have essential representation from their professional bodies in that level, then we have representation from the industry."* AB [Extract 106]

The supply driven approach partly caters to preparing graduates equipped with skill sets needed by the labour market. Besides pursuing a diverse curriculum prepared in consultation with multiple stakeholders including academia (itself), industry and government, the measures include placement of students in industry for their internships. The mobility of students through student internships is complimented by (mobility) programs both for academics and industry personnel. Such mobility would be facilitated through adjunct appointments, sabbaticals, and so forth for which

amenable provisions are to be provided in the institutions' (both academia and industry) HR rules. The placement of academics in industry contributes to their demand side orientation where they start realizing industry's research issues. The industry's referral of its issues seeking knowledge intensive solution accompanies various forms of funds transfer either as contract research grants, establishing a Chair professorship or sponsoring MS and PhD students working on a particular research project. Funds transfer from industry to university constitutes a potent indicator of confidence in academia's ability to solve its problems and add to the credibility of the university research, which in turn strengthens such linkages.

An effort was made by the Founding Chair, Higher Education Commission to build the credibility gap while directly interacting with industry and business associations and to know their research needs. The efforts though could not be sustained by his successors (Post 2008) called for universities in conceiving and supporting research projects in consultation with industry and business associations and preferably those that benefit the industry at large, such as those for energy conservation, Import substitution, environmental degradation, climate change, and so forth and in making changes in the design of products/processes amenable to social processes. One of the respondents opined as:

> "*Both from the Ministry of Science & Technology (MoST), there were a dozen projects and later by HEC. That was a major initiative which was unfortunately discontinued later; and there were also programmes which were conceived in consultation with Federation of Pakistan Chamber of Commerce and Industry*." AC [Extract 107]

The bottom line of having the research inputs is articulated by one research participant as follows:

> "*The common man, how he can benefit from output of higher education; whether it is agriculture, whether it is the other social needs which are the … needs of the common man, how this manpower can help them in the routine life. Because they are not only to confine within the research cells, they have to come out, because society as a whole must improve …*" AG [Extract 108]

b) **Understanding different institutional ethos**

One reason of the huge communication divide between academia and industry owes to their different institutional cultures. The latter is profit driven while the former has its own parameters of accomplishment such as publications, citations, patents, etc. and per se do not include financial returns of their research as one among those parameters and so forth.

As mentioned by one of the research participants:

> "*The problem still is there that there is a huge gap between academia and industry and the skill set required to be in those products which are coming out of university*." AB [Extract 109]

Thus participants were of the view that although gap between academia and industry was huge, still there is realization there to bridge the gap. The ability of private sector HEIs to remain afloat and keep earning returns on investment provides them better reasons to remain connected with the needs of the skilled job market. Improving employability prospects of graduates requires private sector HEIs to nurture problem-solving orientation and skills among their graduates. Another way for the HEIs (whether in the public or private sector) to bridge the gap with the business/industry is through liaising with the representative bodies such as the business, medical, and engineering councils, bar councils, trade and commerce associations and so forth. It is highlighted by one of the respondents in the following way:

> "*Chamber of Commerce and Industry can play a very important role and I have invited chairmen to identify the projects and programmes*." AC [Extract 110]

At times, the academia helps industry but does not cite it publicly, since academics (mostly public sector employees) bear the understanding that it was part of their job to extend help to industry/business. For this reason a number of interventions made by academia, especially those of advisory in character, go unreported and even unnoticed as appears from the following statement:

> "……*if you try to go to industry, mostly innovative industry, you would find that most of professors are helping them, sometimes on voluntary basis, sometimes on commercial basis, but they don't record that sort of activity into their mainstream*." AH [Extract 111]

However, the significance of economically useful research is gaining recognition in Pakistan. The realization of orientation for commercial exploitation, the forerunner of which is seen in enactments like the Bay Dole Act is finding its way in Pakistan, as well.

As stated by one of the research participants:

> "*quality of higher education … is then reflected in (sic) the number of research publications that are … coming out in International Journals of high impact factor, is reflected from the Patents that are coming out Internationally which have an economic significance especially foreign patents not local patents, is reflected from the commercialization of products and processes that are happening, it is reflected from the success or otherwise of the technology parks that exists within the university system, and it is also reflected from joint programs that have been undertaken with industry as joint projects."* AC [Extract 112]

The permission to privately appropriate publicly funded research and to gain financial returns from it provides a strong impetus (Higher Education Commission, Pakistan, 2012) in bridging the communication gap between the academia and industry from knowledge supplier's side. The improved communication bears reflection in improving the relevance and quality of university research in so far as it offers an economic and consequently the financial merit. Such improved merit is in turn reflected in the increased number of publications, the number and quality of patents and propensity for its commercialization. Certain institutional measures introduced in Pakistan include setting up "Technology Development Fund", through which funds are provided on competitive basis to the prospective entrepreneurs to develop prototype and to go for product development.

The mere unavailability of research savvy industry in Pakistan constitutes a reason to shelve research for which there would be no industrial partner in sight. A research participant while commenting upon the lack of industry's absorptive capacity for university research in Pakistan stated:

"*…for example, in Pakistan, somebody starts doing research on biotechnology and he finds …, let us say discovery or advancement in his field, then who is going to use his knowledge – companies, who are doing biotechnology, if they (do) not exist in Pakistan, where this knowledge will go -abroad*?" AF [Extract 113]

For some of the reasons stated above, in which the industry tends not to rely on research being carried out in the country, the industry creates much less demand either for the university research and even for the skilled work force. It then becomes imperative upon academia to take a step forward, create knowledge-based enterprises and demonstrate the viability of the newly created knowledge. This in turn helps in bridging the communications and trust gap between academia and industry.

Further to this, in an interesting comment made by one of the respondents, it was pointed out that even for those who were qualified and educated; there was a significant mismatch between their skills and that of the job market. Such skills gaps were more significant among the professionals with technical background like engineering, accounting, architecture and so forth. As an example, the advent of IT has changed the ground for competition and those trained in the earlier days find it difficult to cope up with newer applications of knowledge and tools available for its efficient use. There was thus a need to train and before that unlearn some of the practices, they had been following in the past.

"*So, we moved from primary, right to university indicating at each stage that what is wrong and what should be provided and ultimately we reached a stage where we found that there are a large number of people who are already educated, already trained and already in service – what to do with them, because they are not productive, they don't have sufficient skills. So, we built into it a component of re-training and / or re- educating or skill development and things like that*." AD [Extract 114]

8.3 Theme 5: Entrepreneurship

Entrepreneurship, practiced by individuals, is a societal trait that capitalizes on economic exploitation of knowledge through innovation. Since higher education institutions are the citadels of knowledge, they are potential powerhouses of spurring innovation (Breneman, 2005). Hall (2003) stated that the new economy is not the one comprising of manufacturing, services, retailing and entertainment, it is rather a place where people want to live, work and learn to think, invent and produce. The economic exploitation of knowledge in the higher education institutions builds on their experience with its dissemination and creation as explained by one of the study participants:

> "*We started higher education with teaching and (research and) then we took the third step, which was the third mission…of innovation and entrepreneurship*". AL [Extract 115]

Table 8.3: Entrepreneurship

Theme 5	Subthemes
Promoting Entrepreneurship	*a) Nurturing entrepreneurship* *b) Taming the Environment for Entrepreneurship*

8.3.1 Promoting Entrepreneurship

The entrepreneurship or the economic exploitation of knowledge since interfaces with industry or the corporate world; it is arduous, uncertain and cyclical. The innovation embedded in the socio-cultural context requires conforming to the context to remain distinct and competitive. The sub-themes above explain the role of 'entrepreneurship' in creating a critical function of higher education in the national innovation system, as a strategy and are discussed below:

a) Nurturing entrepreneurship

Study participants emphasized on creating a new role of universities in preparing students and for deploying knowledge for gainful economic purposes. A mantra adopted by the national universities is to create job providers and not job seekers, in that:

> *"the business departments of the universities should have an incubator advising the small entrepreneur how to make business plan and where possibly to go to get, you know, collateral or funding ...."* AE [Extract 116]

The consultations made for curricular revision were made (more) inclusive including inviting business and industry personnel on curriculum review committee of the Higher Education Commission, Pakistan and universities. It was informed by the research participants as follows:

> "*With reference to the entrepreneurship and innovation within the curricula of various universities, we in Pakistan had also introduced this as an optional subject in many universities after collaborating and in consultation with the experts."* AB [Extract 117]

and;

> "*what higher education can do is to create certain skills which are not usually taught in the universities. Apart from the basic education, they should also teach them, what is entrepreneurship?And to motivate them that they should not equip themselves with this knowledge in order to become an employee of an organization, but you should think of something that you can do based on your knowledge on your own."* AD [Extract 118]

Measures were introduced to prepare students the practical aspects of knowledge utilization through introducing courses on business proposal writing, entrepreneurship, leadership and personal branding, inter-personnel communication and presentation skills, company law, project management; placement of students in industry as interns and introducing short courses both within the country and abroad where the students and young faculty would be able to see similar initiatives up and running.

It was stated by one of the research participants as follows:

"…..*For this, it is important that they have a wider educational basis in which their studies are not just confined to their own subject, but also devoted to applications of the subject in terms of commercial applications, so that they can impact the society in many different ways including industry and agriculture."* AC [Extract 119]

b) Taming the Environment for Innovation

The economic transformation of universities is facilitated by certain socio-technical constructs that mainly evolved in the west. Certain interventions modeled and introduced in the wake of Post 2002 higher education sector reforms included setting up Student Start-up Business Centres, Technology and Business Incubation Centres, Technology Park, Venture Capital, assistance for filing patents, financial assistance for technology up gradation through creating funding streams such as Technology Development Fund, etc. An overarching Office of Research, Innovation & Commercialization was set-up at each university to coordinate and collate multifarious activities in this regard. Though still considered supply side measures, the purpose is to inculcate demand orientation among graduates and nurture ability in them to identify and seize business opportunities through the use of innovation. Citing an example from international experience, one participant put it in following way:

"Turkey decided to setup technology parks to strengthen university - industry linkages and there are many Turkish universities which have very powerful technology parks, one is Middle East Technical University in Ankara – METU; which has a wonderful and a highly successful technology park. Similar steps have been taken by universities in Korea – KAIST and KIST are amongst them, to setup technology parks and promote innovation / entrepreneurship lessons can also be learnt from the policies that have been adopted by Finland and by China, where large number of linkages have been developed between universities and industries directly and through technology parks." AC [Extract 120]

As stated earlier, the examples from overseas have to be indigenized to suit the country's socio-economic conditions and to relate them to the level of its development as against those

countries from where such experiments are picked for emulation. Venture capital has been a successful model in countries where legal regimes allow to economically appropriate knowledge i.e. they have intellectual property rights regimes in places. While enforcement of such laws in gradually taking shape in developing countries and so is true for Pakistan, the less risky sources of funding such as angel and crowd funding are other plausible options given the closely knit social fabric of society.

Lately though certain start up business funds (Plan X, Lakson Investments Limited, etc.)[73] have come up showing the relative maturity that has gradually come up in the previous decade or so. The venture capital adds a layer of security through carefully assessing the prospects of success of the business proposal before committing any funds and keeping a vigil either through an equity stake or through loan syndication through overseeing the business venture by requiring periodic reports and taking corrective measures, where needed. The added layer of supervision improves chances of success of the venture. The transition of an idea from the academic environment to the world of business though appears linear in character; it gets complex overtime due to emergence of a host of institutional mechanisms and organizations structures as referred by one of the study participants:

> *"If you move from the step of applied research to innovation or move from to even to applied research, you need some kind of investment and there comes in their companies, which are known as venture capital companies. They come in and they invest. So, what you have, while you have got this linear system of education, research and development, or scientific and technological development and then going to industrialization; in between, you have to have these hybrid organization systems, which have to be supported."* AL [Extract 121]

A major shortcoming in having linkages between academia and government is the general lack of consultation by the latter with the former while formulating policies. The role of academia

[73] https://tribune.com.pk/story/1202574/new-regulations-secp-grants-first-licence-private-equity-fund/ accessed on Nov. 18, 2018

as think tanks and as resource pools for advising and even mentoring policy formulation processes is an established norm in the West.

Such ethos has though to take shape in Pakistan as yet. This lack of practice of consultations with academics is duly described by a respondent in the following way:

> *The people sitting in Assemblies and the Senate, they never take into confidence the people. I mean, everywhere, you are in UK, you must be knowing that, before implementing any policy, they come here*[74]*, the policy is debated very heatedly and then in the different parts of the country, in different universities, different institutions, after that the policy is implemented. Whenever, President Obama wants to implement any new policy or bring out any policies, or the (other) US Presidents; they come to Harvard University or something; they put their policies in front of the students and the teachers, and there is a debate going on, and after that, the policies are implemented* AP [Extract 122]

One reason for the mismatch in the number of places at each successive level of education owes to the duality of legislative and administrative control among different tiers of education which is due to lack of coordination among such tiers and at times gives rise to conflicts between the provincial and the federal governments.

The national economic plans, such as the five-year developmental plans constitute one potent tool providing commonality of objectives and coherence inter alia, among different tiers of education.

8.4 Theme 6: Actors, Institutions and Linkages

During the course of research, study participants emphasized the role of several actors responsible for promoting innovation. These mainly included the government itself through its different sectoral ministries having varying degrees of involvement to influence economic policy making and administration, quality and standardization bodies, regulatory regimes, competition policy, Securities and Exchange Commission, intellectual property rights organizations, foreign trade regimes, and so forth.

[74] Means 'university'

More so government also governs functionaries including bureaucrats, technocrats, services personnel; and organizations & institutions such as Science Technology Institutions & Higher Education Institutions including different institutional mechanisms working within such organizations and promoting innovation e.g. Office of Research Innovation & Commercialization[75], incubation centres, technology parks, internships (i.e. students/graduates) placement within industry, contract research, programs enabling personnel mobility between academia and industry, etc., HEIs and ancillary institutions working for lower tiers of education; Technical, Vocation Education and Training, the industry – both in the public and private sector, financial institutions especially those providing risk capital, equity markets especially those providing angel funds, non-governmental individuals (NGIs) read intellectuals/thinkers, opinion leaders, political parties, diaspora and expatriates, bi- and multi-lateral organizations, media, the civil society, etc.

Table 8.4: Actors

Theme 6	**Subthemes**
Actors in NIS	*a) Authority figure to collate efforts* *b) Consultation with academics* *c) Actors must be Nurtured* *d) Holistic & Systemic Interaction* *e) Motivation to influence Distincts Performance* f) *Researchers Shield under the Smoke of Compassion*

[75] These offices were established in the HEIs with the mandate, inter alia, to promote innovation

8.4.1 Actors in NIS

Having identified these different actors of innovation through participants' accounts necessitates coordination among such actors. The participants' accounts transpire following subthemes.

a) Authority figure to collate efforts

To provide centrality and better coordination, an individual, an organization or a central authority figure is needed to collate efforts as mentioned by the following study participant.

"If you have the authority to make me the Advisor to the Prime Minister, then I can immediately make a panoramic chart of all our ability and on this view chart, you can immediately see where the gaps are? The gaps are in implementation, the gaps are in providing facilities to the scientific workers, the gaps are in the kind of education we get, and so on and so forth" AD [Extract 123

b) Consultation with academics

The research participant refers to a feeling among the academic and research community that they are rather marginalized in the economic, political and even administrative decision making processes. Examples include alienation of academics in key appointments in universities which are made on considerations other than academic merit (Sheikh, 2018). The appointment of military generals as vice chancellors and at other senior positions (such as Pro Vice Chancellor, Directors, etc.) in universities are made in the name of maintaining law and order or enforcing government's control over the universities. In another example, higher education institutions are placed under the supervisory oversight which is not relevant or would simply add to bureaucratic layers and to the detriment of realizing potential of such institutions. Placement of the Higher Education Commission, Pakistan under the control of Prime Minister, the chief executive of the country has resolved several coordination issues as against placing the University Grants Commission under the administrative and supervisory control of the Federal Ministry of Education. The conflicts arising out of the wrong or misplaced supervisory oversight, often times do not let the entities exploit their full potential or even distracts them from pursuing their mandated strategic direction.

As opined by one of the research participants, there is realization of the significance of academics' engagement in crafting national policies. The reason being that academics because of

having line expertise are better equipped for rendering advice. They are expected to contribute in crafting the sectoral policies.

As stated by one of the participants,

.....In the United States, (and).. I am sure, it's true of other developed countries, where any issue that government faces, they pickup certain academics and they solve(s) those problems AR [Extract 124]

Whilst probing further about how this can possibly work in Pakistan the participant stated:

... in Pakistan, like I said, slowly but definitely, people are starting to realize, people in the government, people in bureaucracy, that without academic input, things are not totally clearer. So, it's increasing in Pakistan, and we are following the model (as) in the western countries, where academia is not an island entire to itself, they are a part of the society and they are connected (to it) in every way. AR [Extract 125]

This subtheme helped in positioning the academics as actors to innovation within the broader economic policy setting.

c) Actors must be Nurtured

The participants were of the view that different actors to innovation need to be nurtured, incentivized and allowed sufficient time to let them assume their due role. As evident from examples from the West, it is a slow and painstaking process and involves learning costs. The freedom to make experiments all of which may not be successful is needed. Looking at the role of HEIs in Pakistan, it is seen that their role in the economic evolution was initially slow but once these institutions had a critical mass of qualified people becoming available during the preceding decade or so, their potential to focus on solving indigenous problems has increased. Such inclination is helping HEIs for the adaptation and creation of knowledge through developing user-producer linkages. This necessitates identification of local and indigenous institutions as rightly pointed out by the following study participant:

"the three very important actors are competition policy, market institutions, financial institutions and corporate laws, intellectual property also. So, all these will create competition. But unless; if we don't have competition within the country and the people have a captive market like there had (been) for so long, so we are not buying any product that they sell it to us." AE [Extract 126]

Consistently, in an interesting remark, one of the respondents stated that relatively complex relationship develop overtime in the developed countries among various actors to the NIS. Such relationships in them provide a buffer, in getting undone with changing political fads and change in priorities due to various administrative compulsions. One of the participants stated that:

...if you move from the step of applied research to innovation or move from to even to applied research, you need some kind of investment and there comes in their companies, which are known as venture capital companies. They come in and they invest. So, what you have, while you have got this linear system of education, research and development, or scientific and technological development and then going to industrialization; in between, you have to have these hybrid organization systems, which have to be supported. AL [Extract 127]

Likewise, much of the current focus of innovation policy is in stimulating scientific research excellence, and the application of technology (Christopherson et al. 2008). However, there is little focus on capacity building of 'people' who are the actual bearers of scientific knowledge.

This is rightly pointed out by the study participant in the following way:

It is people who graduate from university, who learn how to do the research, only these people can move into the scientific and technological fields, do applied research and then come into the field of innovation and then after they have done something in innovation, they develop technologies which are then utilized, this is a step wise thing that takes place actually AL [Extract 128]

Therefore, the Pakistani experience or a developing country standpoint for that matter justify people centered approach for capacity building of academics to help them prepare in deploying knowledge for gainful purposes.

d) Holistic & Systemic Interaction

Literature on National Innovation System emphasizes the significance of having a holistic long term plan, which is derived from experiential and interactive learning.

Sampath (2015) defined role of the university as a holistic instrument that integrates individuals with the society. Consequently, a holistic or in other words an overarching vision would be a perquisite in allowing 'higher education' assuming its role in the NIS. However, as the previous theme highlighted, the mismatch either in conceiving or pursuing objectives towards this holistic vision mars the accomplishment or the unity of purpose. From the study participants account; the proliferation of mistrust, negating others, etc. are few of the ills that have incidentally hindered the emergence of the holistic vision in Pakistan

One of the participants urged ministers for their contribution in developing the holistic vision or an integrated approach for coordination.

> "……*we started from the beginning involving all the different sectors and writing to those Ministries that if they could share with us their priority areas, which direction they are moving so that we should have an integrated approach*." AB [Extract 129]

Such an integrated approach will, in turn, enable universities to dynamically redesign their vision and objectives, to effectuate sustainable models for higher education in promoting innovation. As the following participant emphasizes the need for holistic development vision would be a pre-requisite for evincing returns on investment on higher education:

> "…….. *And unless you have a very clear government decisions that projects will be approved only if they fit into this overall canvas of our vision, only then we will be able to move forward, otherwise you will have sporadic projects."* AC [Extract 130]

e) Motivation to influence Distincts Performance

As (Etzkowitz, 2000) argued that each one of the actors to innovation would have a different set of incentives to contribute in building and strengthening the National Innovation System. While discussing the role of actors and incentives a participant stated:

"The incentives would be different for the different persons. For example, the incentives for the faculty, the university …(the) industry, …common people (would be) different. …the incentive for a university will be … to educate persons…(and) conducting research. … the incentive for common persons, (would include that) their problems are solved. The incentive for the industry, …(would include that) their production may be increased (and that) they may earn higher profits and … bring the foreign exchange to the country. So, incentives (would be) different for the different actors" AP [Extract 131]

Briefly elucidating, the incentives of each actor to NIS must be understood to expect their due role. Simply put, the primary forte of the university is the trained and qualified graduates; the incentive for the researchers would be publications, patents or a prototype as compared to commercial returns. The industry, though, would be more interested in the latter. The role of quality and standardization institutions would be served, if the new product complies with the 'standards'. The regulatory body would be satisfied if the procedural and filing requirements are satisfied and all stakeholders to the transaction have equal rights and privileges (to ensure that the economic activity sustains overtime). The financial institutions would be incentivized to fund new products, if returns are healthy and are able to pay off the financial liabilities, in time. The society, at large, would have the incentive, if the innovation brings in an improvement in the quality of life. Satisfying, seemingly diverse interests though is difficult, it would pave the way for the concerned to work in sync and be able to deliver.

Convinced that the private sector is better placed to realize the commercial returns and consequently to facilitate coordination among diverse actors to innovation, one of the participants stated,

"*Private sector has taken so many roles (upon) themselves and I believe that they should be taking (up) this role by themselves. When they (would) realize that there is a big money in (it) … and the responsibility of the scientists like us is to make them believe that there is big money …provided you are willing to invest*" AH [Extract 132]

Besides motivation by the scientists, one of the participants while opining on incentives that would have to be instituted at the national level stated that,

"(The) incentives could be through tax concessions, it could be through matching grants, it could be through setting up industrial parks and within those, setting up laboratories so that industry has access to high quality laboratories for analysis, it could be through long term promotion of those various industries" AC [Extract 133]

f) Researchers Shield under the Smoke of Compassion

Another observation relates to a societal norm where the actors to innovation tend to, knowingly or unwittingly magnify the accomplishment even though they would not have a direct role in it e.g.:

"*If today, you asked yourself this question related to science and technology, ...what are different achievements or the success stories? People will tell you their performance in agriculture, for example. The argument used is that population of this country has grown from, so many ...(to) 190 million people and they are still being fed, and they are being fed because people produced varieties and so on*" AF [Extract 134]

In conclusion, the role of actors and coordination among them, especially those coming from academics have a role to play in strengthening the innovation systems.

8.5 Theme 7: Building and Strengthening Institutions

This theme entails significance of not only building institutions rather strengthening of the newly and previously established institutions. Following sub-themes would help in illustrating it further:

Table 8.5: Building and Strengthening Institutions

Theme 7	Subthemes
Building and Strengthening Institutions	*a) Building Institutions* *b) Policy Interventions Helped Institutions to Evolve* *c) Decision Making* *d) Governance* e) *Socio-Economic Resource Allocation*

a) Building Institutions

National Innovation System theorists elucidate that in order to acquire capacity to innovate, an organization whether a firm or higher education institution has to tread a historically contingent and an evolutionary path. For university, this would comprise of fundamental research, applied research, prototype development, technology upgradtion to establish its worth as commercially exploitable, and finally the deployment of technology (or new knowledge) for gainful economic purposes (Groenewegen, & Van der Steen, 2006; Oinas, & Malecki, 1999). It is a cyclical process in which back and forth iterations would help in learning the technology and addressing the end user needs. The process moves faster in an environment where the society is adept to recognizing value of innovation. However, universities in Pakistan have historically been known as purveyors and not the creators of knowledge (The Boston Group, 2001). The HEIs' role as builders of the (regional) innovation systems was acknowledged (Caniëls, Bosch, 2011), therefore there is growing concern for building and strengthening the HEIs to take part in the economic evolution.

As was elucidated earlier, the state of higher education was abysmally poor at the time of Independence. The colonial legacy manifested in creating a number of institutions albeit without assigning them sufficient resources (human, capital, etc.) and the administrative autonomy. As put in by one of the participants:

> "*for every particular thing that you wanted to do, you create a little unit, that probably is a legacy of the colonial system"* AR [Extract 135]

Further to this, acute backwardness (at Independence), resource scarcity and the burgeoning population put limits on building necessary infrastructure. Although several policies and developmental plans were prepared; allocation of both the material and financial resources for higher education sector did not evince enough support of the government. As an example, the University of Sindh, the second university in the present day Pakistan, although established in 1946 could only come on ground in 1951 and that too in a makeshift arrangement at Karachi[76]. The indifference towards higher education was commented upon by a research participant as follows:

> *Unless we sit down and do this planning, there is no such thing as a National Innovation System and there is no such thing as an integrated approach to the problem* AJ [Extract 136]

Against a popular hypothesis that it would be difficult to change the character of sluggish higher education institutions, the policy intervention in the wake of Post 2002 reforms proved otherwise. The capacity to utilize government funding, which was believed to be not there before that time, was tremendously improved. There was an overwhelming expansion in the program offerings and enrolment. Increase in the pecuniary rewards for the faculty not only added to the extrinsic rewards but also helped in retaining quality talent. It also provided the university faculty social elation and thus helped in attracting the best talent in academia. Multiple roles of higher education, which were unthinkable a decade or so ago, started to take shape. Such roles included an active involvement of the university faculty in quality research and later in seeking its economic applications (Higher Education Commission Ordinance, 2002). The realization for a more active

[76] As originally intended, It was shifted to Hyderabad (some 100 KM North of Karachi) in 1952.

and pronounced role of the universities in national and more importantly in the regional development has increasingly been brought forth by the planners and administrators and is generally seconded by the societal aspiration. This combination of support from the relevant quarters has earned support of the politicians albeit, at times, not to their free will.

As (Qadeer, 2006, p. 102) stated the institutional expansion needs to be accompanied by corresponding enunciation and/or revision of necessary legislative, organizational, and policy realms as the "soft" collective goods which potentially lays the ground for social transformation, the examples from the higher education sector in the wake of Post 2002 reforms included developing a model university charter (to improve universities' governance), widening consultations' for curriculum development by involving demand side stakeholders such as industry/business, instituting quality assurance, accreditation processes, byelaws, /operations manuals, and so forth which have together had a bearing on the relevance, quality of higher education and its social acceptability, defining incentives and accountability measures, etc.

Initially, the establishment of University Grants Commission, 1974 marked first phase of creating 'soft' collective goods succeeded by Year 2002 reforms and the concomitant creation of the Higher Education Commission, 2002. The Higher Education Commission revisited its bequest afresh to create new rules, procedures, bye-laws in order to make them commensurate with the requirements of the new millennium. Seeing a silver lining, one of the participants observed:

> *"I think, these institutions, if they are appropriately funded, work with - in collaboration with the universities - that will make some significant impact"* AN [Extract 137]

The research participants' views signal to the evolution of HEIs' role in the wake of and in influencing economic transformation in Pakistan.

b) Policy Interventions Helped Institutions to Evolve

The implementation of Post 2002 reforms has brought testimony to the significance of policy interventions that have helped universities gaining economic significance during the preceding decade and half. The policy interventions included increasing the number of universities and university campuses across the length and breadth of the country, increasing number of academic programmes, review of curricula, strengthening quality assurance processes, offering scholarships

to university faculty for MS/PhD studies abroad, strengthening fundamental and applied research programmes, establishing Offices of Research, Innovation & Commercialization at universities and so forth. Such measures bespeak of gradually nurturing the higher education institutions multiple roles in the NIS. It was difficult to expect universities assuming such roles even a decade before. The increased number of places for enrolment brought those earlier left out into the higher education fold. The improvement in quality standards and relevance of the curricula viz. a viz. the industry/business needs in turn created more demand for higher education and have helped in restoring the confidence of society at large, in the economic significance of higher education. The increased recognition of the significance of higher education by the society is reflected in the social elation of both the university faculty and university graduates as well as in the form of increased pecuniary rewards and so forth. The value of knowledge as a productive resource has started to get realized as university research is getting international patents, licensing contracts as well as researchers themselves venturing into enterprise creation. The realization for a more active and pronounced role of the universities in national and more importantly in the regional development is increasingly been brought to the fore by national planners and administrators and is becoming a corner stone *interalia*, of foreign policy between countries. A program to set up a number of universities (UESTPs – Universities of Engineering, Science and Technology Pakistan, 2005-2008) with technical cooperation from countries like Austria, China, France, Germany, Sweden, South Korea, etc. is a case in point[77]. Increased societal recognition of the economic significance of higher education has helped evince support rather created demand in itself for the increased political and administrative support for higher education. Acceding to the significant economic contribution of universities in the development of societies around them, one of the participants relate to and aspire a similar future for national universities:

> "*We cannot ignore one thing that we used this argument in our defence that we are a younger country; Cambridge and Oxford were there centuries ago, MIT and Harvard and Stanford*" AF [Extract 138]

[77] The program was though aborted due to a political government taking office in Year2008.

c) Decision Making

The policy planners and administrators in Pakistan are those officers who have generally been trained as revenue or law enforcement officials and have served at administrative positions in the earlier part of their careers. They rise to the senior ranks to take charge of the national economic policy management. Such officials are not accustomed to making wider consultations while making decisions, rather take refuge in the oft-cited economic constraints for their inaction. This is illustrative through a remark by one of the participants as follows:

> *"Public sector hands are tied, they cannot … think that some critical areas are important unless funds are provided; since they are dependent on the government, so they cannot have freedom of action. They want to say, … introduce a particular field like Metallurgy or some other course of study and degree program like Mechatronics or some other … which they think is more important, (but) they cannot do it"* AK [Extract 139]

The creation of the Higher Education Commission was designed as such and expected to be a departure from the norm as briefly elucidated by one of the participants as:

> *"Most important institution which can play a big role is Higher Education Commission. Because, if I look at … other institutions of this country, they have become too bureaucratic, too introvert and they don't have linkages with the outside world***"** AQ. [Extract 140]

The Higher Education Commission adopted an inclusive decision making process in which recommendations were made by representative committees comprising of academics, academic administrators, government functionaries, industry and business representatives. The consultations and coordination helped in aligning mental models, improving quality and in evincing (a collective) ownership among the concerned. This is not to say that as an 'organization' and as a collective of individuals; the Higher Education Commission (HEC) itself was without societal ills. 'Mutual negation', which is a pervasive societal trait is at play at the HEC as well, thus reducing the organization into discrete silos.

This was true also for universities; put in by one of the participants as:

"I feel a bit disappointed because of the government's interference within the HEC (Higher Education Commission), there is a huge political problem within the HEC. Amongst the people, ... employed there are two major groups, who are always ... fighting (with) each other and an organization cannot succeed, unless there is cohesion within the organization" AC [Extract 141]

The sub-theme suggests that the decision making is influenced by the societal traits and requires nurturing the mental models to expect improved performance.

d) Governance

Governance is considered an integral part of development since the onset of civilization. Well performing institutions have all different facets of good governance (Baland, Moene, & Robinson, 2010). Examples include having rightly laid out aims and objectives, having sufficient autonomy and resources at its disposal, visionary yet pragmatic leadership who believes in setting targets, valuing consultations, a community well aware of the intended roles and plans of the entity, and the systems which are democratic enough to listen to dissenting voices and make changes as and when needed, re-align itself within its framework/charter, having a system of check and balance in place, and so forth. Missing out on any of the facets of good governance mars performance. There exist examples in the country and in the higher education system on both extremes.

" ……..So likewise, we have also to see that our Higher Education Commission set-up is equally autonomous, is powerful, is headed by an appropriate person and has a consultative forum, effective useful consultative forum – because that is which will actually create awareness, will ultimately consolidate all aspects of the requirement of economic growth, of quality manpower, of programs, of funding, etc. AG [Extract 142]

Summing up succinctly, one of the participants opined:

"(the) institutions must be strong enough to deliver; that is the first thing" AC [Extract 143]

An effective governance structure acts as foundation for implementing the development policy. One way to ensure good governance is to allow people to take control of their destiny and

take charge of the decisions that affect their lives and those of the next generations. Any other process of arriving at the decisions is understood to complicate issues.

Sensitizing the stark divide of the rulers and those ruled, one of the participants stated:

"*we still have an issue of (or) a perception that the government is a separate entity and citizens are different people. So, it's still the rulers and the ruled." AJ* [Extract 144]

The HEC was expected and did institute many facets of good governance in its administrative functions including putting in place a transparent and consultative way in curriculum setting, in staff recruitment and promotions, in award of scholarships, in the allocation of funds for universities, etc. during the initial decade or so into the reforms process. However, the societal ills and traits of cronyism and non-transparency did start to appear soon after the departure from office of its founding chair in less than a decade into the reforms process. Commenting on the lack of ability of the national planners to institutional good governance, one of the participants stated:

"As the policy is made and we have made very good policies; then immediately, there should be an identification; who will thus supervise or execute it – executing agency; and sufficient resources in the hands of the executing agency. Unfortunately, both these factors are lacking." AD[Extract 145]

This necessitates inclusion of context-oriented interventions and dynamic process that would incorporate learning in implementing each successive policy set. This would need focusing on the specifics of the development context in Pakistan to improvise and frame better policies and that would assist in designing and implementing appropriate interventions either at the institution or at the national level.

f) Socio-Economic Resource Allocation

A connection between the innovation systems approach and economic growth is lacking since the former is considered fragmented and devoid of the minimum threshold both in terms of material and human resources. Qadeer (2006, p. 227) classifies different social classes of elites who decide on resources allocation in Pakistan. These include:

i. Social or the traditional elite, comprising of landlords, tribal sardars[78], biradari[79] leaders, and the old-wealth rich.
ii. Positional elite, are those who derive power and prestige from their positions in state institutions. It is the authority vested in their offices that elevates them into the ranks of the elite. These include; military and civil officers, politicians, judges, journalists, etc. These are further classified into ruling elite i.e. top decision makers and the middle-ranking officials holding power wands and the state purse; for example, mayors, councilors, magistrates, police superintendents, lawyers, etc.
iii. Economic elite, includes corporate executives, industrialists, professionals, and businessmen. They are rich and economically influential but generally without a social base for political power.

Incidentally the academics, researchers and thinkers are classified into none of the above. They at best comprise the 'intellectual elite', and do not enjoy economic or political power to assert for the legitimate support from the state. Until of late, the academic and research community was marginalized and it is only lately that academics have been made part, albeit partially, of the consultations in national resources allocation.

The marginalization of academics is a colonial legacy (Chuadhry, & Chaudhry, 2012) and manifested in academic institutions remaining on the fringes in resource allocation. The order of the colonial legacy called for putting in place extensive institutional paraphernalia, designed and maintained to provide an imperialist edifice, but by allocating resources just enough for them to

[78] Means chief
[79] Means clan

sustain. Such entities remained short on delivery, active on pomp and show and devoid of accountability. The legacy continues to this date and higher education institutions are no different.

While opining on the performance of government research institutions, one of the respondents said:

> *"I think, these institutions, if they are appropriately funded, (and) work ... in collaboration with the universities that will make some significant impact."* AN [Extract 146]

There is equally apathy among the planners and administrators in valuing opportunities at hand to learn as against opportunities overseas, as stated by one of the participants:

> "*You know the fact that we have so many courses here and we invite the world's best people, ... I have tried my best to call the (officers of) Planning Division and ...the Ministry of Science and Technology to come and attend these courses. I have seen that they don't come, they would go abroad to attend a course, but not come in their own country to attend a world class course*" AE [Extract 147]

There is thus a need there in valuing indigenous opportunities for learning and innovation than to look for the same from alien contexts. This leads to our next theme related to implementation and results alongside its significance.

8.6 Theme 8: Implementation and Results

Table 8.6: Implementation and Results

Theme 8	Sub-themes
Implementation and Results	*a) Implementation Matters* *b) Fragmentation and Gaps* *c) Issues of an Ownership* *i. Democracy Empowers People* *ii. Democracy in an Illiterate Society* iii. *Commitments are not Honoured*

a) Implementation Matters

From the responses gathered; there appeared gaps in the stated and the practiced policy. Even the monitoring and evaluation mechanisms appeared a paper exercise rather than aiming to bridge such gaps. The gaps in implementation of policies seem waning the political support which had initially developed the policy. When a new policy was developed, its premise was defended in the non-realization of the programs and targets of the previous policy rather than any probable accomplishments. This approach steered disbanding implementation of the policy half way through to give way to another policy. The need for a new policy was further justified on the premise that better insights of issues and re-assigning of the priorities were needed.

One of the participants stated as:

> "We unfortunately never had very clear implementation. Every time, a government comes, they start making a new vision. Now, we are having another new vision being prepared. Vision 2030 is already there. We are now preparing Vision 2025. So this is the problem. Things are done by doing them, not by talking about them." AC [Extract 148]

Participants further referred to the inability of the planners to translate the policy provisions into an action or an implementation plan. A common practice developed over the years was that each policy document (would) begin(s) by briefly recapitulating the previous policy's shortcomings and generally not its accomplishments[80]. A mention would be made of design flaw, unrealistic assumptions and more on the implementation gaps and thus the policy's inability to meet the intended results. The stated and practiced mismatches in policy administration compelled one of the participants to state that:

> *"When they are saying that Oh! look, education is a priority, then … education should be at the top, and government should be … promoting … the education sector*" AH [Extract 149]

Furthermore, the new policy rhetoric boasts of accomplishing in future which is not accomplished earlier by the previous policy. But the preamble of the successive policy (regime) entailed nothing much different than the previous policy which is a failure. Setting out caveats such as 'subject to availability of resources' in each policy set and these not being observed/ honoured would provide exit to those responsible in implementing the policies.

An overview of education policies of Pakistan was presented in an earlier chapter[81]; it was found that over the years none of the education policies could reach fruition. While referring to the proliferation of economic policies, a similar fate was seen for several of them. One of the participants stated:

> "*Number of policies that we consulted were enormous; …at least fourteen or fifteen policies were consulted e.g. there was this National Quality Policy and Plan, IT Policy and Action Plan, Labour Policy, Population Policy, National Skills Strategy, National Health Policy, National Environmental Policy, Education Policy, Trade Policy; you name it, there was even a National Drinking Water Policy*" AD [Extract 150]

[80] Because by then the government would have already changed
[81] Entitled 'Context of Pakistan'

b) Fragmentation and Gaps

The research participants alluded that the salient issues affecting policy implementation include gaps either in stating (policy) objectives, in developing a connection between the objectives and the programs, in allocation of resources; both human and material and in having obstructions in the communications flow among the stakeholders such as those among the government, industry, and academia. While referring to such gaps, one of the participants stated as:

> "*What they (S&T organizations) are doing, …is not known to HEIs (higher education institutions). So, one could say that, … the HEIs are producing manpower for an unknown entity and it may not be what is essentially required by those S&T organizations. So, there is obviously a potential mismatch between the two"* AQ [Extract 151]

Another participant complimented it as:

> *"I still see a huge disconnect over there. The higher education sector is not mature enough to sense the needs of the industry and society and to implement appropriate programmes"* AJ [Extract 152]

Interpreted slightly differently, one of the participants stated:

> *"The academics look at industry as something below them, something they do not want to dirty their fingers with and the business community (thinks) these people (as) arrogant-academic elite living in their own ivory towers."* AR [Extract 153]

One example of alienation was seen in the role the Ministry of Science & Technology had assumed upon itself as against those mandated to it. Ministry of S&T was required to coordinate activities in the area of science and technology in whole of the country; it rather restricted itself to overseeing function of those organizations administratively reporting to it.

One of the participants opined on the fragmented approach as:

"*MoST (Ministry of Science & Technology) was basically established to coordinate the scientific and technological effort in other ministries pertaining to different sectors of the socio-economic development. But what happened, the Ministry established its own research organizations and institutes and instead of giving attention and coordinating ... effort in other sectors, (it) started looking only in those few things*." AL [Extract 154]

Another issue highlighted by one of the participants related to skipping steps in the research process to the detriment of not only a particular research project undertaken but to developing capacity for research in the institutions. Hiring short term technical expertise or parts and equipment manufactured elsewhere raised coordination and system integration issues that again go for the detriment of the research effort. While referring to such issues, one of the participants stated:

"It would than lead to a sort of an assembly kind of thing; and the objective of creating new knowledge, new technology would be defeated." AD [Extract 155]

Concurrently, another participant further stated:

"*I think, there, at a policy level; ministries, then R&D organizations and academic institutions and CoEs (Centres of Excellence) and beneficiaries, the ultimate industry, they have to have a very strong unbroken linkage, not a dotted line but a full line relationship with each of them and mechanisms and procedures and protocols, how to benefit and how to interact with each other.*" AN [Extract 156]

Similarly, one of the relatively more noticeable gaps is the non-availability of data and required information.

While referring to conceiving the research projects in the absence of credible data, one of the participants stated:

"*Before getting that job, he (the researcher) would not be aware of exactly what (data) is required*" AD [Extract 157]

It was seen that the different surveys carried out in the country for data collection were not taken up regularly. They were entrusted to organizations either with no or having resources incommensurate with the job.

c) Issues of an Ownership

i. Democracy Empowers People

The colonial legacy had casting shadows in that democratic norms did not mature and people feel that they are not part of the decision making process (Imran, A. 2004). One of the research participants stated that:

"*We still have an issue of (or) a perception that the government is a separate entity and citizens are different people. So, it is still the rulers and the ruled*." AJ. [Extract 158]

The lack of political ownership further manifests itself as stated by one of the participants:

"*We as citizens of Pakistan have to start owning our educational system. We don't own it either. As a result, we don't send our children to public schools; we don't send our children to the public universities. They are always institutions of last resort, and when you add to that the fact that the absolute majority of your population is actually studying in public schools and universities.*" AJ [Extract 159]

This showcases a stark divide in the society where the privileged classes possessing the political and administrative writ and control over resources to influence for the betterment of social services like education, health and so forth are themselves not client of such services. The political and social elite avail education and health services overseas and hence would neither be privy nor affected by the continual downslide of the social service quality including higher education.

ii. Democracy in an Illiterate Society

As (Milner, 2002) states that the model of western democracy when implemented in a society where the majority is illiterate does not work well. In the case of Pakistan, rather than exercising an autonomous franchise, the indigenous model of democracy, where the literacy rate is low had promoted politics of clan, creed and race thus strengthening the social biases and status quo. The selection of those at the helm of university affairs followed criteria other than merit (Amjad, A. K. 2011). The proliferation of narrower and myopic interests, compromises and deceit, deterred the state of higher education. In such scenario, scientific and technological considerations could not find their way in the national decision making processes and continued to remain at the fringes. It was opined by the participants as:

> "*We ended up a British Parliamentary System of Democracy, where politics is a dirty business*" AC [Extract 160]

Another participant while citing injunctions stipulated in Holy Quran, further added:

> "*If you go to Surah Ana'am, Ayat 116, this is in the 8th Paara, Allah says, 'do not follow the wishes of the majority or you will go astray*". AC [Extract 161]

The research participant suggested that:

> "*Presidential System of democracy where the president chooses the ministers not from parliament but from the best people available in the country, as (is) done in France and in USA and in (some) other countries*" AC [Extract 162]

Coincidently, the views of the participant mirror those expressed by Fazl ur Rahman (1947) when he said:

> "*The possession of vote by a person ignorant of the privileges and responsibilities of citizenship is like playing of a child with dynamite and is responsible for endless corruption and political instability*".

iii. Commitments are not Honoured

Although discussed in detail in the preceding chapter related to the [context of Pakistan], commitments made by the government from time to time were frequently stressed. These

commitments range from making public utterances to those contained in the national annual plans and budget documents. Although such commitments were duly backed by the political decisions made at the highest level in the government still they were not honoured. The executive powers then appear in the hands of those who are not answerable to the people. As an example; the development funding for 'higher education' duly approved by the Parliament of Pakistan was Rs. 20.4 Billion (Year 2016-17). However, actual releases were contained to just 40% of the approved allocation. Almost each economic sector, each year faces a similar fate. One participant briefly re-asserted this in the following words:

> *"The recommendations were always given to the Government. They (had) promised that they will do this ... but these promises were never fulfilled*" AN [Extract 163]

The poor state of accomplishment is seen in that, even after spending nearly 60% of the 2.0% of the GDP on primary education each year, literacy rate has increased just by 11% (i.e. from 46%to 57%) between the Years 1990-91 and 2014-15 i.e. in a span of 23 years (Economic Survey, 2014-15, p.173).

8.7 Theme 9: Repositioning Systems

Table 8.7: Repositioning Systems

Theme 9	Subthemes
Feedback Mechanisms	*a) There is realization for having appraisal mechanisms* *b) Assessment taking root in Universities*

8.7.1 Feedback Mechanisms

Final of the four research questions relates to feedback mechanisms that help in re-positioning the National Innovation Systems. The key components of getting feedback constitute assessments, appraisals, monitoring, evaluation mechanisms, third part validation, etc. Such mechanisms provide feedback during various lifecycle stages viz. before, during and after the

project, program or policy implementation phase. They work both at the tactical level i.e. to arrest gaps and make correction on a day to day basis as well as at the strategic level in which each successive phase of the program or policy administration accounts for the learning made in the previous cycle. Accordingly, feedback mechanisms provide inputs and a premise to make changes in the innovation system to reflect and incorporate learning over a period of time.

a) ***There is realization for having appraisal mechanisms***

The policy planners seemed cognizant of the significance of feedback so as to know the lapses and gaps affecting realization of planned results. While discussing the need of appraisal mechanisms, one of the participants stated as:

> *"Evaluation (both) in … quantitative or qualitative (terms) … are important.*" AD [Extract 164]

The purpose of feedback mechanisms is to provide appraisal, evaluation or an assessment and is not intended to be a critique or as reasons to become adversarial. The quote by one of the research participants recounted below reaffirms this understanding:

> *"We involve them in the process of evaluation, and we have performed well; but it is ok, if there are omissions, any drawbacks, we can inform them and we use to take them into confidence, so they do not detract from our future proposals."* AG [Extract 165]

The research study entailed that there are a variety of mechanisms which provide feedback to the planners and institutions of higher education so as to take corrective measures and (possibly) reposition the National Innovation System. Recounting them in top down hierarchical order appears below:

At the top, parliamentary[82] supervision/oversight is exercised, further directed through its Standing Committees (of the Senate, National & the Provincial Assemblies). Citing its significance, one of the participants stated:

[82] President of Pakistan and the provincial governors are part of the respective legislatures and are ex-officio chancellors of the federal and provincial universities respectively

"*There are very important advices we get from Parliamentarians, we do get from those foras and we try to incorporate them. But again, this is whole system, it has to go through so many stages.*" AB [Extract 167]

The tier below parliament constitutes of the executive arm of the government, which include Planning Commission, Ministry of Finance, Higher Education Commission, Ministry of Science & Technology (or any other line ministry/department, etc.) and work under the political mandate and administrative directions of the chief executive of the country, who is Prime Minister. As stated by one of the participants:

"The *Planning Division also has an evaluation process, which looks how successfully you have implemented various programmes, whether you are on track or whether you are lagging behind"* AC [Extract 168]

Next come the professional accreditation bodies which are established through legislation and are mandated to look after interests of the profession including quality of education in the respective disciplinary areas. Examples include, Pakistan Engineering Council, National Business Education Accreditation Council, Pakistan Nursing Council, Pakistan Council of Architects and Planners, etc. While referring to the professional bodies, one of the participants stated:

"*We have already created five professional bodies – one in the business education, one in IT, one in education, one in agriculture and one is technology council; and the mandate of them is to work in consultation with universities/with HEC to improve the quality of those professional education at the different universities level. They are independent"* AB [Extract 169]

At the tactical level or for providing day to day feedback, there are 'Monitoring' mechanisms/units, various inter and intra-organizational review bodies/committees, accounts audit, etc.; There had been voices (Dawn, 2010)] there that each sector should undergo a periodic independent assessment. Referring to such arrangement, one of the participants stated,

"*We do have proper monitoring / evaluation mechanisms as far as development project(s) (are) concerned; we do have the quality assessment mechanism starting from self-assessment to third-party evaluations; we do have this even assessment from Pakistan,*

Government of Pakistan have their monitoring / evaluation mechanisms, there are proper audit systems, we do have commercial audits here. Similarly, the third-party evaluation like when we were going through this, the Tertiary Education Support Program – the World Bank funded project of US$ 300 million, it was a rigorous five year assessment of HEC. So, again nowadays, we are going through this US Aid Assessment of not only HEC, but all institutions." AB [Extract 170]

Furthermore, one of the participants added,

"*Whenever we go for every next year budget, we also go there and apprise the committees in different fora and we do present our case of asking the resources and then we have to justify. Similarly, if we are asking for development projects, we do have to get, kind of, I should say that assessment and evaluation from there, from the different sectors and before getting any approval, we get lot of those evaluation processes."* AB [Extract 171]

Third party reviews instituted by independent organizations such as the World Bank, independent reviews such as those by persons of eminence/journalists, etc.

Emphasizing the importance of reviews by persons of eminence, one of the participants stated,

"Credible individuals provide credible reviews"; AF [Extract 172]

Another research participant conceded:

"*I think a study needs to be done. After …the Year 2002 (sic) with HEC coming in; (assessment is needed as to) how productive … our research …has been …whether …(the) research moved towards development of … new technologies, whether …new technologies have been really used, patented. Patenting is one thing but actually using them is …(an)other thing"* AL [Extract 173].

Further signifying the importance of rankings, another participant stated,

> "*You have HEC itself, which does regular check and publish each year the ranking of different universities, ranking of different institutions based on a number of yardsticks.*" AC [Extract 174]

The demand for higher education programs/preference for a particular higher education institution is reflected in the number of applications per available seat at each of the respective institution. Moreover, the private sector institutions have to per force remain aligned with the market demands for higher end skills. As stated in the words of one of the participants,

> *"Monitoring is done by the market forces, by the employers, ..."* AK [Extract 175]

b) Assessment taking root in Universities

Within universities, review processes include a number of statutory academic (and governing) bodies like board of study, board of faculty, academic council, syndicate, senate, etc. The regular appraisal and monitoring is done through following a calendar. Meetings of the academic (and governing) bodies are held to review the state of curriculum, recommend and adopt changes, where so agreed. The referenced bodies take up inter alia, periodic revision of curriculum.

As stated by one of the participants,

> *"It is compulsory that every 3rd year, (universities) have to review the curricula. We used to have 35 year old curriculum been taught at (the) university level. It is not necessary that you have to wait for 3rd year, if there are certain changes (needed), ...we immediately call meetings of those curriculum review committees and incorporate (the required) changes."* AB [Extract 176]

Another important institution that had only lately been instituted at the universities is 'Quality Enhancement Cells'. The Cells which directly report to the Vice Chancellor/Rector of the university maintains a vigil through a multi-tier process which allows them to exercise oversight through maintaining a documented record of the university's compliance with the stated academic

and academic protocols and third party assessment undertaken by students as well as independent entities. As stated by one of the participants:

> *"In universities, we have established the Quality Enhancement Cells, now we are asking them for self-assessment, we are ranking them, we are asking students to rank their teachers, so it is becoming quite competitive.*" AR [Extract 177]

Several administrative assessments and appraisals are performed by the administrative and managerial tiers working within the higher education institutions. While the process is itself evolving and passing through a learning regime, critics opine that,

> "*The projects are monitored on the basis of an evaluation mechanism, which is been, you know sort of designed by Planning Division and which only looks at how much the money is being spent, and that is all. It does not look at whether the goals, the identified goals have been achieved even at a certain percentage.*" AE [Extract 178]

A number and variety of evaluation and feedback mechanisms provide independent assessments, and in doing so, either directly or through their influence on the decision-making processes facilitate in re-positioning of the systems by using the administrative and financial support as a bargaining tool.

In brief, there seems diversity of feedback mechanisms ranging from parliamentary oversight through its Standing Committees (of Senate, National Assembly, Provincial Assemblies), national entities like Planning Commission, Ministry of Finance, the sponsoring agencies like the Higher Education Commission, Ministry of Science & Technology (or any other line ministry for that matter), executing agencies like different organizations, universities, etc. functional units within organizations, like project directorates, various intra-organizational review bodies (governance, administrative, financial and administrative bodies, etc.), third party reviews (like World Bank, Independent reviews, ranking, etc.) It also includes entities such as accreditation bodies (like Pakistan Engineering Council, National Business Council, etc.), market (parents, teachers, employers, prospective students, etc.) independent reviews (by individuals, sections of civil society, media, etc.). Although undertaken by different entities, feedback mechanisms benefit all stakeholders; in helping realize the national or funding agency's objectives, the implementing arm

in continuing to sustain business and operations and the beneficiary community in helping the intervention and thus living up to their expectations.

The preceding discussion brings out results of the research study delineating broad strategies that tend to help in creating and managing the critical functions of higher education in the National Innovation System in Pakistan. The results transpire that while the social and cultural differences defy adopting alien constructs or the 'one size fit all' approach, they nevertheless vindicate significance of learning from those technologically developed and/or the newly industrialized economies (NIEs - e.g. Hong Kong, Singapore, Taiwan, etc.). Such examples include setting up 'entrepreneurial universities' as e.g. through providing interface(s) for better coordination among academia and industry, through promoting entrepreneurship, providing venture capital, and so forth. A number of actors including organizations, entities and individuals have been identified as having stakes and roles to play in providing feedback and in helping the NIS re-position itself to remain relevant and abreast with the economic, social, cultural and technological changes happening with passing time.

Chapter 9

9. Discussion and Conclusion

This thesis addresses a conundrum as to the role of Higher Education in the National Innovation System in Pakistan. The post-modern recognition of knowledge as an economic resource and with the advent of knowledge explosion, the role of higher education and as such universities is considered crucial in societal transformation. However, even after having over a dozen national educational polices and as many developmental plans, the role of higher education in building the National Innovation System seems an alien concept in Pakistan.

The term 'national innovation system' coined nearly three decades ago and ever since then, has been widely used among the national strategic planners, policy makers, administrators and researchers in several parts of both the developed and the developing world. However, as appears from the study, in hand, little has been realized in Pakistan in crafting one.

This thesis therefore intends to provide some insights as to understand why the concept needs exploration in the context of a developing country as the one, Pakistan. The earlier sections of the thesis began with the recollection and reflections on the origin and use of the concept of national innovation system, as it is explained in theory and is shaped in practice. They further elaborate on the role of higher education in building national innovation system. Building upon this, social constructivist approach was operationalized through conducting qualitative interviewing from the informed participants comprising of the academic elite in planning and administration of higher education, science and technology in the country. An analytical framework proposed by Groenewegen, J. & Marianne van der, S. (2006) was used for purposes of peeping into the research questions and data collection.

Understanding the role of Higher Education in National Innovation System demands a consideration of some fundamental issues in education. Therefore, this thesis explores and entails a series of processes, functions, reforms, as well as the shortcomings of Higher Education that hinders its due role in the NIS and subsequently as a building block of the knowledge economy. Moreover, it identifies actors and the ways through which national innovation processes can be coordinated and linked with higher education and vice versa. As referred earlier, this has been mainly done

through conducting semi-structured interviews with the policy makers, senior academic administrators including the incumbent and former rectors/vice chancellors of prominent national universities, senior-most echelon at the Higher Education Commission, Pakistan; Ministry of Science & Technology and the Pakistan Academy of Sciences, Ministerial Commission of the OIC on Scientific and Technology Cooperation (COMSTECH), etc. The data obtained from these interviews were corroborated in light of the secondary and archival data to add breadth to the interpretation offered by the research participants and to the analysis of results. The results obtained from these interviews were classified into nine (9) main themes, as they emerged from the data. These themes successively built upon each other to allow insight into the object under study, viz. role of Higher Education in National Innovation System. For purposes of re-collection, the nine (9) themes are stated as follows:

a) Critical functions of Higher Education in NIS
b) Setting Priorities Right
c) Building Human Resource
d) Improving Academia Industry Linkages
e) Entrepreneurship
f) Increasing Interaction and Interdependence among Actors/Institutions
g) Strengthening Institutions
h) Implementation and Results
i) Feedback Mechanisms

This chapter comprises of four main sections. *Section 1* discusses and elaborates an overview of the main results obtained from the study. *Section II* describes the implications of the thesis in general and presents a model that seems applicable to the indigenous context of Pakistan. The indigenous model intend(s) to provide a guide to the policy makers in nurturing the role of Higher Education in the NIS in the context of Pakistan. *Section III* describes the limitations and presents recommendations for future research. Finally, Section *IV* describes general conclusions drawn from the present study.

9.1 Overview of Results/Themes

The previous section of results has described in detail, the themes and their sub-themes. In this Section, I will present the key findings as these emerged from the study:

9.1.1 Critical Functions/ Objectives of Higher Education in the NIS

This query was answered in light of three sub-themes which included; Higher Education and Learning/ Knowledge Economy; Research and Development (R & D) and the Application of Research. Together, they explain different roles and functions of Higher Education in the NIS.

NIS is often perceived as a catalyst for change. Higher education institutions, since they are bastions of knowledge, are considered key actors in impelling evolution and change. More specifically, the change is brought forth through interactive and reflexive 'learning', thus making the latter a socially embedded process. The social interaction thus becomes a building block for learning and hence nurtures the knowledge economy (Lundvall, 1992). Simply put, this points to a demand orientation in the knowledge creation and its diffusion. For an academic institution, it would tantamount to a change in the pedagogical style, curriculum, assessment approach, ways through which information is disseminated and is made accessible and so forth so that the academic institutions retain relevance with their context and yet are able to steer transformation. Social embeddness of institutions including the higher education institutions emphasize their ability in contributing to the capability and capacity building. Alternatively saying, and as conceptualized, the distinct roles of the firm, government and university thus impliedly rely on the concept of 'specialization of labour'. This constitutes one key difference between the 'National Innovation System' and 'Triple Helix of Innovation'; rather than pursing 'specialization of labour', the role of university in the latter transcends to assume an entrepreneurial role i.e. creating an enterprise or as think tank advising the government inter alia, on matters relating to economic policy.

Since, the concept itself is contingent upon the evolutionary processes; for HEIs, the evolution relates to the purpose/objectives, structure, wider institutional connections of the higher education and historical processes affecting them in the country. For a country like Pakistan, the historical processes would mean both the Pre and Post-Independence era. The evolution of universities in Pakistan specifically involves framing and re-framing visions/policies to craft the role of higher education in the socio-economic development of the country. This involved a host of

operational strategies with varying levels of financial and political support extended in different spans of time. Unlike the Pre-Independence era, when the locals were not much involved in decision making, the Post-Independence era offered both prospects and challenges in setting out the priorities; in making consultations with the stakeholders and hence in democratizing the decision-making process. A lesson from the developed countries suggests that effectuating such transformation is crucial for the developing countries (Balzat & Hanusch, 2003). The historically contingent processes of organizational and institutional change, as they have evolved in the developing countries and unlike those in the developed world, are seen either facilitating transfer of knowledge from production to application or creating constellations of blocks for such transfers. The data collected for this study pointed to various structural and programmatic biases; proliferating, competing and at times conflicting interests among the economic actors, inability of the State to institute incentive structures comparable to those, in vogue, in the developed countries, e.g. those allowing private appropriation of knowledge, economic constraints either in the production or its transfer to the economic main stream, etc. Such factors are deemed affecting the systemic linkages and hence distinguish the two groups of countries (Intarakumnerd, Chairatana, & Tangchitpiboon, 2002). Hence, an understanding of the (NIS) approach is crucial for policy makers to understand and possibly effectuate roles for economic actors like 'universities' commensurate with the ability (that) they possess.

This research results highlight the significance of promoting 'Research and Development' in universities as an instrument for creating and strengthening the NIS. Roper and Love (2007), emphasized the role of HEIs and research institutes (RIs) in knowledge generation[83]. Since undertaking R&D is common to both, the HEIs and RIs are on same side of the fence; a complementarity and coordination among them means having linkages among the two. Nasierowski and Arcelus (1999 & 2000) suggest measure of the strength of systemic linkages in their ability to help realize dividends of R & D; either through increased 'efficiency', increased 'productivity' or through increasing both.

[83] This impliedly refers to the specialization of labour in the NIS

Indigenous R & D helps relate the theory to the local context. University research in Pakistan, as would be the case in any country, provides a medium of research building successively on the previous accumulations of knowledge related to the local context.

9.1.2 Innovation Systems and Higher Education Policies

As emphasized by Arbo & Benneworth (2007), universities need to identify and define their roles as instruments of social change. This requires structuring and restructuring of higher education policies. The challenge identified by this theme is in having objectivity and clarity in setting out higher education goals. This requirement is compelling as the path to innovation is complex, historically contingent and more so depends on the interaction among various actors, organizations and institutions, both formal and informal, i.e. (it is) socially embedded. Understanding reasons for coherence or otherwise, among higher education and related economic policies leads one to finding ways of making improvements and hence (the policies) keep(s) evolving. Since social processes are context sensitive, they cannot be drawn from alien environment and emulated without adaptation; they would rather require an understanding and alteration with reference to the national (or the regional) context. According to Intarakamnerd, Chairatana & Tangchitpiboon (2002), NIS in a developing country is directly related to the country's development i.e. the state of NIS is only as much developed as the state of its economic, social, science and technology development. Therefore, they recommend to expect the level of NIS development with the corresponding afforested (institutional) development. Any changes desired in the shape and/or the performance of NIS, would need changes in the institutional environment and changes in the role and behaviour of actors. Since HEIs are part of the 'narrow' innovation system (Lundvall, 2007), they tend to directly relate to the development of the NIS. Likewise, a weak NIS would constitute of weak components including HEIs. In the context of the study, in hand, this theme first examined government policies on education and more precisely the higher education and science and technology policies in the country. The participants' accounts revealed that the policies related to knowledge creation and its application through technology development came relatively late after Independence (1947) and much of it owed to the reforms introduced in the higher education sector in the country in Year 2002 and after.

This theme affirms the applicability of the experiences of early starters (e.g. Singapore, Taiwan, Hong Kong, China, etc.) in developing their innovation processes to Pakistan. Liu and White (2001) in their model suggest five activities for an economy to transition to the knowledge economy. Such activities include research, production, end-use (customers of the product or process outputs)[84], linkages and education. They (ibid) developed this model in the context of China; however, based on this study's participants' accounts, it holds valid for Pakistan, as well.

The perspective adopted in this thesis identifies an evolutionary and dynamic role for universities. Withstanding that high-end research requires a competitive environment and commensurate human and material resources; all universities, whether high-end research intensive or those serving the regional economies, are expected to play a proactive role in what has lately been termed as 'frugal innovation' (Mokter, 2017). As against 'entrepreneurial universities' creating knowledge enterprises, the regional universities are expected to address needs of low-income customers through promoting contemporary solutions relevant to industry, society in the particular resources context in which they function. Such an approach is telling in making the NIS concept applicable both to the highly industrialized and the developing economies alike.

There were other sub-themes identified in the study having bearing on either setting out or in pursuing the objectives and goals. In a country like Pakistan, where much is still desired to be set right in seeing a functioning NIS, such sub-themes included proliferation of, competing or at times, conflicting interests among the stakeholders or actors to the innovation process; lack of ability or will among the actors (to innovation) for conflict resolution, failure to identify and address biases (biases, structural, programmatic, others) and imbalances that might have crept into the national economic institutions; lack of continuity of the policies and their inability to permit catching up and for making up for the lost time; etc. A holistic and system wide redressal of several of these factors, though complex to understand, is likely to allow universities assuming role in knowledge creation and innovation through linking it with industry or society's demand.

[84] i.e. demand

9.1.3 HEIs as Intelligent Institutions

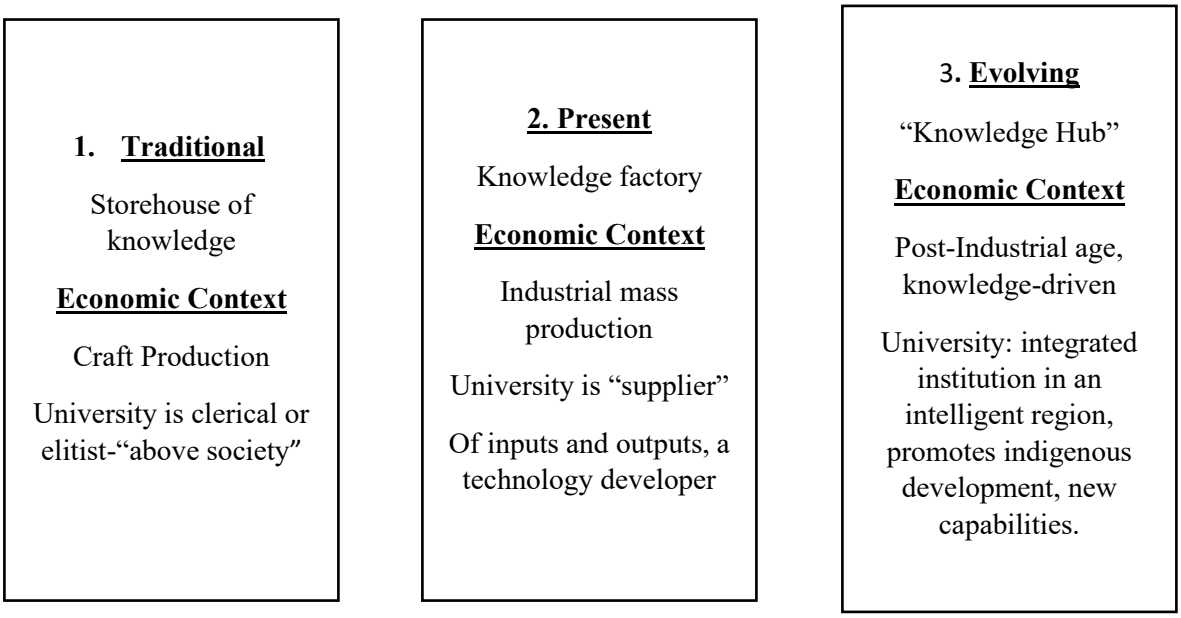
The previous theme identified either gaps or constellation of barriers in the innovation system encompassing a multitude of reasons. These include lack of objectivity in the higher education policy goals, incomplete and hence inefficient evolution of the organizational forms or of the policy reforms, lack of demand orientation, scarcity of resources, conflicting interests of the stakeholders and so forth. This theme aims at identifying broad strategies that help in creating and managing the critical functions of higher education in the National Innovation System in Pakistan. In order to do so, I propose understanding the role of universities in more detail. Universities are not merely catalysts for change, they are rather springs of inquiry, stride for the pursuit of knowledge and in finding its (knowledge) new uses through innovation; they thus act as vehicles of economic transformation. This entails a dual role of universities in that they not only serve for building human resources, i.e. perform a supply side role; they simultaneously nurture the demand side through identifying and creating newer (economic) opportunities.

In the preceding two decades or so, the conventional role of universities has started to shift from the erstwhile role as purveyors of knowledge and as bastions of research to the one creating innovation led 'knowledge hubs'. To do so requires learning from examples from technologically developed countries. (Youtie & Shapira, 2008) identify gradual evolution in the role of universities, which has changed from being the 'storehouse of knowledge' and acting as elitist ivory towers, devoid of societal linkages, to the one in which universities act as 'knowledge factories', which tend to relate themselves to the economic and social context and besides acting as suppliers of qualified workforce, create and deploy new knowledge for gainful economic exploitation. Under this new role, the universities act as wholesome institutions creating new capabilities and acting as 'learning' or as 'intelligent' institutions; ones which tend to craft newer roles for themselves with changing needs.

A relevant example can be cited from the Georgia Institute of Technology which catered to the State's efforts in making a shift from agriculture to innovation driven economy (Youtie & Shapira, 2008). Central to such innovation was the transformation of Georgia Institute of Technology into a knowledge hub (Fig. 8). This was primarily done through the emergence of new institutional leadership, building capacity, and inspiring technology based entrepreneurial development. Pakistan can benefit from an example as the one of Georgia Institute of Technology.

Training students and carrying out research relevant to the region or the society and creating interface(s) for latter's utilization creates a 'knowledge hub' university. Such a model of innovation closely corresponds to the role of university in the regional innovation system.

Fig. 9: Evolving university contexts and missions. Source: adapted from Shapira and Youtie (2004)



The above figure demonstrates an evolutionary model adapted from (Youtie & Shapria ,2008). Looking at the figure and after analyzing the data obtained in the present study, I understand that Pakistan's position lye in a transitory stage i.e. between the "storehouse of knowledge' and the 'knowledge factory.' As such, there appears a long way there to the third stage i.e. the 'knowledge hub'. One possible way to do so is through increasing interaction and creating interdependence among different tiers of education. More so, the linkages among the actors to the innovation viz knowledge creators (universities, R&D laboratories, etc.) can be improved by assigning certain key functions such as quality assurance, standards' approval, regulatory functions, etc. to these entities (universities, R&D laboratories, etc.).

9.1.4 Interface between Academia and Industry

As described in the preceding sections, the universities have, over the years, assumed an extensive role, one more developed than conventional teaching and research to functioning as agents of change. This was made possible through innovation and through transforming themselves (universities) into knowledge hubs at the regional, national, and international levels. The latter signify the difference between the universities in the developed and the developing countries and portray inability of the HEIs in the latter to assume their role and hence been able to share in knowledge creation and its application.

The linkages between academia and industry offer and facilitate a potent connection for utilization of new knowledge (Etzkowitz & Leydesdorf, 1997). University, concurrently emulating the role(s) of university, industry and the government is seen as a hybrid organization or an 'innovation fostering (hybrid) organization'. This is referred to as the 'Triple Helix Model of Innovation' (Etzkowitz & Leydesdorff's, 2000). The linkages in the first place let the principal actors to innovation (academia, industry and government) appreciate role of other actors (to innovation) which in turn help them in seeking ways, liaise and collaborate with such actors to launch a knowledge-based venture. Informal linkages among actors to innovation are seen helpful in problem solving through the use and deployment of knowledge. Once a solution is so perceptible, the prospects may be solemnized through formal institutions. Such institutions include knowledge (or knowledge based) enterprises, legal contracts/licences, or other incentive structures, etc. The solution of many social and context sensitive issues has been brought out through what is known as grassroots innovation. On a similar analogy, a term lately introduced to relate the universities' use of knowledge through relatively inexpensive problem solving approach in the developing countries is known as 'Frugal Innovation' (Hossain, 2015), According to Hossain (2015), frugal innovation is specifically devised to meet the needs of low-income customers.

A developing country context therefore entails diversion of university research towards inexpensive and local needs driven frugal innovation. This calls for the products and services to be economical, convenient to use and maintain/repair. In order to make this happen, HEIs would be required to develop coordination, liaise with the communities and undertake needs assessment, adopt a problem solving approach, possibly through crafting incentives structures be as little as

earning credit (by students) for part or whole of a course or so forth, and cater to the needs of region/communities around them through knowledge inputs. The ability to exploit knowledge would in turn help the local institutions and industry becoming competitive. Since the developing countries offer a comparative advantage of lower costs of qualified and skilled human resource, these countries stand a chance to gain ground, on such premise (i.e. lower costs) in the international trade, as well. This signifies that universities, besides engaging in cutting edge research and its dissemination and application, needs to invest, as well, in generating human capital which can build upon the stock of indigenous knowledge and channel it for economic exploitation through frugal innovation. The concept of 'frugal innovation' is thus an innovation in itself and acts as a focusing device to help empower the universities in developing countries for engaging with the community and local industry around them.

Two of the important actors defining the role of higher education in economic policy planning and administration include the Planning Commission of Pakistan and the Higher Education Commission, Pakistan. The two are therefore better placed to devise an incentives package for promoting academia-industry linkages. Realizing this, the sectoral Vision 2025 crafted by the Higher Education Commission, Pakistan (2017)[85] in line with the national Vision 2025, the latter crafted by the Planning Commission of Pakistan (2014), vies to make a distinction and develop new universities as research universities (Tier I), comprehensive universities (emphasizing producing quality professionals and emphasizing skills building) ~ (Tier II) and community colleges emphasizing technical and vocational skills building (Tier III). The latter two calls for maintaining focus of research with the indigenous knowledge base and use it for solving issues relevant to the geographic environs in which they are located. An economical solution to the local problems is likely to be enduring and build trust in the value of university research and innovation.

There are examples there albeit in other economic sectors, where endeavors were made, in the past, e.g. those taken up the Ministry of Information Technology & Telecommunications, Government of Pakistan back in 2002-03. Programmtic innovations made to simplify certain bureaucratic processes under the garb of E-Governance initiative made the governmental quarters more accessible and transparent. These included placing various governmental forms/permission

[85] www.hec.gov.pk accessed on June 18, 2017

grant processes online and displaying the merit order and status of processing of the applications/permission requests e.g. those relating to the public utilities, public procurement and recruitment processes. (Hussain, 1999) while discussing issues pertaining to improving transparency in governance opined that such changes could not be sustained overtime since changes were still alien to the societal attitudes and cultural practices. This relates to the significance of changing mental models as important institutions bearing upon the diffusion of knowledge and promotion of innovations. This in turn calls for a role of the HEIs as learning and as such change agents in regulating mental models. One possible way to improving communication between university and industry and in turn increasing inter-dependence among them is through modifying the personnel/human resource policies in the two (sets of) organizations. Allowing researchers from industry to work in academia and vice versa are expected to allow personnel acting as knowledge-transfer agents. This would in turn help the two (university and industry) in bridging the communication gap among them. Withstanding the foregoing, such knowledge transfer programs are necessary but not sufficient to turn around the innovation system. The following section further explores the significance of knowledge in promoting (knowledge-based) entrepreneurship.

9.1.5 Universities as Actors in NIS and Agents Promoting Entrepreneurship

The previous sections discussed the transformative role of universities, i.e. one providing traditional education and undertaking research to relatively recent role of spurring innovation and acting as knowledge-hubs. The neo-liberal character of higher education has brought to the fore a new role through promoting entrepreneurship and even what have come to be known as 'Entrepreneurial Universities'. Entrepreneurship, practiced by individuals, is a societal trait that capitalizes on economic exploitation of knowledge through innovation. Since higher education institutions are the sanctuaries of knowledge, they are potential powerhouses of driving innovation (Breneman, 2005). The oft cited preference for increasing 'access' to higher education (as under the Post 2002 reform in Pakistan) *per se* bears upon the notion that higher education would make more number of people upwardly (i.e. economically) mobile which would in turn bear positively on the economic affluence of society and hence the nation. This requires, *inter alia*, demand orientation of the academic program or slightly re-phrasing it; making curriculum and pedagogical practices

relevant to the industry (or society)'s needs. Linking demand with supply though still a classical economics issue, it allows economic exploitation of knowledge and thus defines the post-modern character of 'higher education'. The private appropriation of knowledge through innovation and entrepreneurship conforms to the neo-liberal character of higher education as well.

Withstanding the national idiosyncrasies, Pakistan can learn, say from Singapore's transition towards knowledge economy that has happened in the preceding two and half decades. According to Wong, Ho and Singh (2007), Singapore's universities have given increased importance to the industrially relevant research, technology commercialization and high-tech spin-offs in stimulating economic growth. National programs like A*Star[86] requiring research to be aligned with the national needs and the envisaged competitive advantage of the city State are noticeable. Pakistan is home to some 207 Million (2017)[87] people with 2/3rd under the age of 30. Adopting 'Entrepreneurial University Model' would not only allow reaping the population dividend but in instituting incentives package for private appropriation of knowledge. It would potentially help in spurring knowledge-based economic development. Etzkowitz, Webster, Gebhart, and Terra (2000) have argued that universities around the world are increasingly shifting towards the 'entrepreneurial university model' as against their traditionally accepted roles of undertaking teaching and fundamental research. This is mainly done through the commercialization of knowledge and through creating knowledge-based ventures.

The deployment of Information and Communication Technologies (ICTs) in academia and HEIs has become ubiquitous in the recent years. The concepts of '*globalizing learning economy'* and '*knowledge-driven economy*' are oft cited. ICTs not only support and aid in learning and teaching, they rather have a role in aiding research and its dissemination (Vajargah. Jahani, & Azadmanesh, 2010). For Universities to act as agents and actors of (change and) innovation, they need to equip themselves with the trending ICTs. The developing countries lack of access to the latest genre of ICTs is one reason for their inordinatly slower pace of learning and transformation. Not only that procuring the trending ICTs adds to heavy price tag, they merely are not available or

[86] Agency for Science, Technology & Research, Singapore

[87] National Census 2017, Statistical Bureau, Government of Pakistan, Islamabad.

involve inhibiting transaction costs (Williamson, 1998) for the developing countries. The alternative is to develop them indigenously, which in turn is affected by the heavy transaction costs of not having access to the modern technology and qualified human resource. The concept of frugal innovation as discussed in the previous section would be a feasible alternative for a country like Pakistan.

Last but not the least, the role of Research and Development (R & D) in the economic growth is long appreciated in developing the innovation systems (Khan, 2010). However, prior to 2001, research was not a priority in Pakistani academia. Kwack & Yang (2006) among other indicators found spending on Education and Scientific R&D as major determinants of the long run economic growth in South Korea. On a similar note, Dahlman and Nelson (1996) contend that most critical element of any successful development strategy is the development of human resource.

They contend the significance of other resources as well including finances, institutions, knowledge infrastructure, cognitive capital (itself a function of qualified human resource)**, s**ocial capital (the societal norms of trust, honesty, integrity, and so forth), as well as management of these resources (ibid). A plausible strategy to combat many systemic ills that mar the flow of knowledge from creation to diffusion would require policies that address skills development, supply of capital, easy conditions for entry and exist into business, etc. to help fight, illiteracy, poverty, unemployment and social exclusion.

The next section presents components of an indigenous model of innovation as a possible guide for Universities to contribute their due role in the context of Pakistan.

Table 9.1: Actors & Mechanisms Creating Role of Higher Education in NIS in Pakistan: Indigenous Model

Function 1 – Policy Making, Administration & Implementation	
Layer – 1	**Strategic Direction & Innovation Policy Formulation:** Parliament, Cabinet, Prime Minister's Office, Planning, Development & Reforms Division, Ministry of Finance, Economic Affairs Division, Interprovincial Ministerial Committee[88], Ministry of Federal Education and Professional Training, Ministry of Science & Technology, Higher Education Commission, Chief Minister's Secretariat, Provincial Higher Education Departments/Provincial Higher Education Commissions–Punjab & Sindh , Provincial Planning Board, Provincial Finance Department, etc.
Layer – 2	**Innovation Policy Administration** (Ministry of Federal Education and Professional Training, Higher Education Commission, Ministry of Science & Technology, Provincial Higher Education Commissions – Punjab & Sindh, Provincial Higher Education Departments, Think Tanks
Layer – 3	**Innovation Policy Implementation:** Higher Education Commission, Universities & Degree Awarding Institutions (DAIs), Degree Colleges, Public Research Institutions including those involved in imparting higher education, Not-for-profit social organizations

[88] The overarching constitutional body mandated to oversee maintaining standards and curriculum administration across the country

Layer – 4	**Strengthening Formal Institutions** (Prime Minister's Office, Planning, Development & Reforms Division, Ministry of Federal Education and Professional Training, Ministry of Science & Technology, Higher Education Commission, Provincial Higher Education Departments/Provincial Higher Education Commissions – Punjab, Sindh; Instituting Think Tanks/Public Debates, Civil Society

Function 3- Knowledge Exploitation

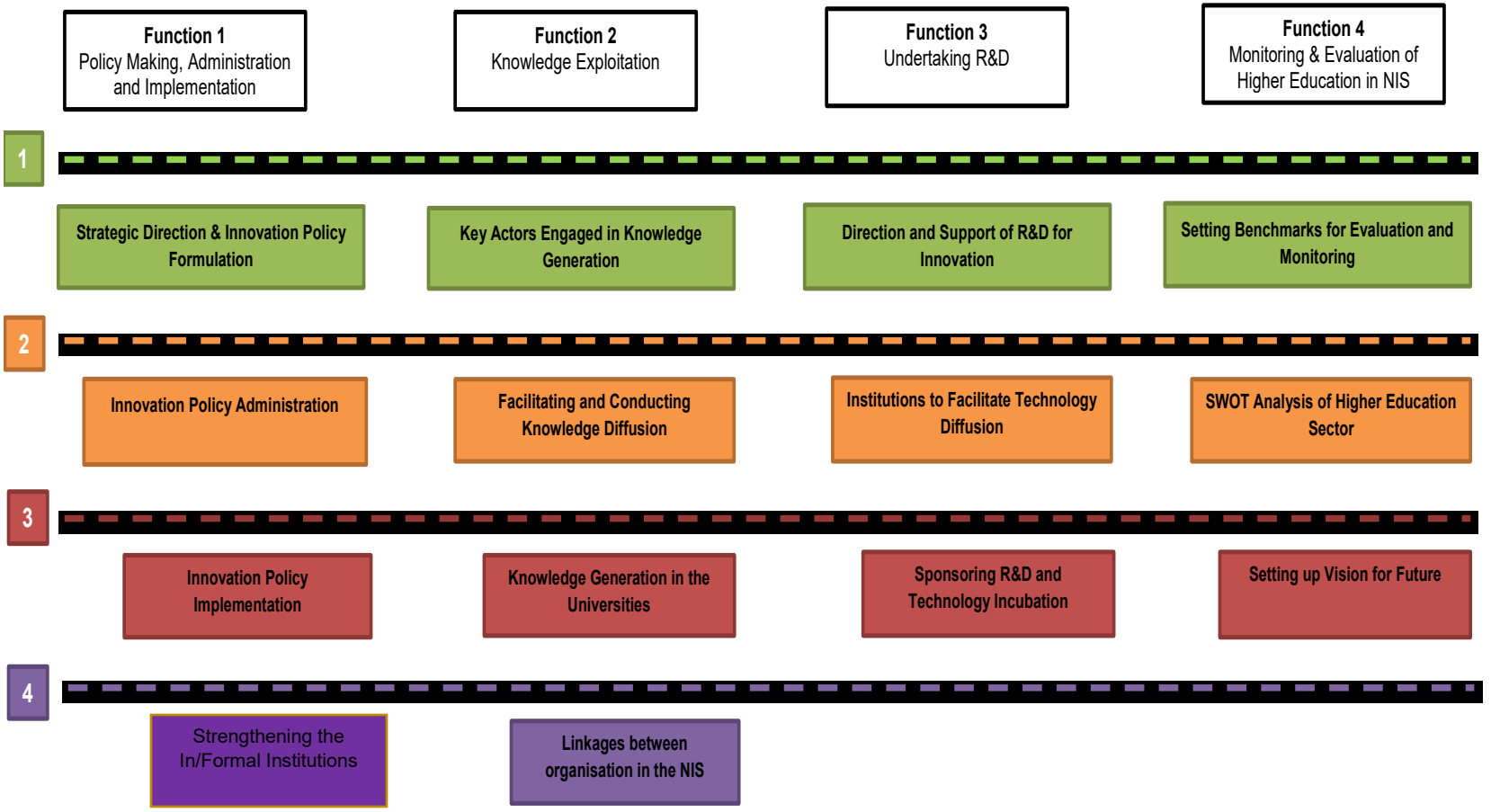
Layer–1	**Linkages with Knowledge Generation:** Academics/Researchers, Universities/DAIs/Degree Colleges, Under Graduate/Graduate/Post-Graduate Students, Industry Associations, Business Councils, Professional Accreditation Bodies, Knowledge Incubators, Firms/Businesses/Not-for-Profit Social Organizations, Banks/Financial Institutions
Layer–2	**Enabling and Facilitating Knowledge Diffusion:** Personnel Exchanges across Industry/Academia (incl. sabbaticals, Internships), Industry Employing University Graduates, Intermediary Organizations like consulting firms, technology brokers, venture capitalists, angel funds/ managers
Layer–3	**Mechanisms of Research in Universities:** Graduate/Post Graduate programs, Fundamental & Applied Research Programs, Developmental/Translational Research, Topical/Issue Based/Contract Research, Collaborative Research, Publications, Patents
Layer–4	**Linkages between Organisations within the NIS:** Knowledge-based entrepreneurial enterprises, Research/Commercialization of knowledge/technology programs, Competitive Research Grant Processes, Scoping & Demand Studies – Feasibility & Business Development Studies, Business/Technology Niche Identification; New ways of organizing inputs either through enticing academia and/or industry, entrepreneurs, Universities, Firms, etc. Tax Incentives, Angel Funds, Venture Capital, Enabling Policies

Function 2 Systemic Linkages between Higher Education and other Economic Policies	
Layer 1	**Direction and Support of R&D for Innovation:** National Economic Vision e.g. Perspective/Strategic Plans, HE/S&T Policies/Sectoral Polices, 5–Year Developmental Plans, Annual Plans; International/Regional Commitments, Trade/Technology Transfer, Contemporary/Strategic and Indigenous/Topical Research, Financial Allocations;
Layer–2	**Facilitating Technology Diffusion:** Laws such as Competition Laws, Intellectual Property Rights/Protection Laws, Patent Laws, Laws Promoting Technology Transfer e.g. those emulating Bayh Dole Act in US, Rules, Scoping & Demand Studies; Universities, Research Institutes, Intermediary Organizations highlighting Demand e.g. consulting firms, training providers, technology brokers, venture capitalists, angel investors, Technology/Business Proposal Competitions, Firms, Business Council, Industry Associations, Cross Disciplinary Coordination Mechanisms
Layer–3	**Sponsoring R&D and Technology Incubation:** Federal Government through MoST, HEC, Universities; Provincial Government and entities like Pakistan Science Foundation, Ignite[89] , Lahore Knowledge Park/Other similar entities; Technology Intermediary organizations e.g. consulting firms), Scoping/Demand/Feasibility Studies

[89] A Government controlled Fund established through mandatory contribution by all telecommunication service providers in an amount of 1% of their gross annual revenues

Function 4: **Feedback for Repositioning**	
Layer–1	**Setting up Framework for Accountability:** National entities like Parliament through Public Accounts Committee, Planning Commission, Prime Minister's Office, Ministry of Science & Technology, Higher Education Commission, Universities, Project Directorates/Project Management Units, Think Tanks, Civil Society through Persons of Eminence/Media, etc.
Layer–2	**Administration of M&E – Monitoring & Evaluation:** Setting out KPIs – Key Performance Indicators, Conforming Institutional Policies for Intellectual Property Proceeds & their Appropriation for the Researcher (Patent/Licensing Income Appropriation), Measures for Enhancing Business Expenditure on (University) Research and Development
Layer–3	**Feeding Back the Decision Makers:A**ssessment reports (regular & periodic) instituted by supervisory entities as stated in Layer 1/above and those by professional accreditation bodies like Pakistan Medical & Dental Council, Pakistan Engineering Council, etc., independent/third party assessments like ranking/league tables by national & international entities, scholarly research/impact assessment studies, etc.

Fig. 9: Indigenous Model for Creating Role of HE in NIS in Pakistan



9.2 Indigenous Model on the role of Higher Education in the NIS for Pakistan

This thesis primarily identified and explored a less investigated link between higher education and its role in the NIS. It further explored the appropriateness of NIS for a relatively less developed economy (Wong, Ho & Singh, 2007). Besides being a developing country, Pakistan is considered less successful in technologically catching-up with the developed world as compared with certain other countries in the region which were at similar levels of development some five (5) decades ago. Such countries include China, Hong Kong, Malaysia, Singapore, South Korea and so forth. Research did identify the role of higher education in stimulating change and in creating knowledge economy (Roorda, S.T., 2013; Leydesdorff, L., & Zawdie, G., 2010). The participants' accounts, collected during the course of study, entail that nurturing the role of universities in building NIS or their role in promoting innovation remained fragmented and weak in Pakistan. Even a basic pre-requisite in building technology savvy or skilled workforce remained an unfulfilled dream. This was, in part, due to the mismatch between the curriculum followed and the skills needed by the employers/job market and due to the research undertaken at the universities which was, at large, not relevant to the industry's needs. Looking at it at from the macro perspective; the national economic planning could neither foretell nor plan for a preeminent role for higher education in building systemic relations among its creation, dissemination and diffusion. The fragmented and at times incommensurate targets set-out for different socio-economic sectors created mismatch among the sectoral policies and the (economic) developmental plans[90]. The incongruence did not help in creating interdependence and hence could not strengthen the systemic linkages among various actors and institutions expected to play (their) role in spurring innovation. Barring rhetoric, there appeared a lack of understanding and will, rather there appeared an indifference, in realizing knowledge as resource; and as consequence thereof, in underplaying the role of higher education institutions as key actors in promoting economically gainful utilization of knowledge. Therefore, this thesis brings forth the recommendations with the help of primary data collected during the course of study, published literature and archival secondary data, an indigenous model in crafting the role of Higher Education in the NIS in the historical, socio-cultural and institutional context of Pakistan.

[90] Economic development (5-Year) plans constitute the principal conduit for channeling resources for realizing the developmental targets of sectoral policies

As the literature suggests, NIS is a multifaceted and a multilayered concept (Groenewegen, J. Steen, M. van der, 2006; Werle, 2012). Therefore, the indigenously developed model described in Table 7 identifies different institutional layers, institutions, actors that would define an innovation system including the higher education institutions. The aim of this explanation is three-fold:

(a) To identify and address current weaknesses of the NIS and exploring ways for strengthening innovation systems through activating the role of universities in Pakistan;

(b) To provide Higher Education Institutions a 'rough guide' in defining roles and interface with other actors, organizations and institutions and in building NIS in Pakistan; and

(c) To identify the key policy mechanisms for universities in knowledge dissemination, generation and its exploitation.

9.2.1 Function 1: Policy Making/Setting

Among key initiatives, foremost are to develop legislation and policies for creating the National Innovation System. I would suggest taking it up at two levels; viz. first identifying actors and then instituting various measures by them. Identifying actors would require recapitulating the role of organizations responsible for promoting 'Innovation Policy', such as, the Parliament, Cabinet, Prime Minister's Office; Planning Commission, Ministry of Finance, Economic Affairs Division, Ministry of Federal Education and Professional Training (formerly Ministry of Education); Higher Education Commission; etc. Creating coordination and interdependence (among various policy actors to innovation) would require, inter alia, establishment of hybrid and representative groups who are allowed to function in democratic manner i.e. one in which all stakeholders deliberate freely (following the essence of democracy) and (hence) participate in decision making; are bestowed authority to translate their vision into programs and to translate these into action. The policy setting and supervisory organizations/entities would play an imperative, top down role in mandating and assisting the HEIs (and research institutes) in making linkages with a multitude of socio-economic sectors and actors (such as other institutions, industry, other universities, various sections in the civil society, etc.) to help create the NIS.

9.2.2 Function 2: Knowledge Exploitation

Knowledge exploitation is a key function in the NIS that provides link between already available or newly created knowledge and its gainful utilization. It therefore denotes an important role for the universities in the NIS in Pakistan. Table 7 lists key actors engaged in knowledge generation; these include, but are not limited to, the individual and organizational actors such as, Academics/Researchers, Under Graduate/Graduate/Post Graduate students, Universities/DAIs/Degree Colleges, Knowledge Incubators, Firms/Businesses/Not-for-profit social organizations, Think Tanks, Industry Associations, Business Councils and so forth. A stock-taking of the contemporary system of higher education highlights presence of many of these actors there in the country, however, skepticism prevails as to the presence of several of these only as namesake entities, rather than functioning organizations and due to the absence of linkages among different actors, organizations and institutions promoting knowledge appropriation, entrepreneurship and innovation.

Building a functioning NIS requires enabling the processes of knowledge exploitation and diffusion in the country. In this regard, there are lessons for Pakistan to learn from the experience of Newly Industrialized Economies (NIEs). In an example from Singapore, she made transition from manufacturing (electronics, engineering goods, biomedical equipment and products, etc.) to process-intensive industry (publishing, chemicals, oil refining, etc.)[91] to the knowledge-based economy (Information Technology services, banking, entertainment, etc.) in the recent decades. According to Wong, Ho and Singh (2007), Singapore's universities have emphasized on taking up industrially relevant research, technology commercialization and high-tech spin-offs in stimulating economic growth. Another relevant example from Singapore includes her incentives program in attracting qualified personnel from overseas including foreign students[92] and ~~as well~~ faculty with an entrepreneurial approach. Another example from Singapore is the development of 'Entrepreneurial University Model' (Etzkowitz, Webster, Gebhart & Terra, 2000). Emulating and adapting this experience, Pakistan can possibly recognize 'knowledge' as an economic resource and benefit

[91] Concurrent with the boom on process intensive industrial investment, there was a construction and real estate boom that promoted commercial activities such as wholesale and retail trade, expansion of financial, transport and communications services, etc.

[92] e.g. A-Star program attracting highly talented overseas students to study at universities in Singapore by offering them fully funded scholarships.

through creating knowledge-based enterprises for her economic development. The results of this study vouch for such strategy and its relevance for Pakistan. It was oft-cited by the research study participants as a possible way to nurture and harness the university-industry linkages. In this regard, role swapping among the personnel at the university and industry is one way to promote knowledge exploitation. Besides looking at the tail-end of the innovation continuum i.e. from creation of knowledge, its dissemination to exploitation of knowledge, universities can extend their (institutional) pursuit for assuming a role in the NIS through recruiting students, researchers and faculty with a flair and understanding of the gainful economic exploitation of knowledge. However, since the awakening of universities in Pakistan has only been a recent phenomenon, the measures adopted at the national level are still inclined more on the supply rather than the demand side, such as investing in people to strengthen the universities with quality faculty and in turn making them a preferred choice for attracting good quality students. This is in line with Nelson and Dahlman Nelson (1995) when they contend that most critical element of any successful development strategy is the development of human resources. The measures introduced in Pakistan include those like;

a) Placement of university faculty for advanced education abroad through offering them scholarships;
b) Mobility grants for university faculty for short, medium and long term (such as post-doc) training abroad; and
c) Research grants for pursuing (research) endeavours both within the country and abroad.

Moreover, in recent years the Higher Education Commission has taken substantive initiatives in promoting research, innovation & commercialization. The specific measures include setting up Offices of Research, Innovation & Commercialization (ORICs) in Universities, establishing Business (and Technology) Incubation Centers (BICs & TICs), support for patent filing, establishment of Technology Development Fund (TDF)[93], University-Industry Technology Support Program (UITSP), etc. The UITSP program is analogous to emulating (and crafting) the 'Entrepreneurial University Model' as it proposes that researchers, preferably having PhD degree and research collaboration with entities at home and abroad, work with the local industry to solve

[93] To take up research on contemporary issues warranting scientific research

indigenous problems. Such efforts offer better pay off when made in emerging areas or in areas in line with the national priorities such as those relevant to national security, environment, climate change, or are in line with other socio-economic needs of the country.

The preceding paragraph sheds light on some of the efforts made by the HEC in promoting academia-industry linkages. However, still more needs to be done by the universities to be competitive. The measures would include fundamental reforms in the curriculum and pedagogical practices to allow fulfilling industry's demand of knowledge and skills, appreciate and allow enhanced role of the private sector in undertaking research and development, establishment of knowledge hubs and so forth. The idea of setting up knowledge hubs through the use of ICTs is emphasized by Vajargah, Jahani, & Azadmanesh (2010) and is underscored as well by the research study participants. However, as argued by Lundvall (1992), national differences in the innovation processes and differences in national idiosyncrasies must be taken into account. Keeping in view the abysmally low levels of R&D, and that too concentrated in the public sector, the private sector's involvement in R&D is still missing and an area of possible public policy intervention. I intend to further dilate upon it in the succeeding section.

9.2.3 Function 3: Undertaking R&D

Notwithstanding that prior to 2001, research was not a priority in the universities in Pakistan, the role of Research and Development (R & D) has long been appreciated as key characteristic of the innovation systems (Khan, 2010). Kwack & Lee (2006) among other indicators, found R&D and investment in education as major determinants of the long run economic growth in Korea.

Acemoglu et al. (2005) differ from North (1991) in that he contends that the political institutions would be more important in determining de facto and de jure political power in a society as against (only) the institutions protecting property rights. They call this framework as hierarchy of institutions which particularly emphasizes that politics, structure of political power, and the nature of political institutions can actually explain why different countries have different economic institutions and subsequently different economic outcomes.

There are number of pathways in taking up R&D and in building systemic linkages. For such purpose, I suggest that the following needs to be taken into account:

a) Through evolution of the historically contingent processes: Building virtuous or vicious cycles depends on whether systemic linkages create synergy among different actors, institutions, organizations and policies or they create constellation of blocks including those which nurture mistrust and/or adversarial relations among them.
b) Investing in science and technology: This can be realized through increasing investment in human resource development, research and development, capacity building and institutional development in areas of national significance (and) to gain competitive advantage. The efforts enunciated in the higher education sector under auspices of Year 2002 reforms did subscribe to the significance of public policy in this regard.

c) Exploring prospects of application of new knowledge: This would be realized through building user-producer linkages or responding to products (or services) demand while conceiving and undertaking national programs of research (and development). Possible way to build capacity at the national and institutional level may be realized through building research collaboration(s) with researchers from developed countries. The developed country experience in building relations between research and its transfer to industry may be emulated through indigenizing linkage mechanisms within the national country context. Such measures would have to be initially incubated before market forces are able to sustain them overtime.

9.2.4 Function 4: Evaluation & Monitoring

As they say, the taste of pudding lies in eating; feedback obtained from implementing the higher education and related socio-economic policies appear helpful in revising and making these relevant to the national needs. Appraisal, monitoring, assessment and evaluation processes instituted at multiple levels of governance (parliament, national, sectoral and institutional e.g. universities, civil society networks, think tanks, etc.) tend to bring out multi-stakeholder perspective both from the baseline standpoint as well in making comparisons with other countries on a number of counts including those signifying the existence or otherwise of innovation systems. A number of input and

output indicators are defined in the Frascati Manual[94], Global Competitiveness Report[95], etc. Such indicators indirectly provide a feedback for providing guidelines in re-aligning the functions, capabilities and roles of different actors to the innovation system. By addressing the specifics of the role and the context within which institutions function in Pakistan, more nuanced and indigenously appropriate policies can be devised and administered through using feedback from external as well a number of internal mechanisms, as referred above. The application of analytical methods (such as SWOT analysis) or in-depth studies rooted in scientific data also provide alternative ways to get feedback and thus reposition the role of Higher Education in NIS in the country.

9.3 Limitations and Implications of the Study

The concept of National Innovation Systems and the role of the HEIs was used as the starting point for this thesis. This was largely premised on the original conception of national innovation system explained by Lundvall (1992). The 'Introduction' section briefly explored major theoretical perspectives linking innovation and economic development (Lundvall, 1992; Freeman, 2002). This starting point largely reflected Western construct or the theoretical approach to the national innovation system. As seen in the literature review, the role of HEIs as an actor to the NIS is much less explored. The glaring gap in the literature thus offered an opportunity to explore the role of higher education in national innovation system. The study, in hand, intended to make such exploration especially with reference to a developing country and underscored the case of Pakistan,. I would concurrently recommend the need for similar studies in other countries both within South Asia and beyond. This is expected to add to the diversity of knowledge base in better understanding the role of higher education in improving national competitiveness and in building knowledge economy. In the present study, effort is made to understand HEIs' role in the national innovation system through interpreting historical contingencies, evolutionary processes, the advent and co-evolution of technology through interaction with institutions and other actors to innovation. The

[94] The Frascati Manual was published and is updated by the OECD; it was last updated in 2015. It defines and uses methodology for collecting R&D statistics, and is meant to keep the science and innovation policy makers informed worldwide.

[95] Global Competitiveness Report is published by the World Economic Forum; the last one was published in 2018. It defines and uses a number of variables to rank different countries in terms of their (economic) competitiveness.

instant effort though preliminary, is one step, in appreciating the historical, socio-economic and cultural context of the role of higher education institutions in the wake of ever changing economic and social milieu in Pakistan.

Another limitation of the present research owes to the proliferation of the theoretical 'construct' of innovation systems (see for example Lundvall, 1992; Freeman, 2002; Nelson & Winter 1993; Niosi, 2008) making it a fluid concept (Sharif, N., 2005). Further ado, the concept has issues with 'operationally defining' and 'empirically measuring' NIS. This limitation leads to lack of an agreeable characterization and hence control over what a 'national innovation system' entails in the first place. On a similar analogy and to my knowledge, there is barely any research that has been carried out to analytically or empirically gauge and measure the theoretical propositions for NIS in Pakistan. This posits an opportunity in itself. However being the first of its kind study, as the one in hand, the scope of this study is fairly encompassing delineating the choice of methodology and the methods adopted in exploring the (NIS) perspective.

Concurrently, the research questions (also) guided the choice of methodology in favour of using the 'social constructivist' approach. In order to evince informed insight into object of the study, reliance was made on 'elite interviewing' as tool for primary data collection. The viewpoints of policy makers, administrators, senior academic administrators and people holding important positions in institutions relevant to the subject area of study were interviewed. Alongside, reliance was made on archival data and iterative analysis of the data was undertaken whilst combining techniques of thematic analysis and interpretative phenomenological analysis. These methodologies strengthened my (researcher's) understanding of the social embeddedness of HEIs in the society, their role in the indigenous context of Pakistan and afforded simultaneously both an in-depth and wider appreciation of the phenomenon. However, as for any other qualitative technique, elite interviewing is not without its criticism. One such limitation is the tendency of participants to respond is a socially desirable way. This was partly undone through the researcher's personal rapport with majority, if not all, of the research study participants. Careful consideration was also made in framing questions at the design stage (and in light of the feedback obtained during the pilot phase of interviews) to evince their interpretations (i.e. primary data) in as much frank and candid manner, as was practicable. This was partly done through asking questions where possible answers would

allow citation of cross references. This was done even at the cost of repetition of interview questions and through extempore prompts during the interview process to possibly evoke detailed responses from the research participants.

Another limitation of interviewing is the 'interviewee effects'. All, but one interviews were conducted with 'male' research participants, reflecting on the one hand a predominant 'male interviewee' perspective; it also reflected that there were too few women who might qualify for the sampling criteria adopted for the study. A detailed note on the *positionality* and *reflexivity* is provided in the 'Methods' section to minimize the chances of interviewee effects. However, any such effects are hereby acknowledged to be part of the conduct of interviews.

Another concern relates to transcribing and interpreting the data. The data transcription and analysis are undertaken by the researcher with inputs and feedback obtained from both the supervisors. To avoid interviewer's bias in interpreting the data, a detailed '*verbatim*' written transcription is made part of this research study's exposition. The nodes were arrived at using NVivo 10 software followed by manually clustering them into sub-themes and themes (i.e. data reduction). As stated above, the quotes bringing out averments and interpretations are reproduced verbatim, while taking up analysis of the results, to ensure transparency and allow the reader an opportunity to draw one's own interpretation or to cross-validate them.

Moreover, the sample used for the present study focused on experts holding key positions in the higher education institutions, Higher Education Commission, Pakistan; the Ministry of Federal Education & Professional Training, and so forth. These represent urban educated administrative elite in Pakistan's higher education i.e. they represent the supply-side institutions based either in the federal or the provincial capitals of Pakistan. Nearly 190 universities currently working in Pakistan though offer more diversity in terms of regional and disciplinary representation. The representation of industry as prime users of the trained workforce and research produced by universities was not included in the scope of present study to keep it manageable in terms of available resources and the time constraints. In some of the subsequent work on this subject, I would recommend inclusion of key representatives from industry as well to find ways where both academia and industry (may) collaborate to exploit knowledge, in turn, working together for creating knowledge-based economy and in strengthening the National Innovation System. This appears entailing more empirical

research so as to be able to generalize the findings for an insightful understanding of the phenomenon. More representative data is expected to elicit further information on the salient role of Universities in creating, garnering and disseminating knowledge and in building knowledge economy. Nonetheless, the study understandably sheds light on the conceptualisation of the role of HEIs in the National Innovation System as an indigenous construct in Pakistan. It provides a notable contrast to the Western perspective and models in ways universities contribute towards building and strengthening the National Innovation System.

9.4 Conclusion

The aim of the research was for finding ways as how do universities contribute their share in building and strengthening the National Innovation System in the indigenous context of Pakistan. It was per se intended not to produce a widely generalizable theory. Following paragraphs summarize succinctly the main conclusions drawn from this study.

The indigenous perspective differs from the Western construct of National Innovation System. Therefore, an approach in sync with the national context and institutions including those ascertaining power relations i.e. political institutions have the capability of empowering universities for assuming and strengthening the National Innovation System.

Setting up national innovation system is not a linear process and does not occur in discrete lumps of any transfer process. It rather unfolds itself in the form of intertwined institutional layers, resources, R&D, policy making and above all political support. Therefore, to study and implement innovation systems one must take into account a 'holistic' approach; as well as studying the phenomenon as its 'constituent' parts. Thus, in order to find ways for contributing the HEIs' role in the national innovation system, such institutions need to take steps for exploiting knowledge for gainful economic purposes. The use and deployment of knowledge for gainful economic purposes is needed not only to create knowledge-based enterprises but for solving the society's problems through use of new knowledge and for wealth creation. In the context of a developing country like Pakistan, which is a technology laggard, I would suggest making use of the 'frugal innovation'. The latter concept may be used as an initial step to allow the universities assuming local and regional focus for solving society's problems. An upward mobility in building nexus with the inter-regional and at the national level would possibly improve as the ability of universities increase in

understanding issues and in crafting their respective research agendas in line with the national needs. To do so, it requires a demand orientation in crafting the research agendas, which in turn is possible through bridging academia-industry divide and devising platforms where the two important actors to innovation may interact and liaise with each other. Role of the government remains a pre-dominant stimulus in this regard. It is noteworthy to reconcile that Universities are the supply side institutions; the demand-orientation or a neo-liberal character would have to be built as part of changing their cultural ethos through building trust and through nurturing a mutually rewarding relationship with industry. Alongside, the Universities can play role in human *capital formation and through allowing private appropriation of knowledge, the latter a strong impetus in itself,* through defining national and institutional policies (such as those related to Intellectual Property Rights, Patent Filing, Licensing, etc.) and hence transform the Universities for an entrepreneurial model of innovation.

Since this study is a maiden effort in understanding University's role in the innovation systems, therefore it is not a definitive word; rather a guinea pig in developing an inductive approach that needs to be debated, applied, empirically tested, improved, refined and re-applied. This thesis is expected to provide a possibly viable stimulus, for future researchers, in putting up a workable framework and to test its potential and limitations.

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Annex-A

Interview Guide

I am currently pursuing 'PhD Degree Program' at the School of Management, University of Leicester, United Kingdom. The title of my dissertation is 'Role of Higher Education in National Innovation System[96]: Case of Pakistan'. Briefly, the proposed study seeks to explore the primary functions of higher education in NIS; the broad strategies that can be employed to effectively create and manage those functions; the actors, institutions and linkages within the system that collectively implement those strategies; and, the monitoring, evaluation mechanisms that bring a feedback / consequent repositioning of the higher education system in the NIS.

As against the premise on scarce resource allocation (in classical economics), innovation patterns are driven by the interactive processes among the institutions and actors promoting learning and competence building. The concepts like co - evolution, cumulative causation, path dependency, periodic quantum change(s), and power of interest groups to maintain status quo or otherwise[97] will be used as focusing devices to provide insights into the higher education sector of Pakistan.

In order to evince answers to the questions below, reliance would be made on the lived experience of the select participants; premise being that knowledge is socially constructed. The worthy participants are expected to contribute through providing detailed description of happenings, their context and a first-hand analysis to allow a fair synthesis which is likely to transform into new knowledge on the subject.

Following questions will be asked, but not in any particular order:

1. What in your opinion is the relationship between present higher education / S&T sectors of Pakistan and the colonial past? ~ Context & Question 1

[96] NIS is regarded as the set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and provide the framework within which governments form and implement policies to influence the innovation process. As such, it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artifacts which define new technologies. [Metcalfe, J. (1995), 'The Economic Foundations of Technology Policy: Equilibrium and Evolutionary Perspectives', In: Stoneman, P. (Ed.), Handbook of Economics of Innovation & Technological Change, Oxford: Oxford University Press].

[97] Groenewegen, J. & van der Steen, M. (2006), 'The Evolution of National Innovation Systems', Journal of Evolutionary Economics, Vol. XL, Issue 2: 277 - 285.

a). Had there (ever) been an express attempt to design and subsequently implement an independent and sovereign education / higher education system?

b). If so, when and how?

2. What have been the objectives / key incentives in the design of education / higher education policies in Pakistan? ~ Question 1

    a). Please advise whether there had been some periods of shift?

    b). If so, when and what they have been for?

3. In your opinion, had / is there been a match between academic programs run by universities and skills needed by the job market / economic mainstream? ~ Question 1

4. Whether linking of university research with its economic applications ever got precedence amongst national economic policies? ~ Question 1 & 2

    a). Whether funds were reserved, programs conceived and implemented to put it into practice?

    b). If so, how and when?

    c). In your opinion, do they compare well with selected practices employed in i) developed countries; and ii) developing countries? Please cite examples.

5. Have there been efforts to create interaction / cooperation among sectoral policies and the higher education / S&T policy? ~ Question 1 & 2

    a). If so, what have been those sectoral polices, please cite instances of (such) interaction?

6. Please identify important actors, institutions, and linkages that together determine character of national and sectoral (higher education / S&T) planning (and financing). ~ Question 3

    a). What are their key incentives (/ handicaps) to contribute (or otherwise) in the process?

7. In your opinion, whether a particular sector; higher education / S&T or any other sector could (ever) perform well in delivering / creating economics opportunities and in meeting the public expectations, etc.? Question 3

8. Whether any recommendations as to create missing links, equip actors and institutions, and create linkages for enabling the higher education / S&T sectors to assume their intended (or desired) role in the NIS have ever been brought out formally? ~ Question 3

a). If so, when and at which forum?

b). Was there any response to such recommendations?

c). If not, what had been the principle causes of inaction?

9. What are the notable appraisal, monitoring and evaluation mechanisms in place in the higher education / S&T sectors? ~ Question 4

10. Do the mechanisms compare well with those in place in other a) economic sectors within the country; b) developed countries; and c) better performing developing countries? Please cite examples. ~ Question 4

Annex - B

Profile of Research Participants

Role of Higher Education in National Innovation System: Case of Pakistan

S. N.	Name of the Interviewee	Time, Date & Venue of Interview	Relevance
1	AB	1710 hrs, Apr. 11, 2014 at his Office at Islamabad.	Senior academic, administrator and planner. Served Higher Education Commission, Pakistan as Member (Operations & Planning), Executive Director and as Chairperson for a cumulative period of over 10 years. Served at international assignments at diplomatic level.
2	AC	1015 hrs, Feb. 15, 2014 at his Office at Karachi.	Senior academic, among the most cited scientists in Pakistan, former Minister (S&T) and former Chairman, HEC. Considered the principal architect of higher sector reforms in Pakistan. Regularly writes in the national press on issues relating to higher education in Pakistan.
3	AD	1510 hrs, Feb. 27, 2014 at his Office & 1505 hrs, Mar. 6, 2014 at his Office at Islamabad.	Senior scientist and academic. Among the most cited scientists in Pakistan. The coordinator and principal author of the Science, Technology & Innovation (ST&I) Policy, 2012.

4	AE	1115 hrs, Mar. 5, 2014 at her Office at Islamabad.	Senior Science & Technology advisor to Government of Pakistan and other countries mainly in the OIC region. Been the Secretary and later Chairperson, Pakistan Council for Science and Technology. Regularly lectures on Science, Technology & Innovation policy issues.
5	AF	1345 hrs, Mar. 18, 2014 at his Office at Islamabad.	Senior academic / policy advisor. Been Advisor (Science) of an international organization in the OIC system. Served as Secretary, Pakistan Academy of Sciences. Also a writer and poet.
6	AG	1250 hrs, Jan. 29, 2014 at his Office at Islamabad.	Senior academic administrator and policy advisor. Remained a key person in the national planning / policy administration at the Ministry of Education. Revered for his contribution to the Education/Higher Education policy inputs in formulation of the 8th Five Year Plan and the Education Policy, 1992. Served as Secretary of a non-governmental organization working for the promotion of Education in Pakistan.

7	AH	1200 hrs, June 14, 2014 at his Office at Islamabad.	Senior academic and academic administrator. Founding Rector of one of the largest and research - active universities in Pakistan. The university found a place in the international league tables under his leadership. Nationally revered for his contributions rendered for the transformation of higher education sector in country.
8	AR	1510 hrs, Mar. 4, 2014 at his Office at Islamabad.	Senior academic administrator. Vice chancellor of a large public sector engineering university in Pakistan. Also served as Interim Executive Director and Interim Chairman, HEC. Served as Convener, Vice Chancellors Committee constituted by the HEC to discuss / deliberate higher education sector issues in Pakistan.
9	AJ	1235 hrs, May 2, 2014 at his Office at Lahore.	Senior academic and academic administrator. Founding Rector of Virtual University, Pakistan and served it for over decade and half. The university has the largest enrolment (over 100,000) among universities in Pakistan. Currently serving as advisor to Government of Pakistan on higher education.

10	AK	1220 hrs, Mar. 1, 2014 at his Office at Islamabad.	Senior advisor on higher education. Author of several books on the HE sector in Pakistan. Served University Grants Commission (UGC) as a senior advisor and continues to render policy advice to the Government of Pakistan Served as Registrar at a prestigious private sector university for over a decade and half post retirement from government service.

11	AL	1515 hrs, Feb. 15, 2014 at his Office at Karachi.	Senior academic, academic administrator and policy advisor. Former Founding Vice Chancellor of (later) a large public sector engineering university in Pakistan. Elevated to serve as Federal Secretary, Education; Secretary, Science & Technology and several other high ranking assignments in education and science and technology policy administration in the country.
12	AM	0905 hrs, May 2, 2014 at his Office at Lahore.	Senior academic and academic administrator. Vice Chancellor of the oldest, and one of the largest and most prestigious public sector universities in Pakistan. Well-cited scientist and writer on the history of science.

13	AN	0810 hrs, May 10, 2014 at his Residence at Isb.	Senior academic and academic administrator. Founded one and served as Vice Chancellor for 3 public sector and one private sector universities in the country. The universities have wide geographic, subjects and pedagogical spread.
14	AP	1025 hrs, Feb. 16, 2014 at his Residence at Karachi.	Senior academic and academic administrator. Served as vice chancellor of one of the largest and older universities in the country. Serves as senior adviser to Government of Pakistan on higher education and is among the highly cited scientists in the country.

15	AQ	1110 hrs, Mar. 1, 2014 at his Office at Islamabad.	Senior academic and academic administrator. Been Dean for over a decade and half at one of the most prestigious universities specializing in Information Technology in the country. Appreciated for his meritorious services rendered to the uplift of the subject (Computer Science) in the country. Serves as advisor to the Government of Pakistan on Information Technology, especially on issues related to higher education in Information Technology.

Annex - C

Participant Information and Informed Consent Form

Instructions: Before filling & signing out the 'Participant Information & Informed Consent Form', please first read the project description carefully.

Project ~ Role of Higher Education in National Innovation System: Case of Pakistan

I am currently pursuing "PhD Degree" at the School of Management, University of Leicester, United Kingdom. The title of my dissertation is "Role of Higher Education in National Innovation System: Case of Pakistan". Briefly, the proposed study intends to explore issues confronting the sector vis-à-vis its (higher education sector's) intended role in the NIS, its contemplated functions, the aspirations attached to it, the available or missing links, the strategies needed to make necessary corrections, and availability (or otherwise) of feedback mechanisms / loop, etc.

As a part of the said study, I intend to conduct interviews of the senior administrators, policy planners and representatives of the civil society concerned with the formulation, administration, implementation and / or periodic critical assessment of the higher education, science and technology and other economic policies in the country. I hereby request your kind contribution in the conduct of study.

Your contribution would be through making yourself available for an interview, the date and time of which would be scheduled as per your convenience. The interview is expected to last about 2 hours and would be convened in the months of Jan. – Mar., 2014. An "Interview Guide" will also be prepared and forwarded to you before the said meeting.

I assure that the contents of your conversation will be treated with utmost care and all ethical considerations will be complied. You have the right to withdraw your consent at any time, and to refuse to answer any question(s) during the conduct of the study.

Tahir Naeem
PhD Student, School of Management, University of Leicester, United Kingdom
Tel: +92-51-90495169, +92-321-8542782

Participant's Particulars:

Name: _____

Designation: _____

Department: _____

Contact Address: _____

Contact Number: _____

Email Address: _____

I have been informed of and understand the purposes of the study	Yes ☐	No ☐
I have been given an opportunity to ask questions	Yes ☐	No ☐
I understand I can withdraw at any time without prejudice	Yes ☐	No ☐
I agree to participate in the study as outlined to me	Yes ☐	No ☐

Signature: _____ Date: _____

Annex – D

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Excerpt of Node Structure File

Role of Higher Education in National Innovation System

Tahir Naeem – University of Leicester

Hierarchical Name
Node
Nodes
1st Informal S&T Policy of Pakistan
4% of GDP Demanded for Education
A Central Entity (or Authority Figure) is Must to Identify
A Sector in Isolation Can't Perform Well
A Well Performing Institution Has All Facets of Excellence
Ability to Apply Knowledge is Not Taught in Universities
Academia & Industry Hold on to Their Turfs
Academia Being Pushed to Address Issues of Society
Academia Industry Linkages Promoted
Academia Quietly Helps Industry
Academia Started Being Heard in Policy Formulations
Academic Industry Interests Not Seem Converging
Academic Not Meeting Industry Demands Even in Japan
Academic Programs Attuned to Job Market Needs in Private
Academic Programs Meet Market Needs
Academic Programs Not Attuned to Job Market Needs in Public
Academic Programs Not Complying to Needs

The complete node structure file can be accessed at the following URL:

https://tinyurl.com/TNAEEM12