Institutional Assessment of Health Research Capacity in Uzbekistan

Research Productivity, Organizational Capacity and Research use in Policy

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Abstract

Health research continues to be an important policy instrument in improving population's health and building a more resilient health system. As developing countries are unable to meet their national health-research needs, many foreign aid actors have concentrated on improving health research system (HRS) of low-income countries since 1990s. While there is growing interest, there is a gap in the literatures in understanding health research system in the framework of institutions and its actors in a developing country context, which affects the knowledge production and research performance.

In light of this argument, the thesis focuses on Uzbekistan. Uzbekistan was ranked as one of the lowest health research producers in the world in 2016. This raises the following question: Has post-soviet political and economic transition brought changes to health research system in Uzbekistan? If so, what was the outcome of change from these reform pressures? To answer this question, this thesis combines elements of neo-institutional theories to analyze the processes of institutional modification in health research system over the past twenty years in Uzbekistan.

The results from both quantitative and qualitative analysis revealed that the slow progress in any institutional change in the health sector was due to path dependent traits dating back to more than 60 years of Soviet science management. Basic incentive structures or forced regulatory reforms, which reinforce path-dependent behavior, often failed to create significant change in Uzbek health research performance. Further analysis revealed that causes of (under)performance in Uzbek health research system are complex and deeply rooted, reaching beyond the current circumstances and resources. The institutionalist approach proved useful in understanding transformations in post-soviet countries taking into account the particularities of local/national research institutions.

List of work submitted to international conferences and awards received

No	Name of the conference	Type of work accepted	Date /Venue	Title of work	Specifics
1	American Society of Tropical Medicine and Hygiene 65th Annual Meeting	Poster presentation	Nov. 13-17, 2016/Atlanta, Georgia, USA	Understanding research activity in the health sector of Uzbekistan: Implications for health research capacity strengthening	Related to chapter 5
2	5th World Research Integrity Conference	Doctoral Forum Oral presentation	May 28, 2017/ Amsterdam, Netherlands	Institutional assessment of Health Research Capacity in Uzbekistan: Productivity, Organizational Capacity and Research Translation	Best Dissertation Award (1st prize) Related to chapter 5 and 7
3	5th World Research Integrity Conference	Poster presentation	May 29-31, 2017/ Amsterdam, Netherlands	Critical Evaluation of health research publication activity in Uzbekistan	Related to chapter 5 and 6

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List of Acronyms

Term	Initial components of the term
ADB	Asia Development Bank
CoM	Cabinet of Ministers in Uzbekistan
COHRED	Council on Health Research for Development
HRS	Health Research System
NI	New (or neo-) institutionalism
PubMed	Public Medline
SCImago	SCImago Journal Rank (SJR indicator)
STS	Science Technology and Social Studies
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
WB	World Bank
WHO	World Health Organization
WOS	Web of Science

Chapter 1.   Introduction

1.1. Understanding the health research system

This thesis analyzes the health research system (HRS) and its research capacity in Uzbekistan. It takes an institutional approach to understand the research production, organizational capacity and the policy-making process in Uzbekistan's health research system. The study gains prominence due to the value and role of health research in developing solutions to the existing and emerging health problems among the populations in low middle income countries (COHRED, 2007). This awareness has led to a number of declarations from WHO and other international entities calling for action to strengthen research for health, development, and equity (World Health Organization, 1996; Pang et al., 2004; Sadana and Pang, 2004; Remme et al., 2010; Andermann et al., 2016). Consequently, studies have focused on the discourse that there is unequal distribution of resources for higher education and research in the world. Moreover, many low- to middle-income countries (LMIC) have difficulties building up their research capacity to support the national health research systems (Kabiru et al., 2010; Ogundahunsi et al., 2015; Cole et al., 2015; Cole et al., 2016; Elmusharaf et al., 2016; Franzen et al., 2017). This recognition has brought together many foreign aid entities to support and demonstrate the importance of health research capacity (Hanney and González-Block, 2014, 2015, 2016). However, LMICs face difficulties in building effective HRS for better decision making. For instance, several studies have shown that the lack of governance structure (Yasamy et al., 2011; Kebede et al., 2014), inadequate legislative framework for research (Senkubuge and Mayosi, 2012); and the lack of research priority setting are hindering when it comes to promoting health research capacity (Romero and Quental, 2014). The lack of interest from stakeholders in research, policymaking, and implementation processes (D'Souza and Sadana, 2006) and the lack of human resources were also challenges faced by LMICs in managing HRS (Kirigia and Wambebe, 2006; Palmer et al., 2009; Ager and Zarowsky, 2015; Kirigia et al., 2015b)

From the collapse of the Soviet Union, Uzbekistan has gone through the economic and political transformations that have made it an emerging middle-income democracy. However, Uzbekistan in regards to health research, has been characterized as one of the lowest research producers in the world with low political commitment and low health research capacity(McKee et al., 2012). What this also implies is, according to the arguments by Mckee et al (2012), that the country hides its under-achievements in health to retain its legitimacy as a state that is in control of its affairs (McKee et al., 2012). As Shaw et al (2005) and van den Hove (2007) pointed out, research is embedded in a social context involving actors and institutions (Shaw et al., 2005; van den Hove, 2007). The research is further complicated by the history and past practices that impact the actions of embedded actors which may hinder or enable, for instance, the HRS development of one's country. Therefore, research on the "research systems" opens up the discussion on the entire process with its actors and institutions. This dissertation therefore analyzes these issues and the ways in which institutions and individual scholars in Uzbekistan are involved in the process of producing new knowledge through their involvement in HRS of Uzbekistan.

Arguments made on authority effects in research argue the importance of identifying the roles of state agencies, scientific elites, and stratification of academies and institutions based on performance as well as funding arrangements to understand the impact of research governance and institutional change on research (Whitley, 2011). For instance, in Uzbekistan before independence the Soviet Union strategized the research and funding priorities to sustain the research institutions. Soviet science had diverse research institutes based on differing disease conditions and health disciplines as well as academies and medical university for education (COHRED, 2002; Ahmedov et al., 2007). Therefore, Uzbekistan, like other Central Asian and post-soviet countries, inherited an excessive number of scientific institutions, academies, medical universities, and inefficient scientists with limited budgets to maintain the system (Ahmedov et al., 2007). It is also difficult to identify the strengths and limitations of the Uzbek HRS without first performing a deep reflection of the political undertone, historical context the system carries, and the strategic role that research has in the country's context.

Such political perspectives (meaning views about institutional change, historical context, authority and control of health research) that influence the effectiveness of a HRS has been less researched. Studies in a post-socialist country setting have shown that the science development and innovation process is deeply embedded in nationally and historically distinct institutional frameworks. Any attempt to govern and coordinate this process needs to consider the complex interplay between politics, science, and the underlying institutional and organizational structures (Whitley, 2003; Yegorov, 2009; Heinecke, 2016). The World Health Organization definition of the HRS and its components are comprehensive but it overlooks the subtle aspects of tensions and political undertones of such a HRS. Although literatures from international development and higher education have contributed to giving insight by considering the complexity of politics and its context(Cooper and Packard, 1997; Wall, 2006; Altbach and Knight, 2007; Smit, 2013; van Assche et al., 2014; Powell and Rey, 2015), these aspects specifically regarding to health are just beginning to emerge (Jentsch and Pilley, 2003; Tomlinson et al., 2006; Landau, 2012; Smith, 2014; Forman, 2016). Therefore, the aim is to add the current debate on the health research system in contributing to understand how the actors in the research domain (researchers, organizations and policy actors) are embedded in the national and international settings in the case of Uzbekistan. The following section briefly summarizes the concepts and definition that will be used throughout this thesis.

1.2. Concepts and definitions

Health research system

Health research is a broad and multidimensional term which includes biomedical; clinical; public health; applied; basic; researcher driven; health system driven; quantitative; and qualitative research (Remme et al., 2010) . The overarching entity of HRS is the health system. The health system's goal is ultimately to reach health equity and a better health outcome of the population(Travis et al., 2004). Health research complements this goal by supporting necessary information for health challenges facing the population through better policies and interventions (Pang et al., 2004). It also aims to monitor health system performance, such as having policies on the health services and practices of health

professionals and developing new technology and health products, as well as evaluating the impact of health research itself (Sadana and Pang, 2004) . In the HRS the purpose is to generate and promote the utilization of high quality scientific knowledge to promote, restore, and/or maintain the health status of populations (World Health Organization, 1996; Sadana and Pang, 2004) . A functioning HRS involves dynamic interaction among research funders, research users (research utilization), and the research product which should contribute to better health outcomes leading to socioeconomic returns of the society (Fig 1.1).

Health research system

Education

Research funding (national and international)

Research output and products

Research utilization

Health outcomes

Socioeconomic returns
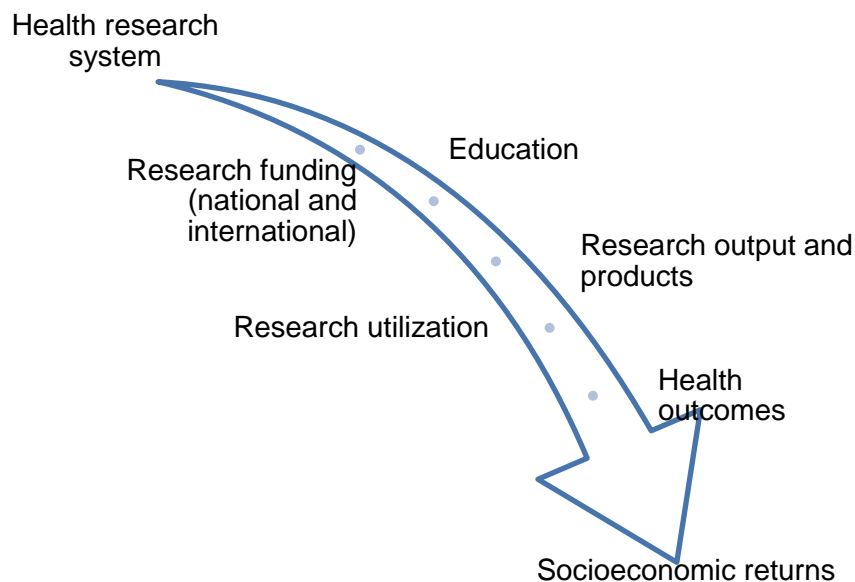
Figure 1.1 Health research system functionalities modified from (World Health Organization, 2001)

The HRS like other public sector entities is intertwined, meaning the health research is both affecting and affected by the health system, education system, and research and development (R&D) system of the nation. The ideological, socioeconomic, geographical, and political orders of the country transitioning through time shape these systems. The reforms of the education system, R&D system, and the health system along with external demands from the international research community inevitably affect the HRS (Fig 1.2).
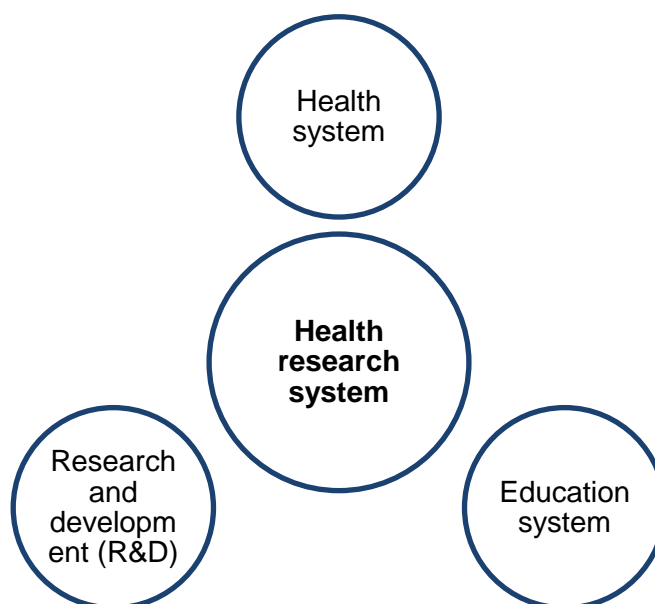
Figure 1.2 Overlap of health research system (modified from (World Health Organization, 2001)**)**

Health research capacity

For the past twenty years there have been numerous studies (Hrynkow et al., 2003; Huber et al., 2015; Elmusharaf et al., 2016; Cole et al., 2016) reporting on outcomes of efforts to strengthen research capacity, but the definition and scope of this concept is still controversial. The 2017 systematic review by Franzen et al (2017), on health research capacity stated that "there is a large and diverse body of literature on health research capacity development, [but] it remains confusing, controversial and poorly defined, with various contradictory understandings and conceptualizations ." (Franzen et al., 2017), p2) Despite this controversy, this study adopts a working definition of health research capacity by Sitthiamorn and Somrongthong (2000). Health research capacity is the ability to define health problems, set research priorities, build sustainable institutions and organizations, and identify solutions to key national health problems (Sitthiamorn and Somrongthong, 2000). Sitthiamorn and Somrongthong (2000) argues that research capacity can be considered into four domains: skills and competencies; scientific activities; outcomes; and

impacts on policies and programs (Sitthiamorn and Somrongthong, 2000). This applies to research capacity at multiple levels, from individual researchers to the national level.

Institutional theory

This study adopts an institutional theory perspective to examine the arrangements of the health research system. Institutional theory is a classical argument not only in development studies but also in organizational analysis and research systems and policies (Hollingsworth, 2002; Hollingsworth, 2008). Scholars analyzing research organizations from an institutional perspective have argued that an institutional environment shapes the general behavior of the actors (Scott, 1995; Frumkin and Galaskiewicz, 2004; Whitley and Gläser, 2014). They have further examined the ways in which rules, norms, and shared beliefs have influenced organizational forms. Charting systematic change over several decades as regards the types and numbers of actors (individual roles, organizational forms and their interrelations) is the nature of institutional logics. Uzbekistan health sector is regulated by the "top-down" models of governance arrangements (World Health Organization Regional Office for Europe, 2014). The national research policies and its organizational structure, characterize society as a whole influence the behavior of the actors.

The concepts of institutional change and path dependency stemming from the institutional theory emphasizes the importance of actors when it comes to reforms (or stasis of) institutions (North, 1990b; Mahoney, 2000). In line of this argument, this study adopts the working definition of "institutions" defined by Gomez (2011) as the political, bureaucratic organizational structures responsible for implementing policy, such as the Ministry of Health along with the design of health research system allocating policy responsibilities to its government research organizations (Gómez, 2011). This study further utilises Gomez (2011)'s definition of institution which refers to actors whose interests and motivations are shaped by informal and formal organizational rules that utilize and work the organizational structures within the health research systems (Gómez, 2011). The type of actors presented in this study is further elaborated in the next section.

Actors

Actors in the health research system can be individuals or organizations "whose primary purpose is to promote, restore or maintain health" (World Health Organization, 2000). These actors are affected by "the persistent and connected sets of rules (formal or informal), that prescribe behavioral roles, constrain activity, and shape expectations" (Keohane, 2005 referred in Szlezák et al., 2010) within the health research system. Actors in the Uzbekistan health research system include researchers, research producing organizations (universities and institutes), decision makers, as well as consultants working in international foreign aid agencies, who all are engaged in making changes within the health sector of Uzbekistan.

The research producers (researchers and research producing entities such as academies and institutes) respond to the needs of the research users (in this case the decision makers) but their research outputs and research practices are influenced by institutional and organizational practices. For instance, the recent policy change on degree accreditation requires Uzbek researchers to demonstrate their research performance through research publications. Therefore, the choice of publishers of scientific journals, article publications in international arenas, and choice of discipline and research topic are representation of researchers' responses to the policies. How are research outputs generated? What are the approaches and disciplinary perspectives in these outputs? How do they place themselves in international forum? These are elaborated in the Chapter 5. At an organizational level, the thesis examines the institutional setting, the national and global collaborations envisaged in the research and how past practices shapes the current pattern of research organization which are elaborated in Chapter 6.

The 'movers and shakers' in the research policy interface, are the ones who play a crucial role in translating research findings to policy practices (Chapter 7). These actors could be members and researchers of the organizations and key political figures in the country such as parliamentary members, members of the cabinet, and ministry officials from the Ministries of Health or Higher Education or R&D. Each of these members plays a different role in shaping health research policy; e.g. revising existing laws, advocating for certain agenda; implementing demands of international conventional frameworks, and setting regulations and guidelines for implementation purposes. Understanding how these

movers and shakers play a role in translating research findings remain prerequisite for effective policy as illustrated in Chapter 7.

Research productivity

Research productivity comprises diverse components from human resources to research output. Research output is a particular form of dissemination that comprises publications, conference contributions, and patents, among many others. The list can be exhaustive depending on the research producing entity (such as universities and institutes) but the general consensus is that it is a form of communication or pathway in which research is made available to people other than the author. Within the context of Uzbekistan and for the purpose of this study, research output will be the focus which includes mainly articles in national and international journals and conference contributions by individuals or a research entity.

Research to policy

The policy making process is complex and is dependent upon the scientific, economic, social, and political context (Brownson et al., 2009a). Studies have found that there is a gap between what research has demonstrated as effective and what policies have been enacted in contrast (Black, 2001; Dobrow et al., 2004; Smith and Joyce, 2012; Parkhurst, 2017). Policy is comprehensive as its working definition includes laws, regulations, decrees, and ministerial or agency guidelines, to name a few (Brownson et al., 2009a; Kingdon and Stano, 2011; Anderson, 2011). Recent studies have shown that trust, communication, and interaction over a long period between research producers and decision makers influence policy (Trostle et al., 1999; Haynes et al., 2011b; Haynes et al., 2012; Gollust et al., 2015; Shearer, 2015; Parkhurst, 2017). The research to policy process is more complex, due to the vast amounts of research output along with its varying research quality, which adds to the issue of the inaccessibility of the research to the policy makers (Brownson et al., 2009a; Hyder et al., 2011; Oliver et al., 2014; Oliver et al., 2015). This study adds to this debate by examining the research to policy process in Uzbekistan. The interaction and responses from diverse actors on policymaking process in Uzbekistan has not been explored extensively. Therefore, this component will be a necessary step

towards understanding the overall decision making process within the Uzbekistan health research system.

With this context in mind, this thesis aims to add to the understanding of institutions, processes, and actors that together constitute the HRS in Uzbekistan. Specifically, the study focuses on the institutional logic and response based on research production output, research producers, and research users, which together are the links in the Uzbekistan health research system. Uzbekistan's health research system has remained relatively less well studied and its institutional structures and policies have remained constant until the late 2000s as the most recent assessment only examines the medical research system of Uzbekistan in 2007 (COHRED, 2002; Ahmedov et al., 2007). This research takes a multilevel approach of macro-, meso-, micro- (national, organizational, and individual) approach which hasn't been carried out in the health research context in Uzbekistan The study can be of interest in different ways to health, international development and research policy fields - empirically, theoretically or methodologically.

Objectives

This dissertation aims to provide an examination of the status of health research system in Uzbekistan through the lens of institutionalism. This thesis will present the development of the Uzbekistan HRS and its activities from Soviet to post-Soviet times which will shed light on government's role in the research system. This is because the health research system is mainly in the public sector; it is highly centralized, as shown later from the case studies. Second, it shows the historical aspect which brings about the institutional change in research systems management and how centralized the location of the research institutes are. These aspects are further giving legitimacy to control, and thus restrict innovation at the health research institutes of Uzbekistan. It makes the global modernization of the health sector and of research impossible to diffuse within the health research system. Therefore, the main question is: What makes this system stable? Has past Soviet influence been so entrenched and the institutional cost so high that remaining in the same state is more efficient than being open to innovation? To answer this question, this thesis focuses on the three objectives:

1. To examine the historical developments (i.e. education, R&D, political economic) pre-independence and post-independence that shape the Uzbekistan health research system. This will examine the policies and programs shaping the HRS in Uzbekistan.

2. To analyze the research outputs on health research systems in Uzbekistan. Through bibliometric analysis. This will examine trend, contribution and quality of the published research outputs on HRS in Uzbekistan.

3. To identify the drivers and constraints shaping health research institutes in Uzbekistan. Taking case study of few organizations, the thesis examines the origin and contribution of these institutions towards HRSs in Uzbekistan.

4. To understand the 'movers and shakers' in the HRS in Uzbekistan. Drawing from the objective 3, it will identify the key individuals in policy making and their role in translating research findings to health policy in Uzbekistan

The reasoning behind examining the health research system in Uzbekistan is twofold. First, the studies focusing on transformations of post-Soviet countries have demonstrated arguments based on economic and political shifts, such as transitions from formerly planned economies to market economies or its impact in driving forces of economy such as agriculture (Saidkhodjaeva, 2004; Murtazashvili, 2012; Khaki and Sheikh, 2015; Hansjürgens, 2016). These studies give insight into the political and economic transformation of Uzbekistan; there have not been many studies to date elucidating societal sectors such as health research system (COHRED, 2002). Second, although this thesis starts from the assumption that research gaps in low- to middle-income countries as well as other inequalities are problematic, many of these health-research system assessments in these countries are modelled linearly, such as the capacity building approach of the UN that examines it at the individual, institutional, national, and supranational level (Potter and Brough, 2004). Understanding the national health research system from this starting point is important but it has overlooked the tensions and dilemmas that low-income countries face to meet the demands of disease burdens, a changing economic environment, changing policies, and the new demands of the international health standards. Moreover, although many low-income countries face

similar challenges, there are context-specific tensions that exist in Uzbekistan as a post-Soviet country. What is most notable is that, Uzbekistan lacks information on the challenges and the current status of the health research system as the ramifications of the Soviet past resulting in this fragmentation and hierarchical management in research is not well studied. Therefore, this thesis aims to fill in this gap.

Outline of the Thesis

Chapter two explores the theoretical framework that will guide the study. Several viewpoints (rational, sociological, and historical) institutionalism have been reviewed and thus have provided different insights to explain institutional change within the HRS (Mahoney and Thelen, 2010). This thesis adopts the framework of institutionalism, which focuses on patterns of social, political, and economic behavior related to change over time. Hollingsworth's study of research systems through historical institutionalism provided the theoretical orientation for this study (Hollingsworth, 2008). The concepts adopted from this theoretical approach were mainly path dependence and gradual transformation. Both of these concepts have been applied in research system analysis from a post-Soviet country context (Jabłecka and Lepori, 2009; Yegorov, 2009; Heinecke, 2016). Scott (1995) argues that for examining institutional change empirically, one needs to focus on the three measurable components— (i) types of actors or organizing models (a combination of cultural-cognitive and normative elements), (ii) institutional logics (primarily cultural-cognitive elements) and (iii) governance structures (a combination of regulative and normative elements) (Scott, 1995). To apply this in health research system context, the analytical framework developed by Karaulova (2016) was applied to this thesis. Karaulova (2016) analyzed the institutional changes within the national Russian science system by applying institutional theory (Karaulova et al., 2016).

Chapter three focuses on methodology and data collection. This study takes a mixed method approach. This study focused on three measurable components to examine the institutional changes within the Uzbekistan health research system. This was due to the multidisciplinary dimension of the health research system. The three measurable components were: (1) the scholarly research product; (2) the types of actors and

institutions (organizations) in the health research system; and (3) the health research policy translation (combination of regulatory and normative elements).

The following chapter four outlines the changes in the political economy, education, and R&D sector along with the health sector over the 25-year time since independence in Uzbekistan. Based on classification of political and economic transition categories, it analyses the intersection of health-sector policy changes with the historical trajectory of political, education, and R&D systems. The chapter gives insight into the impact of the political trajectory of the country that led to both restrictions and advancement in science.

Chapter five explores how research production is set in place in the Uzbekistan health research system. This chapter serves as a base for further discussions that follow in chapters six and seven. The chapter analysis the research outputs and performances of individuals and research organizations in Uzbekistan using bibliometric tool. Further analysis included research producers' quality (such as citation factors and choice of journals) to show the performance aspect of the health research system. Types of research conducted within the varying disciplines in health research was analyzed to examine the government's and international agencies priorities on health research as well as traits of path dependency from the Soviet science system.

Chapter six maps the capacity of the health research systems in some depth by focusing on few selected organizations. The focus of this chapter is on recreation, competence, and the autonomy component of the analytical framework. More specifically, it deals with research funding, human resources, and flexibility in the research decision-making component of the health research system. This chapter complements the quantitative findings of chapter five by in-depth discussions with the research producers from the case study organizations. The qualitative data analysis reveals the entrenched path dependency and conservative management in research that enables and hinders the changes within the health research system. Various tensions and issues emerged about the organizational structures, research funding, and educational reforms based on the responses from researchers of case study organizations.

Chapter seven inquires further into research evidence use in policy making by focusing on the 'movers and shakers' in HRS in Uzbekistan. The chapter highlights the problems and contradictions detected from both policy makers and researchers about understanding the research and its use and diffusion of the research. It also highlights the problem of research priority setting and decision making based on the narratives of the decision makers. It further examines the issue of trust that attributes back to the Soviet past of the health research system.

Chapter eight brings together findings from the empirical chapters guided by the institutional perspective, and examines in depth the health research system and its research capacity. It shows how the health research system in Uzbekistan is deeply rooted in a longer historical legacy of the Soviet past. For instance, the academic practices of thematic segregation of research during the Soviet era brought about the lack of institutional diffusion in the Uzbek research system today that fostered disciplinary divisions, narrow specialization in training, and limited collaboration (Péteri, 1995; David-Fox and Péteri, 2006). This chapter suggests that more research is necessary to examine the theoretical implications that could serve as a framework for generalization of health research capacity and health research system. The increasing studies that examine health systems from an institutional perspective (Gómez and Atun, 2013; Gómez, 2013) should be extended to organizational and institutional studies about the governance of research as well. This chapter ends by coming to conclusions on the health research systems of Uzbekistan with implications for future research endeavors as well as making some recommendations.

1.3. Contribution and limitations of the study

This study contributes to past work of scholars on institutional change in public research systems as well as those who have contributed to the post-Soviet setting of public research systems. In this context, various models to organize public research are scrutinized and debated. The empirical contribution of this study is that it provides a basis for understanding the existing capacity and challenges the Uzbekistan health-research system faces in moving forward from the Soviet past. Moreover, the study contributes to the health research capacity strengthening case studies in a low- to middle-income

country context. Research capacity is one of the important factors that shape health research systems development. One theoretical contribution, the study adds to, is the existing arguments of health-research system analysis is incorporating the views of institutional theories. Furthermore, it looks into whether path dependency has played a role in health-research system development.

Despite these efforts to contribute to understanding the health research system of Uzbekistan, this thesis has the following limitations in its analysis. The first limitation stems from the case study methodology. Case study research has been criticized for lacking scientific rigor or generalizability (i.e. producing findings that may not be transferable to other settings) (Yin, 2009; Crowe et al., 2011). There have been suggestions made to overcome these limitations by using theoretical underpinning in selecting research and, respondent validation (i.e. participants checking emerging findings and the researcher's interpretation, providing feedback). Transparency throughout the research process and transparency in the researcher's background and level of involvement (i.e. explicit details on how the researcher has influenced data collection and interpretation) also helps with overcoming these limitations (Lincoln and Guba, 1985; Stake, 1995; Mays and Pope, 2000; Barbour, 2001; Crowe et al., 2011). The study already stated the theoretical perspectives adopted in this study. Cross-referencing with respondents complemented the findings from both quantitative data and qualitative data analysis. All the open-access materials used for this study were explicit, except for the identity of the interviewees who contributed qualitative data, a decision made for ethical reasons of protecting their anonymity.

The second limitation stems from the lack of transparency and the political nature of the health information systems in Uzbekistan (Ulikpan et al., 2014). Gaining access to information that in other countries is readily available to the public – information such as official health care spending, national accounts, and statistics about the health of the population not only at national level but also at a regional and at district level—is not the norm in Uzbekistan. In Uzbekistan, such information is hard to come by not only for foreigners (Markowitz, 2016) but also for local research users, who need integrated data to continue their research, or even for health officials, who may need to understand the situation in other regions to come up with a possible solution for their locale. Even the

WHO assessment notes the limitations on availability of information in the Uzbekistan health system (World Health Organization Regional Office for Europe, 2016). For instance, typical primary sources of information, such as interaction with scholars and institutions, were not feasible. Health data and research budgets were unavailable to neither publicly nor to foreign nationals. Data on research finance and research performance was not obtainable. Moreover, the plan to observe the daily activities of the project's research activities was not feasible due to conflicts with the overall project and bureaucratic hurdles.

Case study is further complicated when the research field environment is made challenging by scientists' silence as respondents are unwilling to share information in a transparent manner due to political sensitivity as well as fear of consequences (Markowitz, 2016). As Markowitz (2016) and other scholars who have had field research in Uzbekistan argued (Wall and Mollinga, 2008a; Oberkircher, 2011), researchers require patience, consistency, and perhaps a stroke of luck. My experiences in Uzbekistan suggest that most relevant information that I wanted to acquire, such as research finances or everyday research practices was not attainable. This reality required me to design proxy measures such as (1) collection of research products and publications in local library and online database bibliometric; and (2) using legislative framework to obtain data. While archival data assisted in appraising the changes in regulatory and normative institutions, it was insufficient to appraise the nuanced political dynamics in health research system. Therefore, a personal network from past research aided in contacting necessary key informants. Not all of them agreed for the interview; some were hesitant to discuss potentially sensitive information, while others insisted I get ministry approval first. Of the few that have agreed to meet, informal and open-ended interviews aided in putting the respondents at ease in communicating their activities regarding health research and policy decision making.

This thesis is also limited by ignoring the health research and development in private sector, namely health research carried out by commercial pharmaceutical and biotechnology industries as well as patent products, and other research products. Many countries consider this sector to be an important asset as any technology gaps in this sector motivates governments to develop basic sciences in this industry to reduce the widening technology gap between them and developed countries (World Health

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Organization). Although lack of private sector research involvement within the health sector of Uzbekistan is well known (World Health Organization Regional Office for Europe, 2014) the Uzbek government has taken initiatives to strengthen the biomedical health research for pharmaceutical companies (Dusmuratov et al., 2013). As research products in this thesis refer mainly to academic research publications and do not include the above aspects, interpreting results of this thesis must take into account these limitations.

Chapter 2. Theoretical Framework

2.1. Examining health research systems through new institutionalism theory

This chapter's aim is to explore institutional theory's theoretical and conceptual contributions to understanding institutional change in health research systems in the setting of a post-socialist developing country. The literature review considered the interweaving of theoretical and empirical studies of science policy, public research systems, science technology and social studies (STS) precisely because aspects of the health research system overlapped with various social sectors, as previously discussed in the background chapter.

The section begins by presenting neo-institutional theory and the concept of institution, and then explores different strands of institutional theories used in this research. The purpose of this study is to explore institutional aspects of the research system and identify factors that contribute to the institutional change of this system. Providing applications of institutional theory to assess research systems justifies taking a neo-institutional approach as well as providing the strengths and limitations of this approach. The section ends by presenting the analytical framework consisting of institutional indicators addressed in the theoretical concepts.

2.1.1. Basic assumptions

This section gives an overview of institutionalism, specifically its central concepts and its basic assumptions. New (or neo-) institutionalism (NI) developed as a way to understand the role of institutional structures (namely organizations, rules, and norms) and their relation to human behavior, specifically their role in society, in contrast to the old institutionalism which focused on individual behavior (March and Olsen, 1983). The mainstream scholars who have argued for institutional embeddedness of individual behavior are March and Olsen; Hall and Taylor; Peters, and Lowndes among others(March and Olsen, 1983; Hall and Taylor, 1996; Peters, 2011; Lowndes and Roberts, 2013). These scholars typically focused on a broader theory building approach

to institutionalism. In the first half of the twentieth century, the old institutionalism was more prevalent in political sciences and economics, which primarily focused on structural, historical, and normative elements of the government as a separate entity(Peters, 2011). In the latter half of the twentieth century, the studies of behavioralism and rational choice theory brought back interest in theory building as a revival of the institutional approach (Peters, 2011). With the focus on broader political institutions on the integrated nature of organizations, rules, and norms(Peters, 2011).

The debate on institutional change has been a main topic of conversation for decades. New institutionalism scholars have presented various approaches to unify the different arguments of NI studies. NI scholars typically identify the "embedded nature of institutions," pointing out the mutually exclusive influence of institutions and individuals (Marsh and Stoker, 2010), p70). Peters(2011) has categorized the common theme as an analysis that starts with institutions rather than with individuals, and that considers institutions as structures that play a role both in determining behavior and in regularizing human behavior (Peters, 2011). He also summarized institutions as entities that are at the same time formed by human agents and constrain those same agents or actors (Peters, 2011). The preponderance of these arguments also point out the significance of process evaluation, such as taking a historical perspective.

Defining institution itself is a challenge, as the notion has been the subject of discussion already for several decades. Nonetheless, it is critical to point out that the key element of the discussion is the very term 'institution' itself. Of the many NI scholars, several, such as North (1993), Peters (2011), Campbell (1997), Immergut (1998), and Scharpf (2000), have defined institutions in varying ways. For instance, North defines an institution as formal rules and informal constraints that human beings devise to shape human interaction (North, 1993). Peter's take on institution is more detailed than North's; he proposes that "the most important element of institution is the structural feature of the society that involve individuals or groups into a certain predictable patterned interactions" (Peters, 2011), p19). Other scholars such as Campbell and Immergut have defined institutions in similar ways, highlighting both their formal and informal aspects, but with a focus on constraining human behavior bounded by organizational settings (Campbell, 1997; Immergut, 1998). The other characteristic of institution is that it is relatively stable,

yet also open to change (Scharpf, 2000). Another characteristic is it (institutions) carries with it the knowledge and power (Hasselbladh and Kallinikos, 2000; Mahoney and Thelen, 2010)

2.2. Main types of neo-institutionalism theory

The definitions and characteristics of institution will serve as a foundation for understanding the dynamics of the public sector in the context of Uzbekistan. NI is a growing concept with diverse sub-fields; therefore, the classifications of different characteristics of institutionalism are multiple. Hall & Taylor (1996) has identified new institutionalism as historical, rational choice and sociological (Hall and Taylor, 1996). To understand the institutional change of research systems in Uzbekistan, this thesis utilized the institutional classifications of historical, rational choice and sociological, using the particular perspectives on those classifications of Hall & Taylor (1996). Further detailed review of the three strands of new institutionalism (meaning the rational, historical, and sociological perspectives of NI) will serve as the basis on which to build the analytical framework used in this dissertation (Hall and Taylor, 1996).

2.2.1. Historical institutionalism

Examining the intersection between institutional theories and public institution is of particular pertinence in the case of Uzbekistan's health research system. Using the lens of historical institutionalism reveals how past decisions predicate the current structure of policy, actors, and institutions. Historical institutionalism assumes that history constructs institutional structures, the current policy, and the behavior of political actors and interest groups (Daniel Béland, 2005: 1). Therefore the focus of historical institutionalism is the analysis of political and economic processes within the historical context (Steinmo et al., 1992). The emphasis of this perspective comes from noting the consequences of decisions and events based on their historical contexts (Steinmo, 2008). Historical institutionalism's strength comes from considering history to explain the context of the present practices and realities. This feature combines the transaction cost of decisions (the economic calculus component) as well as of the cultural component in relation to institutional emergence, stability, and change (Hall and Taylor, 1996).

The calculus approach of this theory assumes that institutions frame the actors' strategic behavior and reduce uncertainty through the existence of rules, or what Hall and Taylor call "enforcement mechanisms for agreements, [and] penalties for defection" (Hall and Taylor, 1996, p. 943). Economic aspects of historical institutionalism derive from the premise that all institutions "have organizational biases that channel the representation of interests", ((Tuohy, 1999) p108) They play a determining role both in distributing power among political actors in a given polity and in shaping their strategies and goals in the decision-making process, which together shape the political outcomes (Tuohy, 1999) Institutions are located in "a causal chain that accommodates a role for other variables such as socioeconomic development and the diffusion of ideas" ((Hall and Taylor, 1996), p. 942).

Path dependence

The strength of historical institutionalism is that the school of thought emphasizes the choices that take into consideration the context, individuals, and rules of the game. A key feature of historical institutionalism revolves around path dependency and feedback mechanisms with their associated power plays. Path dependence is one of the most widely discussed and studied concepts when it comes to institutional change, and is to a certain degree "abused" in the literature (Rixen and Viola, 2009) . Due to its wide applicability in explaining how the past predicts the future, it is worth examining the applicability of this concept in institutional analysis. The concept of path dependence was originally developed to examine the transaction cost mechanism in the field of economics using the famous example of the QWERTY keyboard case (David, 1985). From an economic perspective, David argued his case based on three issues: First is the "system scale of economies," which implies increasing returns to production. Second is the "technical interrelatedness", which implies complementarity between the actor choosing and learning to use the keyboard and technology that results in increasing returns. Final issue is the "quasiirreversibility," which implies that once an actor has learned to operate a QWERTY keyboard switching to a new system would incur higher learning costs (David, 1985). North (1990) later extended this concept to argue that institutions are costly to establish but that once actors coordinate and facilitate economical interactions to adopt certain procedures or technologies, they gain increasing returns, and that therefore institutions themselves may be important sources of path dependency (North, 1990a).

This concept was later adopted by political science to explain initial conditions and historical incidents have a lasting impact on institutions that may result in status quo despite a more efficient alternative (Pierson, 2004; Kingston and Caballero, 2009). Pierson framed "positive feedback" as four factors of political life as increasing returns. First factor concerns with the collective action, which makes institutional reform less likely due to the collective being a less competitive and less flexible environment compared to the market. Second factor highlights complementariness of institutions that implies that the high density of institutions contributes to increasing returns. Third deals with positive feedback that can result from political authority and power asymmetries. Fourth aspect is that positive feedback can also result from complexity and opacity of politics (Pierson, 2004)). Pierson's "positive feedback" implies that once the precedent is set, it limits the actors from steering in another direction even if a better solution to the problem that forces stasis or perpetuates inertia is available (Pierson, 2004), p30).

This 'path' is set by early events and sets as a crucial reference for the subsequent trajectory (Mahoney, 2000). Path dependence therefore is a self-reinforcing process in institutions that makes established institutions and their policies difficult to change once a path is established (David, 1994). Major external factors such as socioeconomic or political events would be necessary to steer away from this path; those are called "critical junctures" (Pierson, 2004; Capoccia and Kelemen, 2007). The critical junctures are when radical changes occur due to external forces after long periods of stasis (Capoccia and Kelemen, 2007). Conversely, without significant events that prompt such critical junctures, the impact of an already established path of events tends to ensure long periods of stability with only limited moments of substantial changes (Capoccia and Kelemen, 2007). Therefore, in the absence of such critical junctures, institutions continue as before, even if their ways of doing things are considered inefficient or poorly functioning (Capoccia and Kelemen, 2007). The "lock-in" effects mean that a change of policies induces the emergence of elaborate economic and social networks that "greatly increase the cost of adopting once-possible alternatives and inhibit exit from a current policy path" (Pierson, 1995), p42).

Thelen later expanded on this concept, connecting earlier work about historical institutionalism with findings about "critical junctures". Her argument debated whether the

contingent concept of path dependence as the initial choice for a particular situation seemed too deterministic. Thelen argued for a more comprehensive view of path dependence, as gradual change may occur rather than path dependence resulting in automatic stability (Mahoney and Thelen, 2010). While Mahoney and Thelen (2010) agree with the notion that past actions determine the "historical trajectory" or "development pathway," they also argues that these are subject to gradual or incremental changes, and that these changes occur when actors engage in gradual improvement (Mahoney and Thelen, 2010), p7). Thelen characterizes these gradual changes as "layering" and "conversion" (Mahoney and Thelen, 2010) p 15). Conversion refers to a technique in which actors look back in time to locate existing rules or ways of doing things that might be able to handle new problems, rather than searching for new alternatives. Layering refers to introducing new rules to the already existing rules or in conjunction with the existing ones (Mahoney and Thelen, 2010). Thelen proposes these concepts to broaden the discussion about linking path dependence to notions of historical institutionalism.

Framing a research system as an entity and understanding the path dependent nature of research have been explored in the case of Russia (Karaulova et al., 2016a). These studies highlight the locked-in relationship between government and its agents (in this case, research organizations) and observed that such relationships become more difficult to change the more costs are incurred. The core logic often used was that the actors would continue to follow pre-existing practices because of the previously made investments in implementing certain research centers and processes; and that it would be difficult to overcome the transaction costs inevitable to build something new. It would also imply that the practices already ingrained would be hard to change, as they have become habituated practices. Using this logic of path dependence and self-reinforcing mechanism in a context of development in a low- to middle-income country, more specifically the management of a public sector like health or health research systems, opens up opportunities to explain the institutional environment and dynamics in low- to middle-income country context.

While historical institutionalism is helpful in explaining different policy trajectories across countries and policy continuities within countries over time, it is criticized for being unable to deal with the question of institutional change. The challenge in historical

institutionalism is how to analyze the institutional change. Due to this critique, there have been more complex models that explain institutional changes of historical institutionalism (Campbell, 2004). The models provide useful tool in explaining institutional change based on empirical evidence. Campbell provides three patterns of institutional change over time: incremental change, punctuated equilibrium, and evolution (Campbell, 2004), p5). Streeck and Thelen (2005) contribute to this change status through 'change configuration' – the underlying assumption that there are different modes of institutional change (Streeck and Thelen, 2005). Rooted in historical new institutionalism, the analysis on typologies of change and configurations are subject to the process of change (incremental vs abrupt) and the result of change (continuity or discontinuity) (Streeck and Thelen, 2005), p9). Streeck and Thelen (2005) focused on the gradual transformation type of change to give insights to the types of change observed within and across societies (Streeck and Thelen, 2005).

Despite these models to explain institutional change, the roles of ideas and actors in shaping research policy or research systems was limited in historical institutionalism. Due to this caveat, Ostrom (1990), Peters (2011) have argued that adopting a complementary perspective to change within a neo-institutional framework is helpful (Ostrom, 1990; Peters, 2011). One approach to this is to examine the agency's power relations more deeply. Actors defend their interest and strategize through the dynamics of power play, but institutional setting is considered to have the greatest overall influence (Hall and Taylor, 1996). Thelen argues that institutions exist through the enduring legacy of political struggles and that they respond to changing environmental conditions and political maneuverings (Thelen, 1999), p388). This implies that a number of key factors contribute to the concept of power relations among actors. The presence of a historically generated political culture and context, unequal distribution of power and resources, political conflict among actors, and unequal access to the decision-making process all help to explain the actors' role in the (re)distribution of power and resources (Steinmo et al., 1992; Thelen, 1999; Immergut, 2006; Capoccia and Kelemen, 2007). Considering these various factors, incorporating views from sociolological and rational perspective can be useful in explaining the factor driving the introduction of changes at the institutional level.

2.2.2.   Sociological neo institutionalism

Neo institutionalism's sociological approach focuses on the organizational theory perspective in which it considers the impact of institutions on organizations and individual actors. The focus is on the relationship between organizations and their environments. DiMaggio and Powell (1983) define organizational fields as constituting a recognized area of institutional life where legacy takes precedence over efficiency as isomorphism (DiMaggio and Powell, 1983), p148). DiMaggio and Powell define isomorphism as a constraining process in which, once organizational models are institutionalized and diffused; they increasingly resemble one another under the same set of environmental conditions.

DiMaggio and Powell describe two ways isomorphism can be observed: competitive isomorphism, based on market competition, and institutional isomorphism, which occurs through three processes of coercive, mimetic process, and normative processes (DiMaggio and Powell, 1983; Powell and DiMaggio, 2012). In a research context, coercive pressure can be from cultural expectations in the society which organizations function which forces organizations to adopt certain practices and rules. Mimetic pressure derives from uncertainty, for example, from poor understanding of new research methods and practices, which result in organizations imitating others that seem successful (DiMaggio and Powell, 1983; Powell and DiMaggio, 2012). Normative pressures come from shared understandings of what constitute appropriate courses of action, including professional values from a health professional network, social norms that are present among researchers or research entities, and social expectations on researchers or research entities (DiMaggio and Powell, 1983; Cruz-Castro et al., 2012). The strength of sociological NI and the concept of isomorphism gives useful insights for understanding continuity of reproduction and homogenization among organizations. but their weakness is in explaining change and observed change dynamics (DiMaggio and Powell, 1983; Powell and DiMaggio, 2012). Powell and DiMaggio point out the value of incorporating extra-institutional sources of institutional change, such as power and interest when it comes to explaining concepts that cause dynamic changes (DiMaggio and Powell, 1983; Powell and DiMaggio, 2012).

According to Hollingsworth, the institutional perspective stresses the normative environment in which the organizations are embedded (Hollingsworth, 2000; Hollingsworth, 2002). This perspective emphasizes the environmental influences on organizations and how the organizations tend to converge in their behavior as organizational isomorphism (DiMaggio and Powell (1983) cited in (Hollingsworth, 2002)). Hollingsworth's argument is that the normative institutional environment of organizations defines the cultural aspect of what is socially acceptable in organizations (Hamilton and Biggart, 1988; Hollingsworth and Hollingsworth, 2000; Meyer and Rowan, 1991; Zucker, 1987, 1988, Orru et al., 1991; Townley, 1997; cited by(Hollingsworth, 2002). Hollingsworth argues that in a society where stronger institutional norms, habits, and rules are enforced, the organizations embedded in this institutional environment have less autonomy to pursue independent strategies and goals, and that this results in greater isomorphism (Hollingsworth, 2002). Hollingsworth further demonstrates this by linking institutional science environments where radical innovations are less likely to occur as being those that are more rigid and have less autonomy and flexibility (Hollingsworth, 2008). This issue is also relevant in the health research sector, as strong research-based health systems tend to lead to better research evidence, better health policy practice, and influence better health and societal outcomes for the entire nation.

Sociological institutionalism also provides a framework for cultural norms and ideational frames (Landman and Robinson, 2009). The 'culture' refers to the macro level institutional forces such as institutional forms, procedures or symbols (Hall and Taylor, 1996). For instance, a nation's political administrative system and culture as well as societal culture shape the background of public sector governance (Frumkin and Galaskiewicz, 2004). Sociological institutionalism assumes that institutions affect the behavior of actors, as they too are embedded in the social, political, economic, and cultural contexts ((Hall and Taylor, 1996), p. 940). The theory also predicates that institutions frame the ways in which actors see their world by providing "moral or cognitive templates for interpretation action" ((Hall and Taylor, 1996), p.939). Science policy studies has applied this logic looking into research production and practices. Hollingsworth empirically analyzed research institutions of four countries (USA, Germany, France, and Great Britain) to illustrate how institutional arrangement and research culture creates either innovation or conformity in research output (Hollingsworth, 2008). Therefore, actors in

Uzbekistan health research system could also exhibit such responses based on the established norms, routines or existing values when choosing their course of action based on the premise of this theory (Hall and Taylor, 1996).

Social institutionalism provides useful insights in understanding governmental structures in public research systems as well as understanding of actors' characteristics within the system. As government of Uzbekistan faces various external pressures, such as globalization, exposure to media, and international opinion, certain regulations and legislations have been implemented to meet these demands. However, research organizations as well as its actors within health research system already carry certain ideologies and norms from past practices that would respond differently these recent regulation and legislation changes. Therefore, sociological NI strand would be useful in useful in understanding the health research systems.

2.2.3. Rational choice neo institutionalism

Rational choice institutionalism focuses on the rational strategic action of individuals. Its various approaches include politically and economically oriented rational choice (Shepsle, 1989, 2006). This section gives an overview of rational choice theory, which will serve as the basis for understanding science policy and government relations, namely the principal agent theory. Principal agent theory has been used to understand the relationship between state and science (Braun and Guston, 2003).

The argument of the principal agent theory comes from a rational choice perspective. From a rational choice perspective, institutions serve actors' interests. Therefore their purpose lies in serving individual interests rather than public interest, and the utility in this case is considered to be economic benefit (March and Olsen, 1996). Hall &Taylor's review of rational choice also provides important insights into actors, preferences, and strategic actions (Hall and Taylor, 1996). This means that basic features about actors –whether individual or corporate— pay special attention to interaction and modes or orientations of interaction. Actors can be individual or composite, be aggregated or a collective (and further a coalition or an association), and corporate actors are characterized by their capabilities, perceptions, and preferences. Basic self-interest and

the normative role of expectations and identities tend to shape the characteristics of the actors. The political rational choice perspective gives further insight into policy making related to the strategic choices made by the actors. Schaprf's ideas and observations about actors and their interaction provided guidance in understanding the government's or policy makers' choice and boundaries in the actions that they take with regard to research entities (Scharpf, 2000). The institutional setting defined by Scharpf was comprehensive; to narrow down and apply his ideas to the health research system setting of Uzbekistan therefore needed further theoretical insights (Scharpf, 2000). Yet this theoretical insight gives some good background for the analytical framework with which to analyze actor trajectories and policies within the research system. The basic features about actors and themes of interaction, such as unilateral action, negotiated action, majority of vote, or hierarchical direction, shows the mode of action of the actors in the research system. The strategic actions made by the actors in the health research system shape the outcome of things such as policy making in the research system.

The rational choice perspective has been argued from the transaction cost theory and has been introduced by Williamson (Williamson, 2000). This theoretical perspective has been studied in various contexts, including the transaction costs of economics and property rights theory (Richter, 2005). From an economics perspective, principal-agent relations were used to explain the relationship of firms that make use hierarchical forms of transacting business (Zeckhauser and Pratt, 1985). The basic premise of this approach is that actors find ways to minimize decision making and the follow up costs of adopted outcomes (Peters, 2011). In science policy studies, and more specifically the research management context, the above premise applies as a transaction between the actors' contract agreement on the transaction, the transaction in this case being to produce research. Research funding in this case can be viewed as an explicit contractual relationship, for example reviewing a proposal that includes a funding decision or an implicit contractual relationship with the expectations about the expertise of the agent and on how this expertise will be used (Braun, 1993; Meulen, 1998; Guston, 2003; Lane, 2013).

This approach according to Meulen has four features that explain the relations between principal and agent. Meulen points out that for agents – scientists and scientific

organizations – their interest lies in their role and position in the science system, which is quite different from the interest of the principal funding agency. Second, Meulen argues the problem of information asymmetry between the principal and the agent. The argument builds on the premise that the government (principal) lacks in information to judge the value of the scientific research to support its funding. It therefore brings in outside counsel, such as a science advisory board, to compensate for such information asymmetry. Third, principals monitor the resources (funding) transferred to the agent to gain information on the agents' activities. Finally, Meulen argues that for principal-agent relationship to work and to have stable relationships, the principal has to trust the agent. The trust goes both ways, as the agents' performance depends on a number of factors such as research autonomy from the principal and stable funding or reward (Meulen, 1998).

In this thesis, the principal refers to the government, while the agent consists of researchers from higher education facilities, such as academia and researchers from specialized research institutions. Research funding flows from the principal towards science (researchers), while research performance outputs such as research results flow from research producers to policy makers and to society in general. The rational choice perspective supports a calculated approach that emphasizes goal maximization and cost benefit calculation with its purpose being to minimize the transaction cost. Both of the approaches recognize the influence of actors to either monitor or constrain individual behavior based on the institutional arrangement. This insight is useful in explaining the institutional dynamic between the government of Uzbekistan and its relationship with its researchers within the health research system of Uzbekistan (Braun, 1993).

2.2.4.   Applications of Neo-institutional Theory

Despite recognition of the need to consider institutional factors in the health sector, more specifically in health systems (Gómez and Atun, 2013; Brinkerhoff and Bossert, 2014), institutional theory has not been widely applied in the field of global health or health sector studies (Gómez, 2013). As an initial literature review suggests, there is a paucity of applications of neo-institutional theory to health research systems. Recent studies and

reports have argued about the usefulness of applying institutional theory to understand the dynamics of the health sector in a low- to middle-income country context (Chanda-Kapata et al., 2012; Marais et al., 2012; Ager and Zarowsky, 2015). Albeit small, a growing number of empirical studies has employed concepts of institutional theory, such as path dependency, in analyzing the health sector (Takian, 2013; Hanrieder, 2015; Hiilamo and Glantz, 2015; Kwamie et al., 2016).

On the other hand, there was ample literature to illustrate the application of neo-institutional theory in science policy or research systems, and that has provided useful lessons for this study. In examining the dynamic between the government and research producers, principal agent theory has been widely used to explore matters such the dynamic of government funding and research policy regulated activities in public research system, and research and development in technology, to name a few (Guston, 2003; Braun and Guston, 2003; Fernández-Carro, 2007; Rasmussen and Gulbrandsen, 2012). Guston's (2003) study examined institutional frameworks, such as the state of delegation and its relation to reputational competition and intellectual flexibility adopted from the principal agent perspective (Guston, 2003). Hallonsten and Hugander (2014) used the concept of institutional isomorphism to examine the funding structure of the academic research system in Sweden (Hallonsten and Hugander, 2014). Castro's study has shown how institutional environments of the research centers (namely government management and funding sources) has impacted changes in the structure of the organizational field of research (Cruz-Castro and Sanz-Menéndez, 2007). Castro takes this analysis further by analyzing research centers in Spain to determine the convergence of research strategy in light of competitive funding, while some divergence is noted in research management (Cruz-Castro et al., 2012). Studies on the Science Technology Innovation (STI) sector have employed institutional analysis to examine the effect of institutional change on innovation activities (Balbachevsky and Botelho, 2011; Werle, 2012; Mudombi and Muchie, 2014; Valdaliso et al., 2014). For instance, Valdaliso et al.'s 2014 study evaluated STI sector policies in the Basque country, by combining path dependent mechanisms such as layering, conversion, and recombination to demonstrate the progress (or lack of progress) that has been made within the STI sector (Valdaliso et al., 2014). Overall, the case studies from the STI sector and research policy studies have provided useful insights into applications of institutional theory in analyzing research systems in various contexts.

Examining Uzbekistan's health research system also needs to take into consideration its unique political context being a post-Soviet country. Tverdohleb (2012) argued that institutional change is dynamic, and that there are various trajectories of systems change in countries of the former Soviet Union (Tverdohleb, 2012). Countries of Central Europe and Central Asian have undergone dynamic transformations in the political and economic sectors following the dissolution of the Soviet Union, but each country presents a different variety of configurations depending on its historical context (Tverdohleb, 2012).

Uzbekistan, like other former Soviet countries, has gone through the external shocks of becoming an independent state while adopting the market economy mechanism. Uzbekistan's major economy relies on agriculture and natural resources but seeks modernization in education and research for a more knowledge-based economy. Yet Kandiyoti (2007) and Luong (2002) have argued that in Uzbekistan institutional stasis creates difficulties in transforming institutions, even in the agricultural and economic sectors, which are considered to be the most progressive sectors within the nation (Jones Luong, 2002; Kandiyoti, 2007). The same argument has also been made about the lack of progress in the agricultural water management and the economic and political sectors adopting an institutional perspective (Kandiyoti, 2007; Kai Wegerich and Jusipbek Kazbekov, 2014; Hansjürgens, 2016). These studies demonstrate that neo-institutional theory has been used to explain post-Soviet transitional countries (Ahrens and Hoen, 2012; Tsui, 2016) but its application to analyzing research systems has been minimal.

Few studies have addressed the public research systems from institutional perspectives in the post-Soviet context. For instance, the public research system in Poland has demonstrated its institutional change to be incremental and continuous following the lines of logic of Thelen's institutional change framework (Heinecke, 2016). Another example is from Karaulova (2016a)'s study on the Russian Academy of Science, which argued there had been mixed progress in the Russian science sector, for it showed dynamic changes within the its research system and its policies but showed path dependent traits in publication practices and research outputs (Karaulova et al., 2016a). To the author's best knowledge and based on the literature review, there has been no

study that has utilized institutional theory in analyzing the health research system of Uzbekistan.

2.3. Analytical framework - Analyzing Institutional change within Uzbekistan health research system

As a synthesis of different perspectives presented in this chapter, this section presents an analytical framework that used for the empirical data analysis for this dissertation. As a single theory is not sufficient to explain the complexities of research system, several studies have demonstrated combined use of concepts from historical, rational, and sociological institutionalism theory. For instance, a combination of the principal agent model and historical institutionalism was used to analyze actors, institutions, and decision-making processes in the occupational health sector of Sweden (Håkansta, 2013). Håkansta (2013) argued that the politics of decision making between the principal and the agent have been influenced by the path dependent trajectories of occupational health policy (Håkansta, 2013). Several other studies have employed a combination of historical and sociological institutional theory to demonstrate the authority dynamic within the STS studies as well as other fields that address public research systems (Persson, 2008; Jabłecka and Lepori, 2009; Engelstad et al., 2017).

This analytical framework is an attempt to merge the issues raised from different strands of a new institutional perspective, taking into account the context in Uzbekistan. Ostrom (2009) has pointed out that the analytical framework works as a guide to configure elements of theories that would be useful in supporting or invalidating specific explanations for analysis (Ostrom, 2009; Coral and Bokelmann, 2017). This framework incorporates the recent study by Karaulova (2016) comparing the Russian and the Chinese academies, analyzing institutional markers of each country's research system (Karaulova et al., 2016b). Karaulova devised a more detailed conceptual framework to apply in a post- socialist country context to understand institutional change in a national research system (Karaulova et al., 2016b). Karaulova's framework combined both qualitative and quantitative evidence to identify the relationship between institutional actors and transformative change. The framework incorporated concepts that used path dependency, agency, learning, and interaction, and consolidated them into four categories

of an analytical framework: outputs and performance, re-creation, centrality, and competence and autonomy (Karaulova et al., 2016b). The framework starts by understanding the research system as having institutional elements guided by a certain type of logics that has led to the current research system. The logics represent the key dimensions of institutional indicators that are aspects of historical institutionalism, rational choice, and sociological institutionalism (Table 2.2).

By adopting this framework and the concepts of new institutionalism enumerated earlier, the framework of this study aims to highlight the nature of change, that is, the inertia and non-inertia happening in the health research system. In order to assess the research accomplishment and the challenges faced in health research, this thesis uses system outputs and performance measures. As one example, analysis of research output volume demonstrates research organizations' activity and their change over time in relation to the growth of the system. Examinations of institutional influences on scientific research through publications have been done in various country contexts including Turkey, Slovenia, Sweden, and Korea, to name a few (Önder et al., 2008a; Leydesdorff and Wagner, 2009; Kwon et al., 2012; Cadez, 2013; Hammarfelt et al., 2016). Bibliometric data has also been used to examine the changes in patterns of research publication after independence, that is, after the Soviet period (Kozak et al., 2015). Other authors have employed an institutional perspective to examine the reform of research systems in post-Soviet (socialist) settings (Balazs et al., 1995; Jabłecka and Lepori, 2009; Yegorov, 2009; Klochikhin, 2012; Kwiek, 2014). This study will mainly deal with the research quality in relation to the type of journals chosen for publication and its citation factors. The recreation component of this discussion deals with the creative and innovative aspects of the respective research system, focusing on human resources, performance, and institutional factors that influence publishing behaviors (Karaulova et al., 2014; Karaulova et al., 2016b).

Centrality concerns the location of an institution's geographical structure in relation to regional patterns. For this, institutional network and collaboration competence and autonomy were considered, as this component shows the embeddedness and diffusion of an institution in both national and international networks (Vincent and Malbas, 2015; Sooryamoorthy, 2015). The main objective of this analytic component is to observe the

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institutional isomorphism with attention to institution types. This also reflects on global research flows of institutions in Uzbekistan. The resource element shows how research funding sustains research activities (Lepori, 2011). The particular research organization's stability and focus of research activity reveals aspects of the institutional isomorphism. More specifically, the vision and mission of each research institute are used to examine the research institute's characteristics and their convergence (Philipps, 2013). The study also examines the educational sector for structural institutional changes to determine whether there were any GDP investment changes over the years since independence (Heinecke, 2016). Finally, the research system governance component deriving from the principal agent model of the rational choice perspective will reveal the dynamic between government and research producers.

Table 2.1 Analytical framework for the study modified from (Karaulova et al., 2016b)

Institutional marker	Component marker	Key institution	National health research system	Data sources for empirical analysis	Relevant Chapters
Outputs and performance	Volume	What volume of research does the institution produce? How has this changed over time?	What volume of research does the system produce? How has this changed over time?	Published papers	Chapter 5.1
	Quality	Who produces research and in which quality?	Who else produces excellent research?	Citations and journal placements	Chapter 5.1
Re-creation	Rejuvenation	How well does the institution replenish its human resources?	How many new researchers are joining the system?	Secondary data	Chapter 6.2.2

	Learning and innovation	How does the institution reflect on its performance, develop, and implement new practices?	How creative is the system in inventing or adopting new practices and incorporating innovative components? Is there traits of coercive, mimetic process, and normative processes?	Secondary data; interviews	Chapter 6.2.1
	Path dependence	How likely is the institution to reproduce inhibiting components and practices?	How likely is the system as a whole to reproduce inhibiting components and practices?	Publication strategies; secondary data	Chapter 5.2, Chapter 6.1, 6.2
Centrality/ isomorphism	Institutional isomorphism(v an den Hove, 2007)	What are the strong areas of the institution's research? Is there much diversity?	What are the subjects in which the system has traditionally been strong?	Disciplinary research publishing patterns	Chapter 5.3
	Spatial centrality	How diverse is geographical structure of the institution?	What is the regional structure of the national research system?	Institutional research publishing patterns	Chapter 5.3
Competence and autonomy	Collaboration and diffusion	What are the general patterns of national and international research collaborations?	What are the general patterns of national and international research collaborations?	Co-authorship, inter-institutional and international collaboration patterns	Chapter 5.4

	Institutional agency	How flexible is the institution in adopting endogenously driven change in its practice?	What is the overall degree of liberty in strategic decision-making in the organizations within the system?	Secondary sources; interviews	Chapter 6.2.1, 6.2.3
	Resources	What are the funding sources?	What is the general funding structure of the system? What is the degree of diversity of funding sources?	Funding acknowledgements; secondary sources Interviews	Chapter 6.2.2
Research system governance	Principal agent interface	Research capacity of agents (are agents able to give what government principal wants?)	What is the understanding of research between both actors? Is there any information asymmetry or gap?	Interviews Secondary data	Chapter 7.3

2.4. Conclusion

Theory should provide a framework for understanding a particular phenomenon. Walsham (2006) has argued that the choice of a theory for one's analysis is subjective (Walsham, 2006). Walsham (2006) further argues that the choice of a particular theory should offer insight that enables the researcher to gain good comprehension on the field. King et al. (1994) argue that once a theory is chosen, it should guide the selection of observable data (King et al., 1994). Once data is organized, it should provide implications that will help in evaluating the theory in question (King et al., 1994). Moreover King asserts that the theory and data interact and theory cannot be fixed throughout, as learning from data can lead to observable implications of new theory (King et al., 1994).

Following these recommendations and observations, there are two reasons for choosing neo institutional theory: First, a literature review on the post-Soviet setting, research systems, science policy, and education systems suggested that institutional (regulative) elements are constraining factors in this research system. This suggests the need for further investigation using the neo-institutional theory as a guide. Second, internal and external environmental forces influence the multiple interconnected functions and elements of the health research system. The nature of this study is evaluative, as it aims to identify factors that influence the institutional change of a particular health research system and assess its embedded environment. Therefore, employing three institutional theoretical strands was necessary to examine the dynamic, meaning both internal and external environments of this health research system. The strength of neo institutional theory comes from having explanatory power in understanding how an institution influences organizational activities (Scott and Meyer, 1994; Scott et al., 2001; Frumkin and Galaskiewicz, 2004; Hage and Mote, 2008; Whitley and Gläser, 2014). Research law and administrations are bodies of the institutional framework (Hollingsworth, 2000) as well as organizational performance, all of which are driven by regulatory, cultural, and normative forces ((DiMaggio and Powell, 1983; Scott and Meyer, 1994; Peters, 2011)). Adopting the concepts of path dependencies and institutional diffusion aids in examining research performance to explore the impacts of formal and informal institutions (Önder et al., 2008a; Cadez, 2013).

The limitations of new institutionalism (NI) is perhaps that there is no unified perspective, as there are different schools of thought in new institutionalism. Bell (2002)'s review on different schools of NI revealed that each strand requires different methodologies (inductive or deductive), which make integration difficult given the different ways of analyzing social phenomena (Bell, 2002). Despite the differences of methodology and of the overarching framework, there have been crossovers of these approaches. For example, Immergut (1998) points out that new institutionalists address the overall perspective by shared sets of research questions and discussions of border crossing (Immergut, 1998). Peters (1999) argues that various schools of thought in new intuitionalism share the focus on institutions, the influence of structure on agency, the regulating power of institutions, and the complex interaction between institutions and agency as common analytical points (Peters, 2011).

The new institutional school of thought is associated with either a 'calculus' or 'cultural' aptitude, as defined by Hall and Taylor (1996) (Hall and Taylor, 1996). The question is how to complement the differing approach of theories. Historical institutionalism in this sense complements both the sociological and rational choice of new institutionalism. Rational choice focuses on the micro level while sociological new institutionalism underlines the importance of the macro level, and historical new institutionalism combines both micro and macro perspectives (Bell, 2002). The argument for combining different strands of institutionalism is due to their strengths and weakness in explaining institutional change and stasis. The challenge is to analyze and explain the interaction among many different forces rather than just a few of them. Based on the above issues, the crossover of different institutional strands could point to the need to attempt a more integrated framework that has a processual approach to understanding societal phenomena through a new institutionalism perspective.

This chapter aimed to present the result of a literature review in exploring new institutionalism theories for addressing the research questions of this thesis. It reviewed the main characteristics, including the strength and limitation of institutional theory, followed by an analytical framework with institutional indicators for explaining institutional change within the health research system of Uzbekistan. There are limitations to the neo institutional theory approach and combining different analytical approaches of different theories is in itself a limitation. But there have been examples from other empirical studies that have shown that combining different institutional theories provides insights to explain the institutional change process (Currie et al., 2009; Håkansta, 2013; Karaulova et al., 2016b).

The analytical framework adopted from Karaulova et al.'s 2016 study is based on neo-institutional theory, which matches the research question and the overall objective of the thesis (Karaulova et al., 2016b). This study makes a critical contribution to both health research systems and institutional theory. This study will achieve this by exposing the tendencies (e.g., regulative, social, and cultural) exerted by the environments on the health research system and other organizations involved in health research in Uzbekistan, as well as helping to understand actors and institutions of the health research system and the dynamic between them.

The use of institutional theory offers policy decision makers, researchers, and international health related organizations conceptual tools and techniques for understanding institutional change scenarios in the health research system, as the findings of this study will have relevance at the national, organizational, and international levels. It will additionally benefit health research capacity building efforts in Uzbekistan, but also other similar country contexts.

Chapter 3.   Methodology

3.1. Introduction

This chapter summarizes the methodology adopted to understand the health research system in Uzbekistan. The first section of this chapter outlines the research design given this particular context. The second section explains the reasoning behind the choice of the case study approach for this research. The third section discusses the mixed method applied for this study. Quantitative data used in this study is the bibliographic data consisting of a) indexed (global) and b) non-indexed (also referred to as non-source items) local Uzbek publications. As these two datasets require different approaches in data collection and analysis, these are explained in 3.1 and 3.2 of this section. Section 3.3 outlines the qualitative data collection and analysis strategy. Section 3.4, reports on fieldwork activities after which follows an analysis of the strengths and limitations of the method chosen following with the conclusion of the chapter.

3.1.1.   Research Questions and Design of the Study

The purpose of this study is to investigate Uzbekistan's health research system through the institutional theory perspective. The health research system in Uzbekistan is facing challenges to meet the global standards of health research. Different actors in the field interpret and adapt to the situation differently as their research capacity differs in real world. To address the purpose, the following research questions guided this study:

1. How do historical developments (e.g., education, political economy, and research and development (R&D)) shape the Uzbekistan health research system?

    a. What was the impact of the Soviet period on the health research system of Uzbekistan?

2. What is the current state of the health research system in Uzbekistan after independence?

    a. What is the research trend and quality in Uzbekistan's health research system? (research capacity)

b. How do organizations contribute or negotiate the development of the health research capacity in Uzbekistan?

c. How do policy actors draw on the health research findings to negotiate and renegotiate (health) policy changes?

3. Does the institutional theory perspective help in explaining the current phenomena?

a. Is there evidence of path dependency in the health research system –for example, in the research output, research organization, and individual researchers of Uzbekistan?

b. More specifically, are institutional structures of health research and research priorities from before independence still in practice after independence?

This study's boundary is within the institutional context of the Uzbekistan health research system, with the primary unit of analysis being the research outputs and institutional structure of health research in Uzbekistan. By analyzing the research outputs of the studies conducted in Uzbekistan, the thesis will outline the trends of this health research, the topics explored, and the types of research performed both at the national and international level. These research outputs yield good information, such as author affiliation, topics covered in the research, methods used and types of health research conducted in Uzbekistan. The accumulated information over time, the big picture, shows institutional strength, government priorities, and the current research capacity of the country. As mentioned before, while publications provide insight into research capacity, they do not provide a full picture of the existing institution and the research system. Therefore, interviews with diverse actors were necessary to identify perceptions and experiences.

The mixed method approach is necessary since information about the health research system in Uzbekistan is not easily accessible. Therefore, the quantitative research served as a foundation to understand the research capacity of Uzbekistan. The qualitative research aided in better understanding the context. Mixed method approaches rely on multiple data sources, theories that guide the data collection process, and an in-depth exploration of a specific phenomenon (Creswell, 2013). Table 3.1 below outlines

the research design and the specific strategies taken, while the following sections give details of the method choices.

Table 3.1 Research design overview

Context:	Low- to middle-income countries are forging partnerships with high-income countries to build health research capacity and enhance their existing health research system. Uzbekistan, like other low- to middle-income countries, is marching on this same path, yet the system, whether institutional or individual struggles to adapt to the new "norm" with past (Soviet) practices of research still being so present and even dominant currently.
Objectives:	To explore and analyze how the Uzbekistan health research system has evolved from its past Soviet setting to the current reforms.
	To analyze the country's health research capacity as part of understanding the current health research system, and thereby to provide formative feedback for local and national decision makers in the health sector on the health research performance of Uzbekistan
Components	1) research output as proxy measure for research performance
	2) examination of institutional structures and actors involved in the health research system of Uzbekistan
Data collection:	Quantitative: bibliographic data (local and global)
	Qualitative: Semi-structured interviews, documentary data, field notes, observations
Analysis:	Quantitative: Bibliometric analysis using Excel, Stata, Vosviewer
	Qualitative: Thematic analysis with manual coding that emerged from the data
Main limitations:	1) Unable to gain access to secondary data on research budget and spending
	2) Unable to access daily research practices of research institutes. This, in turn, made it difficult to develop a holistic understanding of some key issues that affect the overall research performance taking place or how policy reforms impact their understanding of everyday research performance

3.2. Methodological Paradigms to Assess Health Research in Uzbekistan

Research refers to a compilation of strategies, plans, or design linking the choice of methods to the desired outcomes (Crotty, 1998). Health research system is a compilation of many components, such as research input, output, and outcome (Sadana and Pang, 2004). Hence, this chapter will outline various methodological paradigms to assess health research systems.

3.2.1. Component 1: Exploratory study of the bibliometric analysis

Research spending, as research input, very directly and clearly shows the priorities in health research focus, such as money invested on drugs to prevent/treat certain diseases. However, research spending data is not publically available in Uzbekistan, although aggregate measures of R&D can be found in some studies (Adam et al., 2015; Bertelsmann Stiftung, 2016). Even if exact health research spending data were available, the measure would be complicated as the level of input is correlated but not directly a measure of the research outputs (Kaye, 2012; Phillips et al., 2013).

Research outputs can shed light on many of the aspects of the above conceptual capacity framework that is not well known in Uzbekistan. Research outputs, such as patents and scientific publications, represent the knowledge produced correspondingly of the research activity. Common indicators of research outputs include patents and publication counts (e.g., share of patents or publications), and citation counts (e.g., relative citation impact) (Bordons et al., 2002; Phillips et al., 2013). Others include research output of the university, prolific authors during the period, the authorship patterns of the papers published, and the choice of communication in certain journals particularly preferred by the country's researchers (Inönü and Kurnaz, 2002; Agasisti et al., 2012).

Research outcomes are the most difficult to measure because outputs are not comparable to the outcomes of the research. Examples of immediate research outcomes include evidence that decision makers are aware of the production of specific research data (Kalucy et al., 2009). Intermediate research outcomes may include the demonstration that there has been a change in policy or practice as a result of the research evidence (Buxton and Hanney, 1996; Hanney et al., 2004; Kaye, 2012). Finally, long-term outcome evidence is the most difficult to demonstrate, such evidence being improvements in patient or population health, or health service cost savings resulting from how the research was applied (Glover et al., 2014; Thonon et al., 2015). Given these limitations, researchers and organizations are increasingly using both research output and health outcome indicators that demonstrate progress and improvement along a continuum towards aspirational research outcomes (Campbell et al., 2010; Cozzens, 2010; Glover et al., 2014).

In the current research, the research output is used as a proxy measure to understand the inputs for health policy. The advantage of health research output is that it gives an overview of the individual, organizational, and national focus of the health research of the nation—in other words, the representation of health research capacity. Research output analysis can provide information on the growth trends and characteristics of research; and both may also reflect the funding priorities of local governments or international health agencies. Examining the pattern of international collaboration may also reveal information on the intensity and breadth of collaboration between researchers in Uzbek research entities and researchers from other countries. Even though this particular research chooses health research outputs to examine health research capacity, it represents overlapping aspects of research inputs, which gives insight into the health research system of Uzbekistan. However, this approach has its limitations in representing the perspectives of the actors involved in the health research system of Uzbekistan. Therefore, qualitative study component is added to complement the gap.

3.2.2. Component 2: Examining the health research system- a case study approach

Case study is a research approach used to "generate an in-depth, multi-faceted understanding of a complex issue in its real-life context"(Crowe et al., 2011), p100). There are various definitions to this approach. Stake defined the case study method as "both the process of learning about the case and the product of our learning" (Stake, 1995), p237) cited in (Crowe et al., 2011), p100). Yin defines it as "an empirical inquiry that…investigates a contemporary phenomenon in-depth and within its real-life context… especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2013) cited in (Crowe et al., 2011). Green and Thorgood's definition is more applied, namely that it is an "in-depth study undertaken of one particular 'case,' which could be a site, individual or policy" (Green and Thorogood, 2009), p284 cited in (Crowe et al., 2011), p100). The common theme that emerges from these definitions is that they focus on examining an event or phenomenon in-depth and in its natural context. This approach aids in understanding the causal links and pathways resulting from policy reforms or intervention or development(Crowe et al., 2011).

Case study is used for situations that need "how," "what," and "why" questions to "explain, describe, or explore events or phenomena in the everyday contexts in which they occur" (Crowe et al., 2011; Yin, 2013). This approach is recommended when the researcher intends to analyze the contextual conditions that are relevant to the phenomenon of study(Yin, 2013). Yin (2013) argues that the case study focuses on "a contemporary set of events over which the investigator has little or no control" (Yin, 2013), p9). In the health sector of developing countries where context takes priority, case study approach is often applied. According to Exworthy et al (2012), the scale of case study research in health policy has significantly increased over the past 30 years, especially since the mid-1990s (Exworthy et al., 2012). The above increase implies that the case study approach is particularly valuable at analyzing critical events, and policy construction processes in a real-life context(Crowe et al., 2011). For instance, Grundy utilized the case study approach to observe the influence of history and politics in reshaping the health policy landscape in national settings of different countries such as Myanmar, North Korea, Cambodia, and the Philippines (Grundy et al., 2014a; Grundy et al., 2014b; Ottersen et al., 2014). The above studies have applied case study approach to examine which social theories could best explain the varying pace of policy and system change across national settings.

Considering the above conditions, case study design fits well as a means to discover "how" historical developments and current developments have an effect on the health research system in Uzbekistan. There are competing interests and a multiplicity of interpretations of health development goals both by national and global actors. The result is a challenge to the notion of what health research is and what the health research capacity is at both a global and a national level. Given the above context, the question that drives this research is: "How is the concept of health research interpreted and constructed locally by different social actors with varied interests in the health sector in this post-Soviet setting?" By using different sources of evidence, this study aims to test and validate the main research questions. Therefore, the research combines the information collected through grey literature and document analysis, with the information provided by semi-structured expert interviews and participant observation. The analytical framework from the theoretical chapter 3 serves as the basis of case interpretation or a template with which to compare the empirical results of quantitative data and qualitative

data. With its theoretical orientation, this study respectively presents a detailed analysis of the Uzbekistan health research system in the following three chapters. The chapter 4 details the research outputs with analysis through bibliometric. The chapter 5 focuses on cases of the health research system through qualitative interviews. The chapter 6 includes key informant interviews reveals the gap between research and the policy making process that is taking place in the health research system of Uzbekistan.

Approaches to case study research

There are six steps recommended as research activities when considering the case study approach. They are: defining the case; selecting the case(s); collecting and analyzing the data; interpreting the data; and reporting the findings (Crowe et al., 2011). The following section explain the case definition and selection. The data collection and analysis, interpretation, and reporting of data will be covered in-depth in section 3.3.3.

Defining the case

Yin recommends that when defining a case, each case should have a distinct scope that clarifies the nature and time period covered by the case study (Yin (2011) in (Crowe et al., 2011)). Defining a case also includes identifying the relevant organization, or geographical area of interest to the researcher, the types of evidence to be collected, and the priorities for data collection and analysis (Yin, 2011) in (Crowe et al., 2011). Approaches to defining a case also depend on the epistemological approaches of the researcher, meaning whether the researcher takes a critical (meaning questioning one's own and others' assumptions), interpretivist (trying to understand individual and shared social meanings), or positivist approach (oriented towards the criteria of the natural sciences, such as focusing on generalizability) (Crowe et al., 2011). These are not exclusive approaches, as researchers can usefully draw on a critical, reflective perspective which seeks to take into account the wider social and political environment (Doolin, 1998; Crowe et al., 2011). For my research, I have taken similar approaches to Doolin's interpretive approach to case study to take into account the social and political environment of the health research system in Uzbekistan (Doolin, 1998).

An interpretive studies' research paradigm focuses on the need to understand the world as it is from a subjective point of view. It therefore, seeks an explanation within the

frame of reference of the participant rather than from the perspective of the objective observer of the action. This stance differs from a critical perspective where the research is more focused on action towards a "political agenda and [where] the task of the researchers is not to be dispassionate, disinterested, and objective" (Morisson 1995 as cited in (Cohen et al., 2000), p. 32). Uzbekistan, as an authoritarian state, the opaque transparency to the public about their health policies and health research is to protect the security of their political regime; thus, a critical stance is not plausible. The objective of my research is to produce an understanding of the context of the health research system in Uzbekistan and the process whereby the research system influences and is influenced by the context. In a descriptive and interpretive case study, the researcher analyses, interprets, and theorizes about the phenomenon against the backdrop of a theoretical framework (Cohen et al., 2000). An inductive method is then used to support or challenge theoretical assumptions. The advantage to this approach is that it reveals in detail the unique perceptions and concerns of different actors in a real-world situation, which would have been lost in quantitative or experimental strategies (positivist approach) (Cohen et al., 2000). Taking into account that no research methodology is perfect, this study is a descriptive and interpretive case study approach.

Selecting the case(s)

Selecting the cases depends on the nature or characteristic of inquiry – intrinsic, instrumental, collective (Stake, 1995; Thomas, 2011; Crowe et al., 2011). An intrinsic case study involves an unexplored unique phenomenon (Crowe et al., 2011). An instrumental case aim is to provide a comprehensive grasp of uses an incident using a particular case (Crowe et al., 2011). Alternatively, a collective case study uses multiple cases to present a broader picture of the phenomenon (Crowe et al., 2011). These categories are not necessarily mutually exclusive as an intrinsic case can develop into an instrumental case study (Stake, 1995; Crowe et al., 2011). Such characteristics of the cases help the researcher to recognize the availability of access and of working environment for data collection (Crowe et al., 2011).

Crowe et al (2011) stresses the importance of the researcher knowing the case study site(s) to work collaboratively with them (Crowe et al., 2011). Cases should be interesting but also compatible with the data collection site to gain information and answer

research questions (Stake, 1995; Crowe et al., 2011). The health research system of Uzbekistan is not well studied in the literature compared to other countries, for example in the African context, that have received much international attention (Johnson, 2014b; Reeder and Guth, 2015). The health research system of Uzbekistan is instrumental in this study. The purpose is to provide insight and a basis to examine whether the theoretical perspectives taken for this study applies to the cases chosen. Furthermore, the accessibility to the study site and various actors in health research system determined the chosen cases, as my study was part of a larger project in Uzbekistan (HEALTHCAP). Table 3.2 outlined the overview of the cases chosen for this component. As seen from the Table 3.2, the selected research entities served as avenues to understand the institutional dynamics of health research system. These include universities, specialized research institutes, and a post-medical training center. The interviewees included various personnel, from management level academics to researchers. This was to understand the case study research organizations, and to gain various perspectives on their research practice (Table 3.2).

Table 3.2 Overview of case study research organizations[1] (details in Chapter 6)

	Name	Date of foundation	Type of Institution	Research Focus 1	Research Focus 2	Interviewee /observations	Interviewee code
A	Tashkent Medical Academy (TMA)	1920	University	Various Disciplines under Medicine	Mixed - fundamental and practical	Management (faculty at rector level) Professor (Senior Faculty)	A1 A2
	TMA School of Public Health	2005	University	Public Health	Practical	Professor (Senior Faculty)	A3
B	Tashkent Institute of Postgraduate Medical Education (TIPME)	1932	Post Medical Training (Education)	Disciplines under Medicine	Mixed - fundamental and practical	Professor (Faculty)	B1

[1] Reference: https://www.minzdrav.uz/agencies/all.php?SECTION_ID=111 (Last accessed on Aug 2nd 2016)

C	Specialized Research Institute for Sanitation, Hygiene, and Occupational Health (S-RISHOD)	1934	Specialized Research Institute	Sanitation, Hygiene, and Occupational Health	Mixed - fundamental and practical	Research team manager (3) Research team members (3)	C1-C3 C4-C6
D	Specialized Research Institute of Virology (S-RIV)	1978	Specialized Research Institute	Virology	Fundamental	Research team manager	D1
E	Specialized Research Institute for Parasitology (S-RIP)	1923	Specialized Research Institute	Parasitology	Fundamental	Research team manager	E1

3.2.3. Component 3: Examining research to policy process - Exploratory study

The final component involves an exploratory study to examine the application of research in policy making. This follows the principal agent dynamic from the analytical framework. In order to develop a thorough understanding of this process, the exploratory study component involved collection of multiple sources, including secondary data and qualitative data collections (e.g. interviews, focus groups, and observations). Table 4.3 listed the key respondents who consist of senior politicians, a former senior ministerial official in the ministry of health, independent consultants, researchers, and academics. Each actor in the health research system all play a role in producing and utilizing research for the decision-making process within the health research system (Brinkerhoff and Bossert, 2014). To understand this dynamic, multiple sources of data (data triangulation) has been used as a way of increasing the internal validity of a study (i.e. the extent to which the method is appropriate to answer the research question) (Mays and Pope, 2000; Barbour, 2001; Mason, 2002).

Table 3.3 List of Key Actors in health research system (details in Chapter 7)

Code	Description 1	Description 2
G1	Government official	Former district head of Ministry of health
P1	Politician	Member of parliament
P2	Politician	Former member of parliament
I1	Independent expert	Consultant for international agency
A1	Academic – member of expert group related to health policy in parliament	Academic at medical university

3.3. The mixed methods approach

Mixed methods is an approach helps to consider multiple viewpoints, perspectives, positions, and standpoints (always including the standpoints of qualitative and quantitative research) (Johnson and Onwuegbuzie, 2004; Johnson et al., 2007). Rossman and Wilson (1985) identified three reasons for combining quantitative and qualitative research. First, combinations enable confirmation or corroboration of each other through triangulation. This process complements the strengths of each methods. Second, mixed methods provide richer data on the research problem. Third, combinations are used to initiate new modes of thinking by attending to paradoxes that emerge from the two data sources (Rossman and Wilson, 1985; Johnson et al., 2007). Mixed method provides a framework in combining both qualitative and quantitative data (Fig 4.1).
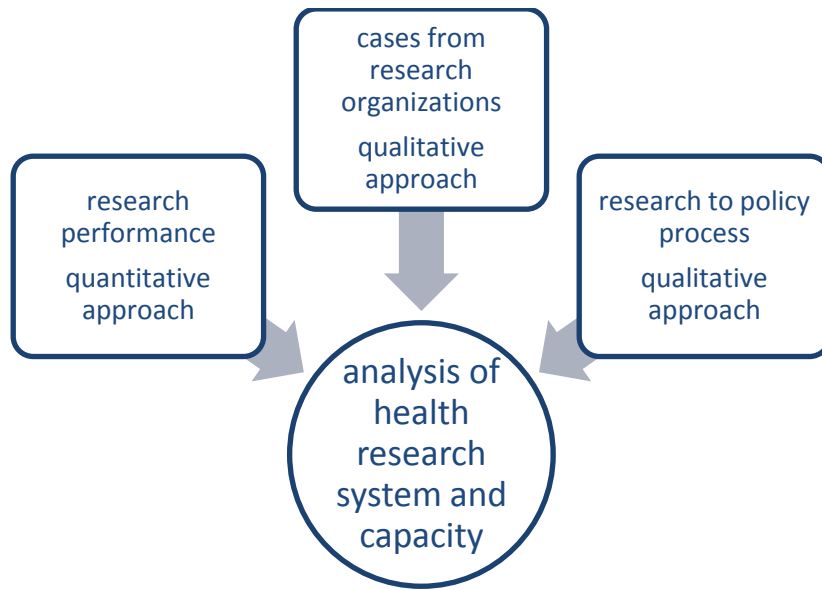
Figure 3.1 Contextualizing Research Overview

3.3.1. Quantitative data --international bibliography database

Overview

The quantitative data used in this study is bibliographical data using bibliometrics as an analytical tool. Bibliometrics is defined by Glas as "the search for systematic patterns in comprehensive bodies of literature" (Glas, 1986), p40). The terms bibliometric, scientometrics, and infometrics refer to component fields related to the study of the dynamics of disciplines as reflected in the production of their literature (Hood and Wilson, 2001; Mingers and Leydesdorff, 2015). These terms have been used interchangeably due to related methodologies (Hood and Wilson, 2001). Diverse disciplines employed bibliometric techniques for various research purposes. With respect to health there have been literatures using bibliometric to assess the health topic trends and productivity in a country or region (Sweileh et al., 2015b; Santoro et al., 2015); analyze a specific discipline or field within health (Huamaní and Mayta-Tristán, 2010; Mishra, 2014); and to measure collaboration amongst researchers (Li et al., 2015). Although not common in the health sector, in the field of social sciences there have been literatures empirically analyzing theoretical implications such as path dependence (Önder et al., 2008b; Klochikhin, 2012;

Karaulova et al., 2016a) and research demonstrating historical trends in particular academic fields (Shen et al., 2013).

Bibliometric are used to analyze research productivity by the volume of documents, citations, and publications produced by a country, an organization (university or institution, organizational unit (department or research group), or individual (Larsen, 2011). Bibliometric also measures the influence of one or more publications on the research community, meaning the impact factor of an article (Larsen, 2011). International academic bibliography databases such as Web of Science, SCIMago, Scopus, PubMed, and Google Scholar are those generally considered for bibliometric analysis to measure academic performance (Gasparyan, 2013; Sweileh et al., 2015a). This study utilized SCIMago, PubMed, and Web of Science. Although Scopus has an extensive social science database, there are several reasons why this study used SCIMago, PubMed and Web of Science for data collection. First, the search strategy had to be open access and transparent not only to follow the case study research design principle but also for it to be useful for potential use in research policy by future Uzbek decision makers. SCIMago, PubMed, and the Web of Science database are open access and do not require an institutional subscription, while Scopus does (Gasparyan, 2013). While SCIMago gives the overview of publication performance in all sectors including health to give a comprehensive understanding of the science performance it, PubMed (www.ncbi.nlm.nih.gov/PubMed) offers an 'advanced search' function using title, keywords, and Medical Subject Headings (MeSH), and a comprehensive vocabulary for the purpose of indexing journal articles in the medical and life sciences. To complement this, Web of Science covers science, technology, social sciences, arts, and the humanities areas, areas in which PubMed lacks subscription (Sweileh et al., 2015a).

Database mining

SCIMago database is comprehensive as it offers research performance in all sectors of science. The database provides overview of the country level and chosen disciplines. SCIMago database aggregates data from journal outlets therefore, offers unique overview of publication trend. The caveat of this database is that it does not offer information on individual publication outputs like PubMed or Web of Science. Hence, in this study makes use of SCIMago to offer general overview of the country research trend.

For detailed analysis of the research performance, PubMed and Web of Science database provided basis for data mining.

For PubMed, initial search strategy was to be as comprehensive as possible to identify the types of research articles produced on Uzbekistan. Initial search strategies were adopted following Kalita et al., (2015) using the MeSH tree "health care and public health" as a 'major topic' to narrow down the search results (Kalita et al., 2015).

The search terms used were:

1. MeSH major topic _ health care public health,

AND

2. Text word _ Uzbekistan, AND

3. Publication date _ from 1991/01/01 to 2015/12/30

4. Field: Article

To ensure that all articles related to health research have been included, a search was conducted to test the accuracy of the search using combinations of MeSH major topic health care with MeSH terms global health, sanitation, hygiene, epidemiology, environmental health, ecology, or occupational health, food safety, and pharmacology. Such terms were used in light of the various interests of research institutes and practice centers currently active in Uzbekistan (World Health Organization Regional Office for Europe, 2014, 2016) . For the first tests of accuracy, the term "global health" was added. This revealed that all relevant articles were included in the primary search. However, the above search turned out to be less comprehensive after adding in additional terms related to health research relevant in Uzbekistan. Therefore, to be as comprehensive as possible the search syntax included additional search terms. In addition, the language setting counted in both Russian and English in order to capture existing literature. As a result, these syntaxes resulted in 243 PubMed articles.

A non-systematic scientific literature survey using Web of Science counted all existing publications up to Dec. 31th, 2015 with the country setting (=CU) "Uzbekistan". This produced a scientific publications dataset similar to the search strategy used in PubMed database (refer to Appendix B for search term index). The content information study based on these two databases yielded 430 resources. After removal of duplicates of 48 articles, and after the application of exclusion criteria, 321 articles were included in the database (Fig 3.2).

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            ┌─────────────────────────┐
            │  Total Pubmed = 243     │
            │  Total Web Of Sci = 177 │
            │  In total 430           │
            └─────────────────────────┘

  ┌──────────────────┐      ┌──────────────────────┐
  │    Removed       │      │  Removed based on    │
  │  Duplicates=48   │      │ Exclusion Criteria = 61│
  └──────────────────┘      └──────────────────────┘

            ┌─────────────────────────┐
            │      Total= 321         │
            └─────────────────────────┘
```
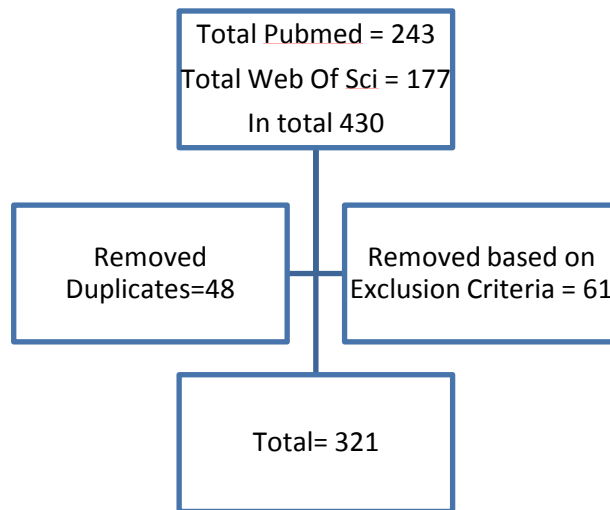
Figure 3.2 The process of data collection for bibliometric analysis

All bibliographic databases were retrieved and then stored to the Zotero® 4.0 library. The data were exported as CSV files using an Excel spreadsheet (Microsoft™ Excel® 2007) for descriptive table and plot generation. A cloud-based bibliometric mapping tool (Knutas et al., 2016) was used to analyze co-words and cluster to identify the popular topics. Vosviewer was used to view the results in institutions and popular research topics as a visualization technology (*VOSviewer*).

Inclusion and Exclusion Criteria:

The eligibility criteria for selected literature were: (i) research journal articles that fell within the medical, public health, and environmental health research definitions and (ii) the period of publication from independence in 1991 to 2015. The exclusion criteria were: 1) topics that did not concern the physical and mental health of humans; 2) Uzbekistan

was not the focus of a specific study but was instead reported as part of a group of countries of the former USSR, CIS (common for HIV/AIDS, TB, HPV disease) or that mentioned 'Uzbekistan' as a reference; 3) case reports published outside Uzbekistan regarding Uzbek citizens (i.e. migration health); 4) topics mainly concerned with environment management/resources/pollution not related to health; 5) letters to editors, personal communications, conference abstracts; and finally 6) articles with no author information available (including no abstract or full text available).

Data checking and Co-Author affiliation

The bibliometric data were standardized and coded by hand in order to correct misspellings and ensure consistency between author institutions and countries. Text-mining software applications such as VantagePoint is a useful tool for carrying out standardization in large datasets. Yet, the cost of this software was beyond the resources available for this study, therefore, was not used.

Analysis strategy

A standardized extraction checklist for retrieving the data from the articles was prepared. Based on the checklist, data such as study designs, core area of research, and type of research (i.e. behavioral/environmental/social, clinical trials, laboratory studies etc.) were collected from publications. Further data extracted based on the bibliometric categories and indicators presented in Table 4.4. The original idea for these indicators was developed from Wells and Whitworth (2007), who produced a classification of four scientific publication performance categories that keep the interconnectedness of bibliometric research performance indicators at the forefront of analysis (Wells and Whitworth, 2007). These indicators and formulas were developed and applied by Chanda-Kapata (2012), Costas et al. (2010), and Kaye (2012) to quantify the research activities (Costas et al., 2010; Chanda-Kapata et al., 2012; Kaye, 2012). Table 4.4 describes a more detailed explanation of the indicators used for the analysis (Table 4.4).

Table 3.4 *Overview of bibliometric indicators category* (modified from (Pritchard, 1969; Wells and Whitworth, 2007; Campbell et al., 2010; Kaye, 2012; Phillips et al., 2013)

Category	Indicator	Definition/formula

Publication outputs	Number of papers	Publication count based on author address
	Growth rate GR	Quantifying change over time where GR = (Xb/Xa). Xb=end date 2015 Xa=start date (1991)
	Compound annual growth rate (CAGR)	Quantifying annual change over time in the number of papers published where CAGR=(Xa/Xb)-1 Xa=total papers between time period a Xb = total papers between time period b
Publication quality	JIF	Journal impact factor
	Citation count	Measures source's citation count per paper
Publication collaboration	Sector and country collaboration	Count of papers co-authored by at least one other institution, sector, or country, based on author addresses
	Institutional and country collaborations rate	The relative intensity of collaboration of an entity at different aggregation levels (institutional, sectoral, national, or international) where: Country collaboration. rate of Uzbekistan = papers co-authored with one or more other countries (all Uzbek papers) Institutional collaboration. rate = Uzbek papers co-authored with more than one type of institution

Publication Activity Indicators

Publication activity indicators show productivity of individuals and units and are sometimes falsely used to imply quality. Hence, it is vital that publication activity indicators accompany indicators such as quality. Compound annual growth rate indicators (CAGR) are used to quantify change in publication production activity over time or to compare the growth of an entity in a given area with that of a reference entity (Campbell et al., 2010; Kaye, 2012; Phillips et al., 2013). CAGR calculates (Xa/Xb)-1 whereby Xa equals the total papers within the "a" period and Xb equals total papers within the "b" period.

Publication Quality Indicators

Traditionally, bibliometric impact measures denote the quality of a journal. The journal 'impact' factor (IF), still in use by Thomas Reuters ISI, was originally developed by

Garfield (1972) as a tool for journal evaluation to normalize for expected relations between size and citation frequency (Archambault and Larivière, 2009). The measure is based on the number of citations in a given year to citable items in the preceding two years (Bordons et al., 2002; Archambault and Larivière, 2009). Over the years, the journal impact factor has been criticized given that it doesn't measure the impact or influence of a journal but of an average item published in that journal (Bordons et al., 2002; Campbell, 2008; Archambault and Larivière, 2009; Royle et al., 2013). Despite these limitations IF is considered in this study for research quality measurement, as other measures require analysis from the Scopus database or Google Scholar, which are not used in this study.

Collaboration Indicators

Based on cross-institutional, cross-sectoral, or international collaboration rates the relative importance of collaboration was calculated. Some bibliometric studies attempt to measure collaborations by dividing the total number of papers written by an author or entity in collaboration with another institution, sector, or country by the author's or entity's total number of papers (Li et al., 2015). These indicators have limitations, as they offer minimal insight into the structure or implications of research collaborations. To date, evidence to demonstrate the connection between global health scientific outputs (publications), quality, and collaborative research in both developed and developing countries is not widely understood (Holmgren and Schnitzer, 2004). Despite the limitations, collaboration indicators used here assess how collaboration in Uzbekistan has changed over the years since independence in 1991.

The analysis based on above indicators will give background information on research performance in Uzbekistan. It will be a base for analyzing signs of path dependency in a given field, the impact of research policy changes, and the research practice norms of Uzbekistan since independence.

3.3.2. Quantitative data – non-indexed (non-sourced) bibliography of Uzbekistan

Overview

International bibliography databases SCIMago, PubMed, Web of Science, Scopus, and Google Scholar include vast numbers of journals. For instance, the Web of Science database includes more than 12, 000 journals from all over the world and all fields of science (about 250 disciplines) (Gasparyan, 2013). PubMed covers over 25 million citations for biomedical literature, and Scopus includes 21,500 peer-reviewed journals (*PubMed Help*, 2016). All these databases have distinct characteristics and some are more or less selective in their database journal indexing criteria (Thompson and Walker, 2015). Some of the literature concerning these databases have pointed out that a large number of scientific journals, such as those not published in English or those which don't have an international focus, have been left out due to their "standards of selectivity" (Gasparyan, 2013). Analysis based on the number of publications in the Web of Science database, for example, considers factors such as GERD (Gross domestic Expenditure on R&D). GERD with the analysis on the number of researchers or residents demonstrates comparable data for countries that differ in population size or level of wealth for journals to be indexed into their database (Thompson and Walker, 2015; Sivertsen, 2016). Therefore, journals of developing countries or transitioning countries are omitted from these databases and are more difficult to find (Salager-Meyer, 2008, 2014). These journals are termed "non-indexed or are also called non-sourced items" (Chi, 2014).

Non-indexed records for bibliometric analysis are items that are not indexed by citation indices such as Web of Science (WoS) or Scopus or PubMed (Chi, 2014). So far, these have been neglected by most bibliometric analyses in developing countries (Vlassov and Danishevskiy, 2008; Spira, 2010; Mohammadi et al., 2011; Salager-Meyer, 2014). Many scholars in Uzbekistan publish in non-indexed journals. Non-indexed sources include conference papers, books, handbooks, book chapters, monographs, working papers, and corporate and government reports. There are studies in South Africa that have measured the indexed vs. non-indexed items in publications and scientific production (Sooryamoorthy, 2010; Senkubugei and Mayosi, 2012). In the case of South Africa, the non-indexed items covered more than 40% of the research publications in the health

sector. Therefore it is evident that the international database only gives a partial picture of actual research performance (Sooryamoorthy, 2010).

Recent papers have dealt with the issues of transitioning countries' publications being paid insufficient attention (Salager-Meyer, 2008). The reason why examining non-source items is important is that there are limited numbers of articles published in international journals that represent the full picture of research performance in Uzbekistan. For instance, papers published in Russia and east European countries point out that the language barrier, such as English, hinders the full representation of the researchers' work. Researchers are already burdened by having to disseminate their work and findings in their own languages, never mind disseminating them (for example) in English (Vlassov and Danishevskiy, 2008; Fung, 2008; Spira, 2010; Spiegel et al., 2015). Consequently, it was necessary to examine the research outputs in local Uzbek medical journals.

Database mining

According to the medical library in Tashkent, there are 25 periodicals available for view. Of those, 12 were identified as the journals (the 12 highlighted in bold in Table 3) most used in research communication.[2] Given the time and resource constraints of this study, manually entering 12 journals of article from 1991 to 2015 proved to be difficult. Therefore, I picked two journals: the Journal of Dermatology and Reproductive Health and the Uzbekistan Medical Journal. The Journal of Dermatology and Reproductive Health was chosen as it had most recently been initiated in Uzbekistan (in 2006) and was a good candidate to examine whether there were any improvements in research output compared to the long-established journals. The Uzbekistan Medical Journal is one of the oldest journals of Uzbekistan, published since 1986. The Uzbekistan Medical Journal covers all health topics and its editor-in-chief is the deputy minister of the Uzbekistan Ministry of Health. All the issues of both journals reviewed manually. The articles were downloaded from the website Uzmed (www.med.uz)[3], and if the issue was not available on the website,

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[2] Uzbek scientists publish in 12 journals, which confirmed by the Dean of the School of Public Health of Tashkent Medical Academy. This information is from the qualitative interviews with him. I asked him directly, as he is the advisor of the scientific research committee of the Ministry of Health.
[3] Currently there is no system or portal to track scientific publications in Uzbekistan. The Uzmed (med.uz/periodicals) has started to upload all the journals but so far, only covers from the year 2013, and not all journals are uploaded or downloadable. It is not a search engine, but rather an uploaded journal issues in

then the Tashkent Medical Library was utilized for collection of the article. After taking the pictures of abstracts of each article, relevant information was manually entered into Excel for data analysis. Exclusions for this data entry included book reviews, letters to the editors, conference announcements, and organizationally based communications. Both journals publish four to five times a year, and had an average of 25-30 articles per issue during the study period of 2011-2015. The analysis for the non-indexed journal database employed the same analysis strategy from the international database data analysis, which includes analysis of publications, based on subject categories and affiliation institutes.

3.3.3.   Qualitative Data

According to Yin (2013), there are six possible sources of evidence for case studies: documents, archival records, interviews, direct observation, participant-observation, and physical artefacts. The case study's unique strength is "its ability to deal with a full variety of evidence—documents, artifacts, interviews, and observations" (Yin, 2011), p.8). Since no single data source has a complete advantage over the others, but rather each is highly complementary with the others, a good case study would collect data from as many sources as possible (Yin, 2011). As stated above, because no single data source is complete on its own, this study uses multiple sources to collect data on qualitative aspects, in particular: (i) semi-structured interviews, (ii) grey literature, and (iii) direct observations, participant-observations, and field notes.

Semi-structured Interviews

Qualitative interviews are defined as "interviews with the purpose of obtaining descriptions of the life world of the interviewee in order to interpret the meaning of the described phenomena" (Brinkmann and Kvale, 2014). Qualitative interviews have been categorized as unstructured, semi-structured and structured (Corbetta, 2003). This study does not conduct structured interviews because pre-established questions place "serious limitations on the objective of flexibility and adaptability to the specific situation analyzed" (Corbetta, 2003), p269). This study also does not conduct unstructured interviews

pdf format. Scientists register under the academy.uz portal system, so their academic institutional affiliation and publications are available online, but to do so one has to know the name of the researcher and not all researchers list their publications.

because the interviewing process can be time-consuming and susceptible to digression (Corbetta, 2003).

This study therefore conducts semi-structured interviews because they provide flexibility "in terms of the order in which the topics are considered" (Denscombe, 2010), p.167). At the same time, semi-structured interviews let the interviewees develop their ideas, elaborate points of interests, speak more widely on the issues raised by the interviewer, and give open-ended answers (Denscombe, 2010). In brief, conducting semi-structured interviews has the advantages of giving both the researcher and interviewees flexibility and freedom to interact with each other (Denscombe, 2010).

The sampling strategies employed for data collection were purposive sampling and snowball sampling. Purposive sampling is used to choose prospective interviewees who "have some special contribution to make" (Denscombe, 2010), p.172) and "have some unique insight [due to] the position they hold" (Denscombe, 2010), p.172). Snowball sampling is also used to locate interview subjects with relevant purpose of the research. The sample is built through a process of reference, for example by asking the subject to nominate two others with similar characteristics or topics of interest to the researcher to conduct interviews (Corbetta, 2003; Denscombe, 2010; Hennink et al., 2010).

In this study, I conducted interviews with diverse actors, from decision makers in parliament to physicians. The majority of the interviews were with so-called "elites." Studies using elites— business, political, or social—are quite rare; most research in the social sciences involves "ordinary" individuals (Mikecz, 2012), p483). Therefore, it is particularly helpful to interview elites in order to gather rich details about their attitudes and thoughts on specific policies or political issues (Littig, 2009; Harvey, 2010). Following section, report on fieldwork activities, describes the types of people interviewed. What is missing in the interview description is the ultimate beneficiaries of this research; perhaps it is the population of Uzbekistan. Then again, the population of Uzbekistan was too large in number to get their insight and to interview all of them individually. The interviews that I have conducted throughout this study are neither large nor representative enough for quantitative analysis. Yet the interviews were qualitative, and revealed the opinions of key agents working in the given context. For that reason, it was important to recognize that the

reliability of data collected from interviews likely would be subject to the biases, knowledge, and memory of the particular informants. The strategies to overcome these limitations were to crosscheck the data collected from semi-structured interviews with data collected from the above bibliometric component and grey literature (Fig 3.3).

Documents
•grey literature

international setting
•actors from donor
  - funded projects

agenda setting actors
•parliamentarians
•academics
•ministry officials
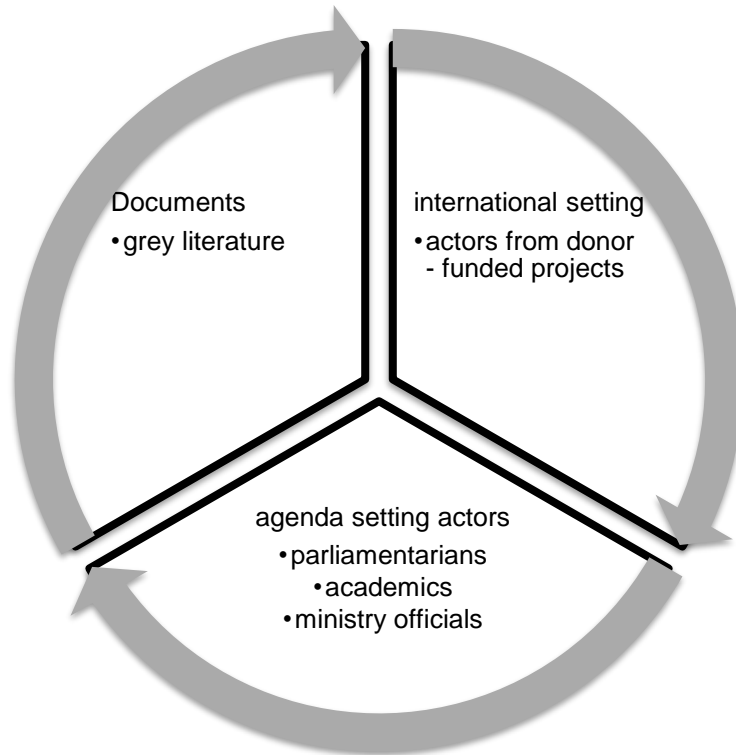
Figure 3.3 Sources of qualitative data

Grey literature

Documents were considered as a vital component of this study not only because of the theoretical implications in understanding the context and as history of health research in Uzbekistan but also for triangulation of the data obtained through qualitative interviews. Common grey literature publication types include reports (annual, research, technical, project, etc.), working papers, dissertation abstracts, government documents, white papers, and evaluations (Booth et al., 2012). However, there remain additional challenges as Uzbekistan lack records that refer specifically to health research policy or capacity. Therefore, different types of documents were collected that have direct or tangential relevance to the health research system of Uzbekistan.

Denscombe (2010) argues that books and journals "should be the first port of call" (p. 212) because they "contain the accumulated wisdom on which the research project should build, and also the latest cutting-edge ideas which shape the direction of the research" (Denscombe, 2010), p.212). Thus, books and journals were analyzed based on the above quantitative data analysis component. Denscombe (2010) also argues that government publications provide a key source of documentary information, data, and statistics which are authoritative, factual, and objective because they are produced by the state with large resources and expert professionals (Denscombe, 2010), pp. 216-7). However in the case of Uzbekistan, statistical government reports need to be viewed with caution as the method of analysis or the numbers reported may not represent an exact picture of the current state of the country (Rechel et al., 2014; World Health Organization Regional Office for Europe, 2014). Therefore, international organization grey literature reporting on health-related topics of Uzbekistan were also sought out to triangulate the conflicting statistics and compare data of both document sets. This study aimed to triangulate from different sources of documents to interpret, strengthen and support the arguments, and supplement information when qualitative data is lacking or incomplete to give a fuller picture (Bell and Waters, 2014).

Analyzing, coding, and interpreting data

Making sense and offering a coherent interpretation of the typically disparate sources of data (whether qualitative alone or both qualitative and quantitative) is far from straightforward. Repeated reviewing and sorting of the voluminous, detail-rich data are recommended as crucial for the process of analysis (Bell and Waters, 2014). Coding of data is needed to allow the key issues, both derived from the literature and emerging from the dataset, to be easily retrieved at a later stage. An initial coding frame is recommended for qualitative data to help capture these issues, and it can be applied systematically to the whole dataset.

In qualitative data, codes are "tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study" (Miles and Huberman, 1994), p56). Miles and Huberman describes that codes are attached to words, phrases, sentences, or whole paragraphs in a certain setting (Miles and Huberman, 1994). Bell and Waters (2014) state that coding allows the researcher to group key issues from the data

to guide the researcher to draw implications from the results of the study (Bell and Waters, 2014). Therefore, without the identification of the clusters the collected data will have little meaning (Bell and Waters, 2014) .

For this study, coding was created manually based on my research questions. The coding was divided into several categories : (i) characteristics of the health research system; (ii) the process of reform; (iii) contexts or external factors (e.g. political, economic, social, institutional, and ideological) which shape health sector reforms; (iv) contents of the health research related reforms; (v) different views about current health research system (e.g. positive/negative/both; happy/worried; advantages/disadvantages of the reforms; and suggestions) from different groupings (e.g. government officials,, scholars, members from medical profession or health-related organizations, students, citizens) (vi) other emerging themes.

Regarding (vi): other emerging themes: I used two strategies adopted from aid development research and health system reform study (Brodén Gyberg, 2014; Luk, 2014). The first strategy was to let my draft research questions guide the interpretation of qualitative data transcripts. The second was to take an "interpretive" approach by just reading, take notes and code according to the pre-set categories. For those that did not match the pre-set categories, I read the material and took detailed notes (without categorizing them at first) being aware of repetitions, contradictions, and other things that were worth taking notice of. Gyberg's study recommended coding for things that "emerged"—which could be the use of metaphors, or the appearance of "new" concepts (Brodén Gyberg, 2014). For example, Gyberg also recommended going back to theories that guide the research questions; for example, re-reading interview transcripts while thinking about development or knowledge production theories could show what was missing from the above categories.

Report on Fieldwork Activities

Field research is defined as the investigation that is carried out in the usual environment in which a phenomenon occurs, rather than in controlled laboratory settings (Kapiszewski et al., 2015). The main activities of data collection included interviews, and collecting publication data from the Tashkent Medical Library and gray literature.

Fieldwork Activity in Tashkent

There were two field visits in Tashkent. The first round was from May to Dec 2015 while the second round was from Oct 2016 to Nov 2016. All of the prospective interviewees were contacted after arriving in Tashkent through personal contacts or through project contacts. In total, I was able to interview 20 persons, including a former government official, medical personnel, and academic researchers. Table 3.5 is a list of interviewees, containing a simple description of the interviewees, the date, time, and places of the interviews.

Table 3.5 List of interviewees

National actors	Rank/status/profession	Method	Interview date
1	Oilijs parliamentary member	Face-to-face and in-depth (café near Metro buyuk ipak uli)	Oct 3, 2015
2	(Former) Oilijs parliamentary member	Face-to-face and in - depth (café, Grand Mir Hotel)	Nov 16, 2015
3 (9)	9 researchers from Research Institute of Sanitation, Hygiene, and Occupational Diseases (RISHOD)	Face-to-face and in-depth (at RISHOD)	Aug 3, 2015
4	Dean of School of Public Health at Tashkent Medical Academy (TMA)	Face-to-face in-depth (TMA public health dean's office)	Nov 20, 2015
5	Physician TMA	Face-to-face in-depth (at TMA clinic office)	Sep 23, 2015
6	Professor at TMA	Face-to-face in-depth (at TMA office)	Sep 10, 2015
7	Physician private	Observations/semi-structured interviews (lobby of hotel)	Sep 6, 2015
8	Former MOH official	Face-to-face in-depth (private office of respondent)	Nov 12, 2015
9 (2)	Health professional/practitioner in institute (2 individuals, separate emails)	Semi-structured email interviews	Aug, 2015
10	Professor at National University of Uzbekistan	Semi-structured interviews (private office of respondent)	Oct 15, 2015

11	Environment Consultant (former university professor)	Face-to-face in-depth (café Grand Mir Hotel)	Nov 11, 2015
12	Observations from teaching public health epidemiology, statistics, and training students on survey methods	Participant observations	June, Oct, Nov, 2015
13	Workshop feedback with Tashkent Medical Academy researchers and (potentially) key informants	Nov, 2016	
14	Observations from field	Field observations	May – Dec 2016
International actors			
1	EU-Bologna UzHealth Project Coordinator	Refused	May/June 2016
2	MSF Uzbekistan research coordinator	Refused	May 2015
Total number of interviewees	Total contacted (22) Total interviewed (20)		

As an outsider, I had to use of my personal contacts and the snowballing technique in order to gain access to some prospective interviewees who know about the overall operation of the health system or who do relevant work in health research. I called them directly (if they spoke English) or called them through a translator to arrange a convenient time and place to have interviews with them. Quiet locations were sought out to ensure privacy of the conversation. I was able to conduct face-to-face interviews with 20 interviewees. Two of the interviews were sent via email as those individuals declined to do face-to-face interviews. In this study, 15 of the interviewees who agreed to participate were through purposive sampling. The rest were introduced through snowball sampling, in which I asked the subject interviewed to recommend people with similar interests. However, some of the interviewees who a personal network were against the idea of snowball sampling. For a variety of reasons, they refused or declined to give any names, for example because they were too busy, because they would have to ask for official approval from the Bureau, or because health topics are a matter of national security. Therefore asking them to give me names of colleagues was tantamount to being unreasonable or showing disrespect.

Based on the above reactions, recognizing that health is a sensitive topic to discuss in Uzbekistan, and given the dearth of interview opportunities in Uzbekistan in

regards to health, minimally invasive interview techniques were adopted to safeguard the interests of those interviewees who did agree to be interviewed. I also abided by the following ethical principles when conducting interviews in order to avoid any harm to the interviewees: verbal informed consent, right to privacy, and protection from physical and emotional harm (Wall and Overton, 2006). I promised the interviewees not to disclose their real names in the study and only to take written notes during the interviews (rather than, say, audio- or videotaping the interviews) in order to allay the interviewees' anxiety, maintain trust, and protect them from harm (Shenton, 2004). These ethical considerations are particularly important to some of the interviewees who are well-known public figures or scholars who work closely with the Uzbekistan government. Most of the interviewees said that they were willing to have follow-up interviews or welcomed me to contact them through phone calls or emails any time if I had further questions to ask at a future date when I was wrapping up the interview.

A voice recorder was used only when the interviewee agreed and was comfortable with this. In most of the interviews, however, digital recorders were not used to record interviews. Although there are many advantages to voice recorders the idea of audio recording worsened both interviewees' anxiety about confidentiality and increased the possibility of declining the research interview. Even taking notes by hand in notebooks caused much sensitivity because of the fear of tracing particular comments back to the source as such similar field experience was reported from Uzbekistan (Oberkircher, 2011). Therefore, in cases where voice recording wasn't an option (which were most cases) I took notes only after the interview was finished in order to capture the gist of what was discussed during the interviews (Wall and Mollinga, 2008b; Oberkircher, 2011). The advantage of note taking is that it can include information that audio recording would miss.

Most of the interviews lasted between one to one-and-a-half hours. Except for two, all of the interviews were in either Russian or Uzbek. In this case, Russian or Uzbek translators aided the interview translation process. The contents were translated from Uzbek/Russian into English. Interview notes were typed and stored in the notebook and backed up on a USB. For the sake of security, I also made hard copies of the notes. I made sure that the notebook, the USB, and the storage space where the hardcopies were kept were secure and could not be accessed by other people. The typing up of the

interview took from one hour to three depending on the interview. In each case, I aimed to capture the essential content of each "sentence" or point. I transcribed most of the interviews relatively late in the process. This has both advantages and disadvantages in the process but the advantageous part was that re-reading and transcribing the data from each interview relatively close in time to one another made it easier to identify patterns.

Apart from having interviews, I also collected documents related to health research in Uzbekistan. I went to the Tashkent National Medical Library to take photos of all relevant local medical journals from 1991-2015. Documents and books about Uzbekistan available online were examined and saved. As Yin states, "Systematic searches for relevant documents are important in any data collection plan" ((Yin, 2013) p.87). Legislation related to health reform, health research, and education reform were found in open sources including uzmed (http://www.med.uz), the legislation repository (www.lex.uz), and the Ministry of Health of Uzbekistan (www.mizdrav.uz). Reports on the health sector were accessed through international donor websites, such as UN agencies or through searching Google (www.google.com). Newspaper articles on healthcare reform were from uzmed (http://www.med.uz), which is a database that has provided access to local Uzbek news since 2000.

Overall, the data collected through multiple sources, which include semi-structured interviews, bibliometric records, and grey literature, were useful. Different sources of data are complementary to each other. Data triangulation not only helps facilitate data validation, but also helps form a more complete picture of the development of the health research system and its capacity and thus yields richer and more convincing research findings. Final workshop feedback in the end was also a way to triangulate the findings and get constructive feedback.

3.4. Putting it all together: Linking theory and data

This study aims to identify a series of factors that help to explain Uzbekistan's current health research system. This case study focuses on institutional level responses to the changing health research environment as carried out within the context of a post-soviet Uzbekistan. The study employs an analytical framework of various institutional

theories to test the proposition of path dependent tendencies of Uzbekistan health research: publication pathways, institutional centralization of health research; limited institutional diffusion; and patterns associated with the internationalization of Uzbekistan health research by examining outputs, publication paths, and collaboration patterns. It furthermore investigates the forces that influence policy, procedures, and participation as the actors in the health research system seek to find their place in the global community of research and higher education providers in the years following political independence.

The study aimed to reflect the mixed method design of the research with the analysis of a bibliometric dataset and a qualitative component that explores various actors in the health research system in Uzbekistan. First, the bibliometric analysis uses both internationally indexed bibliographic data and locally non-indexed bibliographic data. This is to show a fuller picture of research practices in Uzbekistan where international bibliography does not represent publications that published by local non-indexed journals. Second, history, the national economic strategy, and national health priorities explored through the theoretical prism of institutionalism inductively proposes a typology of the research governance model that is being practiced in Uzbekistan.

3.5. Conclusion

To conclude, this chapter provides an overview of the research methodology adopted in this study. It explains the approaches used to examine the health research system of Uzbekistan. The mixed method approach fits well, as both quantitative and qualitative data have limitations on their own. The quantitative data represents two datasets: one is from the worldwide complete literature systems, the other one from the national repository at the local library. Since there are no existing sources that provide the bibliographic records of all publications by all researchers in Uzbekistan, this study utilizes a second approach, collecting the manually in-put publications from local journals to build up a manageable publication list for the health sector. The limitation here is that this still may not represent a full picture of research performance of Uzbek researchers. Moreover, publication output does not give any insights into researchers' everyday practice within the health research system. As part of triangulation, the qualitative data in this respect can give insight through interpretation and validation of the quantitative results (Baran, 2016)

Chapter 4.   Complexity of Assessing the Health Research Capacity in Uzbekistan

As previous chapters have dealt with the theoretical orientation and methodology of the study, this chapter focuses on the political, economic, and public sector development since independence. The Republic of Uzbekistan (hereafter Uzbekistan) became independent in 1991. It is the most populous country within the central Asian region, with the population growing from 8,789,492 in 1961 to 31,299,500 by 2015, with half of the population living in rural areas (World Health Organization Regional Office for Europe, 2014; World Bank, 2014) The period of transition is characterized by the political and economic changes over the past two decades (Akimov, 2015) that give context to and reflection on education, and the R&D sector that gives insight into changes (or the lack thereof) within the health research system.

In Uzbekistan, the transition periods have been broadly divided into the economic transition periods of 1992-1995 (known as 'the Uzbek paradox') (Pomfret, 2006), 1997-1999 (a period known for 'reform reversals'), and finally the period from 2000 known for its 'ad hoc developments' (Akimov, 2015). This chapter modifies the transition period argued by Pomfret (2006) and Akimov (2015) and applies these periodic changes in relation to research and development (R&D sector), the education sector, and the health sector. The periods are those from 1924 to 1990 known as the period of Soviet Ruling; from 1991-1995, the period of Independent state building or the Uzbek Paradox. The period from 1996 to 2007 is referred here as a period of reform reversals and the turning point of the authoritarian regime turning point; and 2007-2015 is considered here as the period of 'ad hoc developments' post elections (Pomfret, 2006; Akimov, 2015) (for the summary table refer to Appendix A).

4.1. Historical trajectory on political economy, education, research and development (R&D) , and health sector in Uzbekistan

4.1.1. Pre-independence 1927-1990 Soviet Ruling

Uzbekistan's economy was dependent on Soviet oil and industrial production, while Uzbekistan contributed with its agricultural production (i.e. cotton and rice) (Pomfret, 2006; Akimov, 2015). Higher education and R&D were also under the aegis of the Soviet regime, as educational funding and research were mainly dependent upon Soviet science and Russian academy science directives (COHRED, 2002). Over the course of six decades, Soviet science and management left lasting effects in the societies of post-Soviet countries (Yegorov, 2009), and this was also true of Uzbekistan (Laruelle, 2010). During the Soviet Union era, the social support services (such as education) were free of charge, funded by the state. From the late 1980s to the early 1990s, the Soviet Union support dwindled and the states (such as Uzbekistan) had to fend for itself. This further affected the independent Uzbekistan economy, which had a limited budget for the social sector ((Weidman et al., 2004)cited in (Weidman and Yoder, 2010)).

Uzbekistan's health system, like the former Soviet Union, followed the Semashko model (World Health Organization Regional Office for Europe, 2007). This means that the state provided basic health care services, and that the state employed all health workers and researchers. Highly centralized planning of resources and personnel based on a hierarchy of facilities at the district, regional, republican, and national levels governed the health sector (World Health Organization Regional Office for Europe, 2007, 2014). This system had its strengths (for example, it was very effective in controlling communicable diseases), but it was not prepared for emerging non-communicable diseases (World Health Organization Regional Office for Europe, 2014, 2016). Health research facilities and structures belonged to the scientific academy of the USSR or federal research structures at the time. For instance, the USSR scientific technical programs (COHRED, 2002) funded half of the 159 medical research projects conducted in Uzbekistan. The Academy of Sciences of the USSR guided the general framework of research in biotechnology, immunology, virology, hematology and blood transfusion, endocrinology,

psychiatry and narcology, gastroenterology and cardiac surgery, or what were known as the "basic medical sciences." After independence, the health research systems suffered from a shortage of funding and hence of research directives (COHRED, 2002). Chapter 6 analyzes detailed aspects of the history and structure of the health research system further.

4.1.2. After independence 1991-1995: independent state building or the Uzbek paradox

Uzbekistan focused particularly on nation building with its trajectory towards becoming an independent nation. For instance, the initial constitution instated a three-entity state power: the legislative, executive, and judicial branches of government (Akimov, 2015). The president, however, held enormous power, as he was empowered to appoint the prime minister and all ministers of the cabinets as well as the judges of the national court but parliament cannot remove the president (Saidova et al., 1997; Akimov, 2015). The parliament of 1991-1994 inherited the previous Soviet legislative system called the Supreme Soviet[4] (Akimov, 2015). Uzbekistan as a young state at the time adopted laws that gave attention to basic issues and other legislative acts. During this period, the nation's focus was on establishing various committees that were committed to national finance, science and education, foreign affairs, and environmental affairs, among others. According to the arguments of Weidman and Yoder (2010), two interpretations of this era exist (Weidman and Yoder, 2010). One is that the president was necessarily authoritarian in order to transition the country from a single-party and centralized economy into a liberal democracy and free market economy (Saidova et al., 1997; Weidman and Yoder, 2010). The reasoning behind this was to prevent economic instability and social conflict (Weidman and Yoder, 2010). The other arguments from international scholars view the slow transition and authoritarian regime as a manifestation of political elites maintaining power by using the threat of ethnic violence and civil war (Weidman and Yoder, 2010; March, 2010; Freedom House, 2016). Tsui (2016) argued that such acts were ways of maintaining institutional legacy, and that the separation of powers through direct election was merely superficial work towards developing a democracy (Tsui, 2016). This was due to several changes made during this first transition period. In 1995, the most notable

[4]Source: www.senate.uz accessed on May 26, 2016

initiative after December 1994, when the first Parliamentary elections took place, was extending the President's first term in office (that ended in 1996) until 2000. The same year the President, due to international pressure, announced a tolerance policy to respect opposition party movements, which resulted in the establishment of multiple parties such as the Social Democratic Party "Adolat" (fairness) or The Social Democratic Party of Uzbekistan, "Vatan tarakkiyoti" (Forward with the Fatherland"), and The Democratic Party of Uzbekistan "Milli Tiklanish" (DPMT Party) (Akimov, 2015). Nevertheless, the President's party maintained its dominance with 189 of the 250 parliamentary seats (Akimov, 2015). This was also well supported by the citizens due to the maintenance of peace and stability and continued social support for prices of essential goods (such as food, utilities, and transport) as well as other essential social services (i.e. health and education), which enabled the president to retain control (Khaki and Sheikh, 2015; Akimov, 2015; Tsui, 2016).

On the research and development (R&D) front, Uzbekistan has adopted gradual selective reforms in science and technology as well as economic reform in the same period. Similar to the research and development sector, Uzbekistan's educational reform was state oriented, with limited private sector involvement. The educational reform during this period focused on National Program of Personnel Training (NPPT), which commenced in 1996 through decrees of the President and resolutions of the Cabinet of Ministers. Like the above-mentioned political economic reform, the educational laws and reforms have been very centralized. NPPT is a national reform plan to create an educational system to meet the new demands and international standards while preserving some elements of the previous education system (Weidman and Yoder, 2010; Ruziev and Burkhanov, 2016). Weidman and Yonder (201) have argued there has been no evidence about which component of the previous education system remained (Weidman and Yoder, 2010). Other allegations voiced on that the legal decisions and reform have been very centralized without any civil society involvement (Dawisha and Parrott, 1997; Weidman and Yoder, 2010). Moreover, both the R&D sector as well as the education sector suffered from the disintegration of Soviet Union, as they were dependent upon inputs from the Soviet Union on infrastructure and finances as well as the networks of the Soviet academy, such as academic exchange and relationship building (Brunner and Tillett, 2007).

The government aimed to maintain the Soviet socialist system as much as possible and to retain state control of health care. The intention of this act was to maintain government as the major player in the delivery of health services while shifting cost to users for services not guaranteed in the state benefit package of health services (Johnson, 2014a). Despite the financial challenges during this early phase of state building, in which the new state of Uzbekistan was recovering from the collapse of the Soviet Union, the government drafted a law in the early 1990s defining the basic benefits of health protection for a limited basic benefits package funded by the state (Law on health protection, 29 August 1996) (World Health Organization Regional Office for Europe, 2014). The basic benefits package includes primary and emergency health care along with care for vulnerable populations and those with "socially significant and hazardous" conditions. The structure of the health services featured some elements of the Soviet health system, which meant the major service providers being public and most of the health workers being government salaried employees (World Health Organization Regional Office for Europe, 2014).

Like the education and R&D sectors, health research also suffered as the economy reoriented itself to being a market economy. Restrictive financial opportunities due to detachment from the USSR science academy network left existing research institutes short of funds to manage research (COHRED, 2002). This had negative impact on human resources, for people were unwilling to work in a public research sector with a depleted infrastructure. The management of science and engineering has been under the purview of the Ministry of Health. Economic reform of the nation and striving to remain afloat amid the financial crisis right after independence also influenced the health research center (COHRED, 2002). For instance, the products of medical science were considered to be state property during Soviet times (Y.M. Komarov and V.E. Tcherniavskii, 2006). This took a positive turn after independence, all medical science output was considered to be individuals' intellectual property, even financially, especially given the need for research institutes and academies having to be financially self-sustaining, given national economic reform (COHRED, 2002). Academies, practical centers, and medical research institutes were encouraged to introduce financial incentives to staffs to conduct practically oriented scientific activity. This period was also a starting point in the expansion of international

science contacts, and this significantly affected the development of medical science (COHRED, 2002).

4.1.3. The turning point of the authoritarian regime, 1996 -2007: reform reversals

During the second period from 1996 to 2007, the unicameral parliament of the Republic of Uzbekistan– Oliy Majlis replaced the Supreme Soviet with its bicameral parliament (United Nations Development Programme, 2013, 2014a). This period focused on establishing multiple factions of political parties and Deputy Blocks; in total, there were 13 committees working within Oliy Majlis. The main function of these committees were to work on diverse aspects of society such as national finance, science and education, foreign affairs, and environmental affairs, among others (United Nations Development Programme, 2014a). The formation of this new government showed that Uzbekistan did not have any existing legal base as a new nation. Therefore, the unicameral parliament adopted the necessary legislation to establish the framework of the country.

Between 1999 and 2000, the second round of parliamentary as well as presidential elections took place. After the election, a referendum for a bicameral parliament was created (2002), a parliament in which the legislature was to consist of a Legislative Chamber (a Lower House of 120 seats) and a Senate (an Upper house of 100 seats, with 16 regional governors selected by president). By 2005, this led to the creation of a permanent legislative structure (United Nations Development Programme, 2013, 2014a, 2014b). Scholars argued this creation was a way to show the national and international community that three entities divided the power, when in reality the Senate was under presidential control (Nichol, 2013; Akimov, 2015). During this period, the constitutional provision declared to extend the presidential term to seven years. This period consisted of the joint session of the Legislative Chamber and the Senate of Oliy Majlis, tasked with modernizing and reforming—and specifically democratizing--the country. The ministries, the cabinet of the ministers (CoM), and the local government authorities focused on the implementation and regulations of the law (United Nations Development Programme, 2013, 2014a). In Uzbekistan, eight state authorities have the right to initiate a law (the General Prosecutor, the Supreme Court, the High Economic Court, the Constitutional

Court, the Cabinet of Ministers, the Jukargi Kenes of Karakalpakstan, the deputies of the Legislative Chamber of the Oliy Majlis, and the President of Uzbekistan) (United Nations Development Programme, 2010). These key actors may involve relevant ministries and subordinate state authorities, policy experts, civil society organizations, and citizens in the different cycles of the law making process. Based on the role and the authority of the members of the legislature, it is evident that the policy hierarchy is top down, from the President's approval to ministerial bodies (Fig 4.1) (United Nations Development Programme, 2014a); State Senate Records accessed in 2016[5]).

The law-making activities, however, were considered to have been improved during this period, but most of the decision-making power continues to lie with the president, the cabinet of ministers, and the parliamentary members (United Nations Development Programme, 2014a, 2014b). Although the Uzbekistan parliamentary system strives for democracy, the lack of transparency in the decision-making process is well known to both national and international community (Ulikpan et al., 2014). Laws regulating public administrative bodies often do not differentiate between functions, tasks, and authorities (Hakimov, 2016). Formulations like "other functions determined by legislation" leave a lot of room for interpretation. The lack of clarity and vagueness in the functions of the CoM allow almost all issues to be referred to the central offices (Ergashev, 2006) implying that the laws adopted before were either inherited laws before independence or new laws focusing on the establishment of the state for legislative legitimacy (Hakimov, 2016)[6].

[5]Source: www.senate.uz accessed on May 26, 2016
[6] Source: Parliament history of Uzbekistan parliament.*gov.uz/en* accessed on May 26, 2016
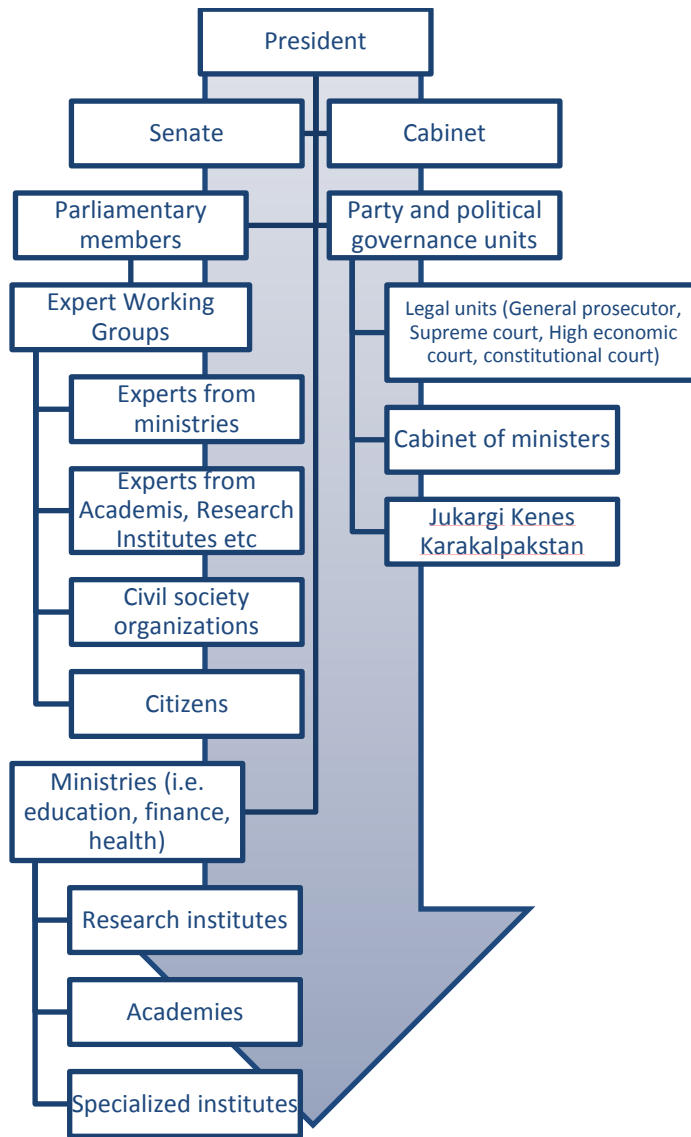
Figure 4.1Uzbekistan policy transmission route (United Nations Development Programme, 2014a); State Senate Records[7])

The economy growth remained steady due to strong agricultural and economic sectors, but the promises made during the late 1990s by the Uzbek government on reform measures, such as liberalization of foreign exchange markets or the privatization of large enterprises or the privatizations of banks, were not well implemented (Ruziev & Ghosh 2009 cited in (Akimov, 2015)). International agencies noted the deterioration in the quality

[7] parliament.gov.uz/en accessed in November 21, 2016

of statistics in both official and alternative estimates on economic indicators, such as price inflation (Akimov, 2015). Other social sectors in education and science were slow to reform. For instance, the educational reform program National Program of Personnel Training (NPPT) was intended to be the government's recognition of the market-based economy, and thus building an education system aligned with international standards it was thought would be a stepping stone to economic prosperity (ADB, 2004, p.94 cited in (Ruziev and Rustamov, 2016)p. 11). Though it was argued by Weidman and Yoder (2010) and Ruziev (2016) that the government's progress towards educational reform was slow and still maintained a top-down approach of management which did not allow any autonomy in course design nor any management of finances (Weidman and Yoder, 2010; Ruziev and Rustamov, 2016). The reforms occurred in stages. The first stage of 1997-2001 involved securing infrastructure for implementation of the program. The second stage of 2001-2005 involved development of teaching content along with replacing Soviet-style five-year academic degree courses and research-based aspirantura and doktorantura programs with a Bologna process style of Bachelor's degrees (four years), Master's degrees (two years) and PhD programs (Weidman and Yoder, 2010). The Bologna process instated in 2012, despite the initiative has been in the agenda during the early 2000s. Regarding laws on science research development, a Presidential decree on 'On improving the organization of research activities' and 'measures to improve the coordination and management of science and technology' were implemented in 2002 and 2006 but the extent of the implementation is questionable (Ruziev and Rustamov, 2016).

The latter part of 2000s, especially 2005, had a damaging effect on the exchange of international research and on collaboration. Markowitz (2016) described scientific closure in Uzbekistan as occurring in the following phases:

> Scientific closure can emerge in hard authoritarian regimes over three distinct phases: (a) an initial phase of relatively open access to international scholars and a climate of open academic exchange; (b) a phase in which gradual limits are placed on access to politicians, journalists, and societal leaders, and a growing constriction on academic exchange; and (c) a phase in which there are enormous barriers to scholarly access and a near disappearance of academic exchange in the wake of a crisis in the regime (in this case, international criticism of a government's violent crackdown on protest). (Markowitz, 2016)

Markowitz (2016) argued that the years 2000 to 2005 introduced new constraints on scientists from various disciplines (Markowitz, 2016). According to assessments of the health research system in the 1990s, international exchange was encouraged as was international research collaboration (COHRED, 2002). Markowitz's arguments also state that in the early 1990s scholarly exchange was flexible, meaning that obtaining visas to conduct field research for those with formal affiliations to local institutions allowed access to archives, libraries, and interviews with key informants (such as government officials) (Markowitz, 2016). However, the government's reaction to the Andijan province protest in 2005, which led to international criticism from Western Europe and the United States, resulted in the expulsion of US troops and NGOs, (Johnson, 2014a) as well as scientific shut-downs (Markowitz, 2016), which made conducting research extremely difficult in the following years. This timing has been argued to be the critical point that intensified scientific closure, especially on topics of a political nature, and it put informal pressure on politicians, journalists, academics, and researchers, among others not to talk openly about politics and related issues in Uzbekistan (Markowitz, 2016). But this has also been observed in other sectors of research besides politics, such as the agricultural sector (Wall, 2006; Oberkircher, 2011). It also impacted academic exchange not only on an individual level but also on an institutional level, as the USAID and many local nongovernmental organizations were forced to leave the country (Johnson, 2014a; Markowitz, 2016). Bibliometric analysis of Chapter 5 demonstrated the extent of this effect as path dependence and institutional stasis in the.

From the second half of the 1990s, international development assistance was crucial to address health systems restructuring and building. The hierarchical structure of political decision-making and legislation building also applies in the health sector. The CoM decides on the financing of health care programs and medical research, monitors environmental health, ensures a standard system for the collection and processing of health data, and coordinates and supervises the activities of all government bodies concerned with health protection (World Health Organization Regional Office for Europe, 2014). The Parliament adopts legislation on health care, approves the national health care budget, and controls its execution. The labor and welfare committees of the Parliament deliberate and debate on the Health care laws. The Ministry of Finance formulates the budget to be approved by the Supreme Assembly and allocates funds to the Ministry of

Health and the viloyats, including funds for health services and capital investments (World Health Organization Regional Office for Europe, 2014). Based on the policy directions, the state policies directed towards the protection of the population achieved positive results toward maternal child health, especially in reduction of maternal and child health mortality and of birth rate. The 1998 presidential decree identified priority areas and plans for 1998-2005, including primary health care reform, medical education, and the development of private sector in healthcare. The following reform initiated a pilot reform program of tertiary care and research institutions to create specialized centers and clinics equipped with modern technology and diagnostic and treatment facilities (World Health Organization Regional Office for Europe, 2014).

With support from WHO and the World Bank programs, a regular monitoring program was established on the mortality and morbidity of the population, along with research on disease burdens as a result of unhealthy life styles and chronic disease conditions. The medical reforms established from the latter part of the 1990s focused more on the development of quality health services, access to health services, health finance mechanisms, fostering of private medical practices, and efficient use of health finance to protect the population from extraordinary health expenditure (World Health Organization Regional Office for Europe, 2007). The reform of the health systems did not set concrete objectives for the health research systems. Yet, the reforms from the education and R&D sectors (i.e. moving towards the Bologna system and 'On improving the organization of research activities') indirectly influenced the reforms of the health research system. For instance, the competitive grant funding system applied to both basic and applied research as well as the structure of medical education. The government's reform moved towards a more competitive project-based research funding system, where funding is earmarked for a specific project and period (President of Uzbekistan, 2002, 2006; (World Health Organization Regional Office for Europe, 2014)).

Just as the education and R&D sector felt a lack of autonomy in planning their budgets and minimal involvement of the private sector, so also did those in the health research systems. The State managed and prioritized the main research producers, such as medical academies or health research institutes in Uzbekistan. There were few private health research activities in Uzbekistan (World Health Organization Regional Office for

Europe, 2014). As mentioned above, the hierarchical management style and the hierarchical authority of the health research system meant that its work was at the mercy of the decisions of the parliament and cabinet of ministers, along with supervisory role of the Ministry of Health (Fig 4.2).
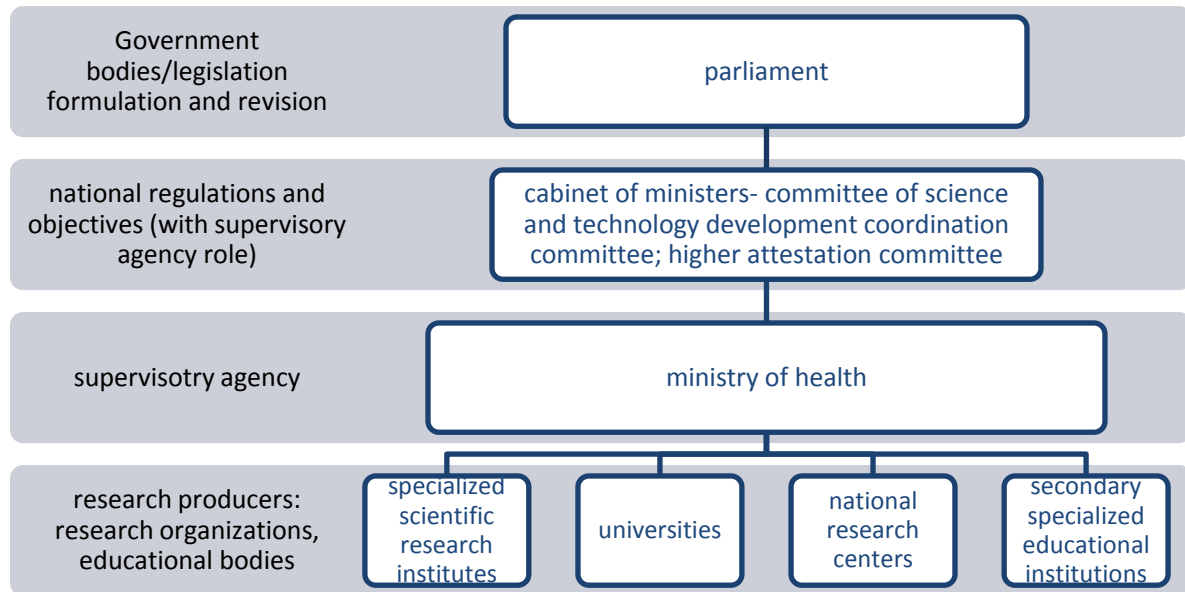
Figure 4.2 Organizational structure of health research system[8]

Health research in Uzbekistan took place within the threefold structure inherited from the Soviet science system: 1) the Higher Education sector (HE); 2) the Uzbek Academy of Science (UAS)[9], responsible for basic research; and 3) the Government-supported Research Institutes and Specialized Centers, for instance, under the Ministry of Health, which mainly dealt with applied research. These research institutes are broadly: specialized research institutes and educational training institutes and academies (Table 2.2). While detailed information about the research institutes is in Appendix B, the brief overview of the research organizations (Table 4.1) shows overlapping functions. For instance, specialized institutes, such as cardiology or urology, also do research under their respective specialty, while education facilities also conduct research with the other disciplines. Such discrete sets of health research institutions questions their integrated

[8] Adopted from Ahmedov et al. (2007).
[9] Formerly the Russian Academy of Science (RAS).

approach to health and their inability to address complex health issues. Chapter 5 elaborates on how these institutions function and operate.

Table 4.1 Overview of the government-supported research institutes and specialized centers

Category	List of organizations
Specialized research institutes	Scientific Research Institute of Epidemiology, Microbiology and Communicable Diseases Scientific Research Institute of Hematology and Blood Transfusion Scientific Research Institute of Traumatology and Orthopedics Scientific Research Institute of Virology Scientific-Research Institute of Sanitation, Hygiene, and Occupational Diseases
Specialized centers	Republican Specialized Cardiology Center Republican Specialized Center of Surgery (named after academician V. Vakhidov) Republican Specialized Center of Urology Republican Specialized Eye Microsurgery Center Republican Specialized Scientific Research Medical Center of Phyisiology and Pulmonology Republican Specialized Scientific-Practical Medical Center of Dermatology and Venereology Republican Specialized Scientific-Practical Medical Center of Endocrinology Republican Specialized Scientific-Practical Medical Center of Obstetrics and Gynecology Republican Specialized Scientific-Practical Medical Center of Pediatrics Republican Specialized Scientific-Practical Medical Center of Therapy and Rehabilitation
Republican center	Republican Emergency Care Research Center[10] Republican Oncology Research Center [11] Republican Research Center of Neurosurgery Republican AIDS Center[12] Republican Pathologic Anatomic Center Republican Perinatal Center Republican Mother and Child Screening Center[13]

[10] The structure of the Emergency Health Service includes the head office in Tashkent city – Republican Research Center of Emergency Care, its regional branches in each region (in total – 13). Besides, in 173 settlements of Uzbekistan sub-branches of the Republican Center at the Regional Healthcare Complexes.
[11] RORC MoH UZB is the head institution of the oncology service of the Republic of Uzbekistan, incorporating 17 big institutions of oncology service (city, regional, and republic-wide dispensaries), as well as 271 oncology units at district and city clinics. In total there are 2265 oncology beds in the Republic, and 145 of them are intended for treating children).
[12] The structure of AIDS Center includes the head office in Tashkent city, 14 regional AIDS centers, and 59 inter-district laboratories
[13] The organizational structure of the screening centers consists of the Republican Screening Center (RSC) (Tashkent city) and 12 regional ones (Samarkand, Bukhara, Ferghana, Andijan, Nukus, Namangan, Karshi, Termez, Navoi, Urgench, Jizzak and Syrdarya), covering screening and testing of newborns and pregnant women all over the republic. Patients from all regions of the Republic of Uzbekistan are admitted.

Republican Clinics	Clinic of Tashkent Pediatric Medical Institute[14]
	Republican Clinical Ophthalmology Hospital
Education Facilities	Andijan State Medical Institute
	Bukhara State Medical Institute
	Fergana Branch of Tashkent Medical Academy
	Nukus Branch of Tashkent Pediatric Medical Institute
	Samarkand State Medical Institute
	Tashkent Institute of Postgraduate Medical Education
	Tashkent Medical Academy
	Tashkent Pediatric Medical Institute
	Tashkent Pharmaceutical Institute
	Urgench branch of Tashkent Medical Academy

4.1.4. 'Ad hoc developments' post elections 2008-2015

With the 2007 election for a third term of the President, scholars have argued that Uzbekistan has progressed either moderately or little towards being a market economy, despite political promises (Spechler, 2007; Khaki and Sheikh, 2015). But political economists argue that such slow-to-moderate progress has allowed the government to maintain stability during the global financial crisis, as the GDP growth rate has been over 8% annually (Murtazashvili, 2012; Khaki and Sheikh, 2015; Hansjürgens, 2016). Policy analysts of the Uzbek economy suggest that the government's active engagement in investment rates and low integration in trade and capital markets has protected the Uzbek fiscal system from the negative effects of the global financial crisis (Khaki and Sheikh, 2015; Hansjürgens, 2016). Yet ostensibly the credibility of government statistics has been raised due to their opaque nature and the lack of their being audited by international organizations (Khaki and Sheikh, 2015). Interestingly scholars have argued that Uzbekistan has not been active in undertaking any further reforms towards market economy or democratization (Khaki and Sheikh, 2015; Hansjürgens, 2016; Tsui, 2016). The reasoning behind such stagnation was due to then President Karimov's vision to

[14] The Clinic is a structural subdivision of integrated training-research-medical-methodological complex of the Institute, which is designed to give multi-profile, specialized, in-patient, and consultative-diagnostic care to children of the Republic of Uzbekistan. Here pediatric GPs, and specialists in pediatric surgery, ENT, traumatology, ophthalmology with eye microsurgery, anesthesiology and resuscitation, pediatrics, dermatology, and neurology are trained, as well as nurses in the specialty of Higher Nursing Care.

control the political and economic structure of the nation (Rumer (2005) cited in (Tsui, 2016).[15]

A centralized approach to export-led growth and less direct trade has indirectly guided the education and R&D sector. The slow progress in the implementation of policy agendas in improving higher education and the R&D sector has met with mixed responses. While the Millennium Development Goal (MDG) report states the achievement of MDG 6 (basic education for all), analysis indicates that Uzbekistan's Higher Education system scores were low in human capital indicators, such as the number of patent applications and journal publications (Center for Economic Research, 2015). In 2009, the number of patent applications per million people was only 19, and the number of technical and scientific journal publications per million population was only 5 (World Bank, 2014). The relatively poor quality of human capital at Higher Education Institutes hinders not only the Higher Education sector's contribution to overall economic performance in terms of R&D.

Uzbekistan is reported to have spent around 8-10% of its 2008 GDP on its education system, a relatively high figure for a country of Uzbekistan's per capita income level (Weidman and Yoder, 2010; World Bank, 2014). Due to the government's attempt to introduce private funding in tuition fees, the enrolment towards Bachelor's and Master's degree level higher education (HE) decreased from 100% in 1990 to around 33% in 2015 (Ruziev and Rustamov, 2016). In 2013, the average tuition fees for domestic Higher Education institutes was around US$1,400 and for international ones around US$4,400 (World Bank, 2014). Another peculiarity of Uzbekistan's HE funding model is that up to 40% of the HE system budget is spent on student stipends, of which only one third comes from the state budget (World Bank, 2014; Ruziev and Rustamov, 2016). Regarding the R&D budget in the research development sector, the data shows that Uzbekistan leads in expenditure of GDP for R&D (Table 4.2). However, in terms of scientific output in terms of publications, patents, and technological exports, the performance of Uzbekistan fares lower than Kazakhstan. The underperformance of higher education inevitably influences the health sector in research performance as well.

[15] This is based on observations to 2015, as the new president in 2016 has set out more open policies towards building a market economy (Freedom House (2016), International Crisis Group (2016b, 2016a))

Table 4.2 Research and Development, Science Sector (UNESCO, 2015a, 2015b), World Bank indicators 2015)

	Research and development (R&D)		Scientific and technical journal articles	Expenditures for R&D	High-technology exports		Patent applications filed	
	Researchers	Technicians					Residents	Nonresidents
	full-time equivalent per million people	full-time equivalent per million people		% of GDP	$ millions	% of manufactured exports		
	2005-15	2005-15	2013	2005-15	2015	2015	2014	2014
Kazakhstan	734	176	879	0.17	2,844	41.2	1,742	271
Kyrgyz Republic	..	..	60	0.13	42	11.9	132	7
Tajikistan	..	..	71	0.12	..	..	2	2
Turkmenistan	..	..	7	..	..	..	..	..
Uzbekistan	534	60	347	0.2	..	..	345	223
World	1,282	..	2,184,420	2.12	2,148,145	18.3	1,713,099	793,310
Europe & Central Asia	2,995	868	720,932	1.89	713,865	16.1	145,986	51,690
Low income	..	..	3,909	..	..	3.4	..	..
Lower-middle income	..	..	141,887	0.55	76,240	11.3	18,461	52,904
Upper-middle income	1,264	..	646,082	1.57	741,015	20.7	857,919	214,657
High income	3,975	..	1,400,796	2.46	1,241,215	17.9	836,702	525,691

According to the official statistics, access to and the quality of healthcare in Uzbekistan has improved immensely over the past two decades (Center for Economic Research, 2015). Nonetheless based on the WHO statistics, the Central Asian countries all share the common characteristic of having cardiovascular disease, especially ischemic heart disease, as the leading cause of disease among the population. Based on the burden of disease data, the population between the ages 30 and 70 of both sexes have a 31% chance of dying from a non-communicable disease (World Health Organization Regional Office for Europe, 2014). This tendency is also true of other Central Asian countries, as non-communicable diseases account for more than 60% of total deaths based on the WHO report 2014 (Table 4.3). While NCDs trouble the population, communicable disease also accounts for more than 10% of the death profile except for Kazakhstan. Although proportionally it may not be as strong as non-communicable diseases, infectious disease still ranks among the top 10 causes of disease, which include maternal, neonatal, nutritional, and acute respiratory infections. Uzbekistan, a developing country with an unfinished agenda of infectious diseases (IDs), also faces problems related to NCDs (World Health Organization Regional Office for Europe, 2007, 2014).

Table 4.3 Central Asian country profile of proportional mortality (% of total deaths, all ages, both sexes) (World Health Organization Regional Office for Europe, 2014)

Country	Proportional mortality (%)						
	Communicable Diseases	Injuries	Cardiov ascular	Cance r	Chronic respiratory	Diabete s	Other NCDs
Tajikistan	30	8	38	8	4	1	11
Turkmenistan	13	10	50	9	4	2	14
Uzbekistan	14	7	54	8	3	2	14
Kazakhstan	6	10	54	15	4	1	10
Kyrgyzstan	11	9	49	10	4	1	16

Examining the ID in greater depth, like the trends in the Commonwealth of Independent States (CIS), tuberculosis has been an increasing trend, as has the multi-drug and extensively drug-resistant tuberculosis. Moreover, HIV infections have also shown an increase from the 2000s and the early 2010s. Acute infectious diseases are also lingering problems due to one third of the population lacking access to acceptable standards of drinking water (Cornia, 2003; Bekturganov et al., 2016). Access to drinking

water and sewage system, along with problems related to other hygiene issues continue to ail the country. Issues with drinking water often lead to preventable water-related diseases such as hepatitis and parasitic disease spreading in rural regions (Herbst et al., 2008; Crighton et al., 2011). Further, a lack of a coherent approach to reforms, particularly evident at the sub-national level, has placed the Central Asian countries, like Uzbekistan, at a risk to health (World Health Organization Regional Office for Europe, 2014, 2016).

The growing demands and complexity in the health sector along with health status dynamics test the decision-making capacities of the health policy makers. Decision makers face further dilemmas by the balancing act of the ideologies of macro political economic reform, such as centralization of state control and selective privatization. These aspects are reflected in their health policy initiatives as the focus is more on health regulation and social protection (1996) then to infrastructure building and provision of basic health care services (1998) such as setting up a primary, secondary, and tertiary network of hospitals and primary care centers with the support of international donors. The primary service provisions that do occur with the help of the donors made significant health impacts, as evidenced by the Millennium Goal targets of a two-thirds reduction in child and maternal mortality by 2015 (Center for Economic Research, 2015). Then again, challenges remain with less prioritized issues, such as human resources investment, education reform, and health research systems, as less focus on these sectors has left Uzbekistan health system to respond to the increased institutional complexity and diversity of health demands that need long term planning and human resources equipped with much needed capacity.

4.2. Discussion

The contextual background of political economic education, and the R&D policy trajectory between 1991 and 2015, showed how the state building and legitimacy of the single leader led to some progress but overall inadequate changes in the societal sector of Uzbekistan. The country transitioned from communism to authoritarianism or, as other scholars have argued, patrimonialism (Silitski, 2010; Way, 2010; Markowitz, 2012). This chapter's intention was not to point to the "negatives" of this political context but to focus on the ramifications of and challenges to the societal sector of that political context, such

as education and health to meet the demands of the changing population. The historical trajectory and the political highlights over the past two decades have shown how the economic and political intersections with health policy and history mirror one another to a degree, which explains the behavior and the narratives shaped by the actors in the field. Policies related to health and health research have both to a certain degree intersected with the political agenda, as those in government focused more on approaches to illness, treatment, and health sector infrastructure building.

After the Civil conflict of Andijan in 2005, the international relations-strained health policy took a strategic turn to use the NGOs' medical service provisions to maintain state legitimacy and satisfaction of the population (Johnson, 2014a). By providing a basic package of services through these activities, the government appeased the population and prevented resistance. However, lack of focus in human resources strengthening, such as education or the modernization of medical and public health education, led to continued lack of transparency in health information (statistics) (Anderson et al., 1994; Tolts, 2008, 2001). The same approach took place for education and science. It can be seen that science and health research have also not developed nor been given priority by the nation.

What we see from these legacies is that power is centralized and based on personal networks. Part of the reason why the president's authoritarianism has been sustained for over two decades with limited expansion of the free market economy and the monetizing of relations is perhaps because of these sustained traditions or "habitus" of institutions (Seifert, 2012). This practice or behavior manifests in the social sector and more specifically the health sector, in various ways. First, the government maintains it is favorably disposed towards providing public education and health services, yet it is reluctant to share negative aspects of the current system and reluctant to address let alone encourage criticism toward the government. Second, hierarchical management in health itself has led to a less flexible system of management in the health sector, which means it maintains a top-down approach to policy changes and implementation. This has opened the door to short-sighted decisions regarding the transition from Soviet health to the current Uzbek health system where the policy direction is not only dependent on the technical and emerging issues but also on the interest of the government and the ideologies of the ruling elites (e.g. parliamentary decisions). In depth issues of health

policy decision directives are discussed at greater length in chapter 7, where the qualitative narrative in the decision making process of the elites shows limitations in their use of research for policymaking.

This is particularly useful insight to explain the practice and learning of the embedded institutional behaviors in the health research system. Recent literature on health research systems, and more specifically health research capacity building studies, have focused more on monitoring and evaluative framework to build better indicators for monitoring such activities (Bates et al., 2006; Boyd et al., 2013; Bates et al., 2014; Bates, 2015). Although these studies are good at understanding the progress of input efforts, they have limitations in understanding why some efforts result in unexpected conflicts and difficulties (Vasquez et al., 2013). Only recently have studies highlighted the political undertone that gives insight to institutional arrangements and networks that impact health research systems (Ager and Zarowsky, 2015; Palmer et al., 2009). Grundy (2015) argues that in health policy and health systems analysis studies it is rare to see an explicit connection made between the historical context and a particular aspect of the health system. Grundy(2015) argues historical context gives a long-term view of the changes (or stasis) that have taken place, which could give insight in how and why those with power tend to make particular choices about health policy changes (Capano, 2009; Grundy et al., 2015). I would concur with this analysis of the health research system. Despite the benefits argued by Grundy et al. (2015), it is rare to see studies combining historical context with the institutional perspective, or studies that take into account other sectors (such as education and R&D) that connect with the health research system(Capano, 2009; Grundy et al., 2015).

4.3. Conclusion

This chapter examined the political, economic, education, and R&D sectors pre- and post-independence. One basic reason for this is the absence of accurate measures of research performance. A somewhat detailed depiction of Uzbekistan's experience with its newly instituted rules and regulations regarding research productivity would be of interest to researchers and policy makers around the world, especially those in developing countries where similar changes are taking place.

The contextual background on economic and political progress, along with similar trajectories in the education and science sectors, has shown distinct characteristics over the years, as summarized below:

a. Economic growth: despite the country's economic growth, the Uzbekistan health research system has not been able to take advantage of simultaneous growth in the health sector

b. Missed reform opportunity in the social sector – maintaining state legitimacy has led to lack of progress in social sector reform, such as in the education, health, and R&D sectors, which in turn impacted the medical education and science potential in health research systems

c. Health and demographic transition: the current demographic transition related trends of an aging population, a population doubly burdened with non-communicable disease, which together present challenges to the current health research system, which is unable to meet the demands on it

Based on the review, specific features of the health research system are as follows:

The double burden of disease of the population (both communicable and non-communicable) requires the Uzbek health sector to be responsive as well as adaptive to the population's changing needs. However, based on the review of the legislative framework as well as the organizational structure of the health sector of Uzbekistan, there is little to no evidence of progress towards investment in human resources nor of research on health conditions of the population. The legislations put forward since independence have first centered on health services to meet the demands of the rural population, who did not have health care access. Later legislations focused more on infrastructure building and expansion of health services. With limited resources, the priorities set by the government could have lasting effects in meeting the health care demands of the population. For instance, if the decision makers had invested in human resources from the beginning of independence, in the end they would have benefitted from understanding and gaining necessary health information about the population. However, the current decrees and legislation on health professionals, human resources, and research development still lag behind the needs, which has resulted in inadequate response to understanding the population's health.

Even the legislations already in place by the government show slow progress in implementation and in showing the intended results. There is no specific health research policy document or legislation that deals with health research, though there was supposed to be a National Public Health Strategy (2008-2015) that established a list of national health priorities (COHRED, 2002; Ahmedov et al., 2007). Unfortunately, there has been no framework/mechanism designed to disseminate and inform policy and decision makers about research evidence, although The School of Public Health at Tashkent Medical Academy is advocating for such a unit (COHRED, 2002; Ahmedov et al., 2007). The latest self-assessment report on the Ministry of Health identified that the government is paying greater attention to health and environmental issues, and is undertaking appropriate steps towards strengthening its capacities (World Health Organization Regional Office for Europe, 2016). However, ineffective implementation has been reported due to insufficient capacity for making analysis and assessment of the existing health database for evidence-based managerial decision making (World Health Organization Regional Office for Europe, 2016). Even though public health institutions are being equipped through "Health-2" and "Health–3" projects of the World Bank, there is a shortage of qualified personnel with advanced knowledge and skills in the public health area (World Health Organization Regional Office for Europe, 2016). It is clear from the literature that there is no clear process for what practices should be used to set research agendas, who should be involved in this, nor how often the agendas are revised (World Health Organization Regional Office for Europe, 2007).

Another distinct characteristic of Uzbekistan health research is that unlike other countries in the Central Asian region and the world, most of the research is conducted within the public sphere of the state (UNESCO, 2015b). As mentioned in the UNESCO study, almost all the health professionals who pursue research end up in academia and the public sector, which is problematic as it means that this workforce relies heavily on government funding (UNESCO, 2015b). Scholars in science, technology, and R&D sector have argued for the triple helix of knowledge production--a combination of government, academia and the private sector -- working together for positive outcome (Kwon et al., 2012). Those cases – industry, academy, and government collaboration in research - were rare in the health sector of Uzbekistan. Even in the more liberalized pharmaceutical sector

in Uzbekistan, there is limited interaction between industry and pharmaceutical academies in research and development (Dusmuratov et al., 2013).

These international initiatives and donor-funded projects resulted in interventions in health, health research, water, sanitation, and hygiene over the past two decades (Franz et al., 2008, Herbst et al., 2008, Herbst et al., 2012). For instance, to better understand the overall political social dynamic of water management, several research projects have taken place in collaboration with EU countries such as Switzerland and the Czech Republic (Kment and Krepl, 2012). Another example comes from COHRED, which facilitated a health research mapping project in Kazakhstan, Kyrgyzstan, and Uzbekistan (2007) to understand how to strengthen the health research system in the region (Ahmedov et al., 2007). As health and environmental issues become a priority in Uzbekistan's national health settings, efforts could be made at both the individual and institutional levels, such as revision of monitoring and surveillance mechanisms, strengthening existing health information systems, and developing integrated models for improved risk assessment strategies in Uzbekistan (Saravanan, 2011). Despite these plans, the health research system remains a low priority with donor-led interventions that remain superficial. Given these circumstances, it is important to understand why this situation has transpired.

The literature review of complexities in the health research systems in Uzbekistan has only revealed the contextual background as the constraining force. This suggests that in-depth analysis of the institutional elements influencing health research system is a priority. In order to achieve this, the findings derived from the review of the historical trajectory of the Uzbekistan political, educational, R&D, and health sectors will serve as a useful guide to identify the theoretical framework needed to explain the institutional elements in the health research system. It will further guide the study design (e.g., data collection methods) needed to elicit information that addresses the research questions and recognizes the thesis's main aim. The following chapters delve deeper into the research performance and the actors of the health research system in Uzbekistan.

Chapter 5. Research outputs and performance in Uzbekistan health research system

The previous chapter provided an overview of the progress made in the political, economic, and social sectors (specifically in education, R&D, and health) in Uzbekistan since independence. This contextual background, to a certain degree explained the trajectories undertaken in health research systems. With this background in mind, this chapter deals with theoretical aspects of understanding health research systems in the Uzbekistan context. This chapter examines the health research production of Uzbekistan. Examining various components of health research system is an essential part of health policy and of strengthening health research system. The main purpose of this chapter is to understand the output and performance of the health research system. Output assessment gives an overview of the volume and quality of health research product is to understand the main actors and key organizations in producing research. As knowledge is typically not tangible in the science sector, publications are a means of presenting in quantifiable indicator in transferring knowledge of R&D (Bozeman and Melkers, 2013). There is a general consensus on bibliometric studies that significant findings of scientific research end up in journals, but also that publications are not a perfect measure of research performance and its production (Bozeman and Melkers, 2013).

Nonetheless, scientific publications are important indicators of information that gives insight into the scientific process, as they show the type of research undertaken, and are a marker of the institute's productivity, credibility, and legitimacy. Identifying publication practices such as classifying authorship (single vs. multiple) and research communication— namely to identify where scholars publish their work— reveals the country's main communication channel along with collaboration patterns. This chapter examines the outputs and performance, re-creation (more specifically path dependence), centrality/isomorphism, and collaboration and diffusion of health research system in Uzbekistan based on the analytical framework of the theoretical chapter. The empirical findings from examining the components of the analytical framework will elucidate the institutional changes within the health research system of Uzbekistan.

5.1. Research landscape in Uzbekistan

After the independence from the Soviet Union, Uzbekistan had to adjust their scientific institutions to new frontiers to accommodate to state independence and its reform directions. Since the disintegration of the Soviet Union, the new states of Central Asia have been obliged to adjust their institutions to new symbolic frontiers and to take into account the independence they achieved in 1991. Based on the arguments of Larauelle (2010), the Uzbekistan science system (meaning the National Academy of Science and universities) was advised to accommodate its research policies to respond to emerging national issues (Laruelle, 2010). The response to state independence impelled the continuity of individual, institutional, and intellectual research relationships and trajectories of the Soviet past intertwined with contemporary research issues of the Uzbekistan science system. Thus, this invites inspection of the past two decades of the Soviet past in order to understand the process of building the nation-state.

The Uzbekistan science system formed in response to the leadership of the Scientific Committee formed in 1932[1]. The Uzbekistan Academy of Science was established in 1943 as part of the Soviet Academy of Science. The Soviet Academy of Science had many scientific branches within the academic disciplines of geology, botany, chemistry, and problems of water resources (from 1941 – the Institute of Energy Industry and Power Engineering). The academy also had history, language and literature, along with the soil science sector, zoology, physics, and mathematics (together with the helio-technological laboratory) as part of their scientific branch[2]. Fig 5.1 represents the basic schematic of the USSR Academy's focus. According to the Uzbek Academy of Science, the latter half of the 1940s focused on other sectors, such as economy, culture, medicine, and other industries.

[1] Source: On the Uzbekistan Academy of Sciences 70 years Anniversary About Academy of Sciences
http://www.academy.uz/en/news/23 accessed on March 26, 2016

[2] Source: On the Uzbekistan Academy of Sciences 70 years Anniversary About Academy of Sciences
http://www.academy.uz/en/news/23 accessed on March 26, 2016
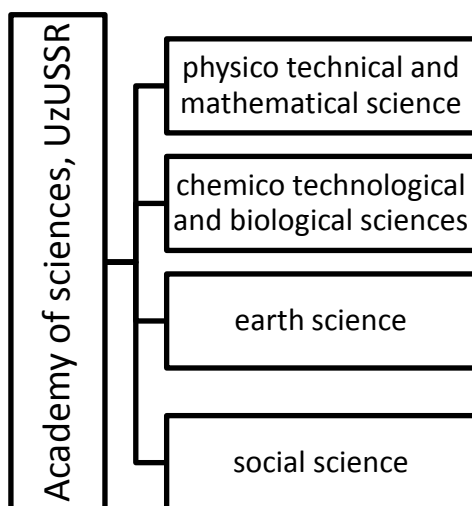
Figure 5.1 *Priorities of the UzUSSR Academy of Science (1940s) adapted from (Kassel and Campbell, 1980)*

Uzbekistan, reportedly, has a comprehensive approach to innovation, as it focuses on traditional areas of research from the Soviet past (agriculture, plant and animal sciences, etc.) and, as well as, areas with higher potential to support innovation, such as engineering, material sciences and molecular biology (COHRED, 2002). The same trajectory of R&D priorities continued as the Uzbekistan government formulated eight priorities for R&D for the era up to 2020. The priorities aimed for an innovative economy that focused on energy and resource savings; development of renewable energy use; development of ICTs; agriculture, biotechnology, ecology, and environmental protection; medicine and pharmacology; chemical technologies and nanotechnologies; and earth sciences. The Uzbekistan science sector encouraged project proposals from these sectors, allowing flexible finance support from industry and the state regions. This innovation goal was written into law in January 2011, in order to encourage innovation and bridge between the public research sector and industrial enterprises for democratic reforms of the society (UNESCO, 2015b).

This reform proved successful, as innovation projects that were approved for governmental funding included biotechnologies (26%), new materials (19%), medicine (16%), oil and gas (14%), chemical technologies (12%), and energy and metallurgy (13%) (UNESCO, 2015b). This resulted in government spending of more than 85 billion Uzbek

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soums (UZS), equivalent to US $37 million, on more than 2,300 innovative projects as well as 60 new technologies, and 22 product types that subsequently went into production (UNESCO, 2015b). As seen in Table 5.1, over a span of 20 years, Uzbekistan increased its research production from 87 to 517 publications. However, the overall ranking and the research production in comparison to the Asian region as a whole is relatively low. What is more interesting is that though in 1996 Uzbekistan ranked higher than other Central Asian countries such as Kazakhstan, by 2015 it had fallen behind Kazakhstan (Table 5.1).

Table 5.1 *Overall research production ranking based on SCImago Data 1996 vs 2015(Asian region)*

Ra nk	1996				2015			
	Country	Docume nts	Citable docume nts	Citations	Country	Docume nts	Citable docume nts	Citations
1	Japan	4403	4395	78541	China	407905	400486	4390399
2	India	2400	2398	21810	Japan	374719	366810	9238882
3	China	996	995	16609	India	142441	138475	1595484
4	Taiwan	477	474	9820	South Korea	110658	108268	1856132
5	South Korea	319	318	6377	Taiwan	53632	52666	971355
6	Philippin es	211	211	5991	Singapor e	23842	23167	662754
7	Pakistan	180	180	1310	Hong Kong	19043	18485	495473
8	Malaysia	172	171	3161	Thailand	15335	14912	212751
9	Indonesi a	161	161	3941	Malaysia	13835	13531	118165
10	Thailand	148	147	2746	Pakistan	8527	8312	83226
11	Hong Kong	139	139	2731	Indonesi a	3207	3148	37907
12	Banglade sh	131	131	694	Philippin es	2844	2782	54341
13	Singapor e	104	104	2866	Banglade sh	2718	2662	24288
14	**Uzbekist an**	**87**	**87**	**101**	Viet Nam	2680	2632	32437
15	Sri Lanka	49	49	642	Kazakhst an	1359	1346	4711

16	Viet Nam	41	41	526	Sri Lanka	1102	1069	14939
17	Kazakhstan	38	38	318	Nepal	962	928	10592
18	Nepal	25	25	371	**Uzbekistan**	**517**	**510**	**5980**
19	Mongolia	7	7	111	Macao	501	491	4447
20	Tajikistan	6	6	15	Mongolia	370	357	5446

Source: Authors analysis from SCImago Journal & Country ranking accessed on Sep 16, 2016

Further analysis in Uzbekistan science system's research performance over the past 20 years shows varying degrees of research outputs from different disciplines. Table 5.2 highlights the number of publications in the most notable sectors such as agriculture, chemistry, physics, and medicine. Table 5.2 represents the absolute number of publications from the entire field of disciplines published in Uzbekistan since 1996. As seen from Table 5.2, traditional areas of science (e.g. agriculture, biochemistry, physics) as well as energy and materials science research have higher number of publications in absolute terms compared to other areas such as medicine, nursing and dentistry. The growth rate of the medicine related sectors, however, have grown steadily over the past two decades. This could be due to the nation's initiatives to strengthen the health sector as part of the national research innovation priorities (Table 5.2).

Table 5.2 Number of publications in the most productive subjects, according to SCImago data on Uzbekistan (data source: http://scimagojr.com) [3]

Subject area (Notable grow sectors)	Number of publications in Year				
	1996	2000	2006	2015	Growth (%)
Agriculture and Biological Sciences	87	88	71	55	-1.93%
Biochemistry, Genetics, and Molecular Sciences	24	24	31	18	-1.31%
Chemistry	36	51	52	33	-2.63%
Energy	46	45	58	46	0.02%
Materials Science	90	66	84	51	-2.28%
Medicine	11	16	17	25	6.69%

[3] The SCImago Journal & Country Rank is a publicly available portal that includes the journals and country scientific indicators developed from the information contained in the Scopus® database (Elsevier B.V.). These indicators used were to assess and analyze scientific domains.

Physics and Astronomy	115	151	185	133	0.82%
Dentistry, Nursing, Pharmacology, Toxicology, and Pharmaceutics	7	16	16	7	0.25%

One interpretation of this is that the majority of publications in the Uzbek science sector, and notably its strongest areas, mirror the legacy of Soviet science. Many of the research institutes established during the Soviet times still exist in Uzbekistan. This is demonstrated by the example of most active research organizations based on the UNESCO report (Table 5.3) (UNESCO, 2015b). In Uzbekistan, physics and astronomy has been strong in research productivity, as these have long been two focal areas of Soviet science (UNESCO, 2015b). While the most active research organizations are those that focus on physics and science and agriculture, other sectors are relatively less productive and active. For instance, health, medicine, and pharmaceutical areas show minimal activity, based on the UNESCO reports as well as the absolute data from SCIMago (UNESCO, 2015b).

Table 5.3 Uzbekistan's most active research organizations, 2014 (UNESCO, 2015b)

Physics & Astronomy	Energy
Institute of Nuclear Physics Institute of Polymers, Chemistry, and Physics Institute of Applied Physics at the National University of Uzbekistan	Institute of Energy and Automation Tashkent State Technical University Fergana Polytechnic Institute Biochemistry, Genetics, and Molecular biology
Chemical Science	Biochemistry, Genetics, and Molecular Biology
Institute of Bio-organic Chemistry Institute of General and Inorganic Chemistry	Centre of Genomics and Bioinformatics Institute of Plant and Animal Genomes Institute of Microbiology

5.1.1. Total research production in health discipline

In depth look into publications on Medicine, Pharmaceutical Science, Health Professions, Immunology and Microbiology, and Social Science from 1991 to 2015 demonstrate the further imbalance of research production in each health discipline. The analysis of the SCIMago data suggests that the strength of Uzbekistan health research production lies particularly in medicine, specifically research on infectious diseases,

radiology nuclear medicine, and medicine (miscellaneous)[4]. The publications in these categories in the years 1996, 2000, 2006, 2014 number fewer than 15 per year, which means that rest of the disciplines publish fewer than five articles per respective year. Publications on pharmaceutical topics showed varying degrees of progress in pharmacology, toxicology, and drug discovery, but the results implied that there was no progress in research in other areas of pharmaceutical science, such as pharmacoeconomics, clinical science, and regulatory affairs research in pharmaceutical policy. There was limited research on the health professions as well as on social science research related to health. Although microbiology and immunology research production was greater than that in the health professions (138 documents vs 16 documents), overall the research production in each area was disproportionate rather than balanced (Table 5.4).

Table 5.4 publications from Uzbekistan (1991-2015) based on the absolute number of publications from SCImago data

Medicine				Pharmaceuticals			
H index[5]	Documents	Citations	Citations per document	H index	Documents	Citations	Citations per document
33	491	4171	8.49	24	236	1886	7.99
Social science				**Immunology and microbiology**			
H index	Documents	Citations	Citations per document	H index	Documents	Citations	Citations per document
13	189	745	3.94	25	**138**	1865	13.51
Health profession							
H index	Documents	Citations	Citations per document				
4	**16**	68	4.25				

[4] The Miscellaneous Medicine category includes journals that not categorized in a specific medicine discipline as they cover broad topics. Journals in this category include the Journal of Cell Biology, the Journal of Experimental Medicine, The Lancet, the New England Journal of Medicine, the Journal of the American Medical Association, along with Environmental Science and Technology.
[5] The h index expresses the journal's number of articles (h) that have received at least h citations. It quantifies both scientific productivity documented in journals and scientific impact, and it is also applicable to scientists, countries, etc.

Past historical trajectories partly explain this research production pattern. At the time of independence, the Uzbekistan health research system consisted of 17 separate research institutes and 9 central laboratories of medical institutions operating in the medical sciences (COHRED, 2002). These included scientific research institutes of cardiology, pediatrics, obstetrics and gynecology, pulmonology, oncology and radiology, dermatology and venerology, hematology and blood transfusion, epidemiology, and microbiology and infectious diseases. Some of these institutes were branches of the Academy of Sciences of the USSR, such as the Central Institutes of Virology, and Immunology, and the USSR Science Centre of Surgery, among others (COHRED, 2002). Between 1986 and the 1990s under the framework of the USSR, scientific technical program commissioned large-scale research projects related to basic science. More specifically, the technical programs were designated as "Basic medical sciences" in the fields of biotechnology, immunology, virology, hematology and blood transfusion, endocrinology, psychiatry and narcology, gastroenterology, and cardiac surgery (COHRED, 2002). Therefore, the research production strengths mentioned above in areas such as immunology, biotechnology, and cardiology as presented in the SCImago data, reflects the structural and disciplinary strength that carried on from the Soviet past.

Research producers within the health research system of Uzbekistan

While SCImago data shows strength in showing aggregate measures of indexed journal topics from its publications, it is limited in showing details of publication's authors, affiliation, and the types of research. To complement this gap, in-depth examination on research production was necessary to explore the progress so far in the health sector of Uzbekistan. Data was from publications reporting on health in both WoS and Medline/PubMed data from 1991. From the WoS and Medline/PubMed data, the absolute number of articles from 1991 to 2015 was 321 articles. During the first decade (1991-2000), in total, 30 articles were published, while in the subsequent decade the absolute numbers of articles has increased six-fold to 180 articles with the growth rate of 3.28% (Fig 5.2). The publication trend was low during the early 1990s and 2000s. Many factors could have contributed to the low number of publications before 2000. One possible explanation behind this trend is that between independence and the early 2000s, Uzbekistan has gone through various reforms in education (such as changes to official language requirements e.g. Russian to Uzbek) and the health sector (such as structural

reforms in professional health education and services), which may have contributed to low research production. The research production rates increased after 2000, which implies research production stabilized after the various new policies had begun their implementation. It also implies that more research communication opportunities may have become possible since 2000, as Uzbekistan has collaborated with various international partners.
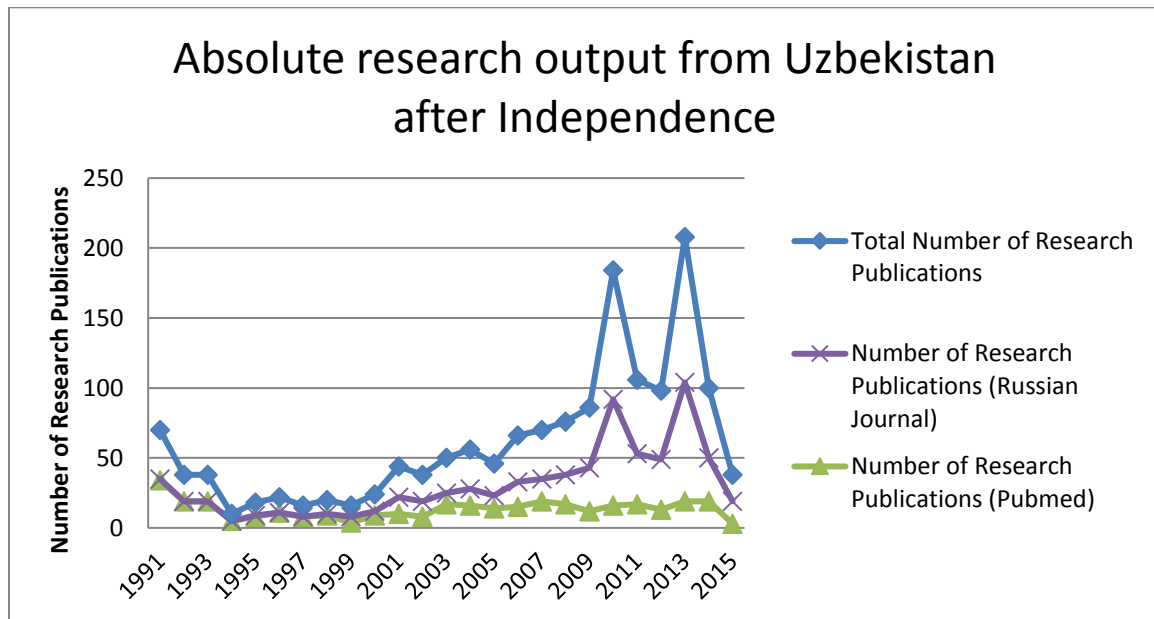
Figure 5.2 *Overall Research Publications in Health from 1991 to 2015, WoS, PubMed data*

The analysis of each organization and academy of its publications based on the corresponding author addresses elucidated the research producers, specifically those who were most productive in the health sector of Uzbekistan. Table 5.5 lists the top 10 health research producers based on the corresponding author affiliations in Uzbekistan. Since 1991, the research entities whose correspondence addresses based in Uzbekistan produced 39.5% (111/321) of the research papers from Uzbekistan. The majority of these institutions were located in Tashkent city (Tab 5.5). Results show that educational entities such as academies are observed as the research hub of Uzbekistan that are most active not only in terms of local research production but also in international collaborative research, which will be analyzed further in the later section.

Table 5.5 The 10 leading institutions for health research in Uzbekistan *1991 to 2015, WoS, PubMed data*

No	Research institution	Number of papers by corresponding author affiliation	Percentage of articles	Location of region
1	Tashkent Medical Academy	26	8.10%	Tashkent
2	Republican Specialized Center of Cardiology, Tashkent	17	5.30%	Tashkent
3	Tashkent Institute of Postgraduate Medical Education	14	4.36%	Tashkent
4	National Cancer Research Center of the Ministry of Health of the Republic of Uzbekistan, Tashkent	9	2.80%	Tashkent
5	Republican Scientific Centre of Emergency Medical Care under the Ministry of Public Health of the Republic of Uzbekistan, Tashkent	9	2.80%	Tashkent
6	The Centre for the Scientific Study of Endocrinology, Tashkent	9	2.80%	Tashkent
7	Republican Specialized Scientific and Practical Medical Center of Tuberculosis and Pulmonology	8	2.49%	Tashkent
8	Pediatric Medical Institute, Tashkent, Uzbekistan	7	2.18%	Tashkent
9	Samarkand State Medical Institute, Burn Department of RSCUMA, Inter-Regional Burn Center, Samarkand, Uzbekistan	6	1.87%	Samarkand
10	Scientific Research Institute for Hematology and Blood Transfusion, Ministry of Public Health of the Republic of Uzbekistan, City of Tashkent	6	1.87%	Tashkent
	Total	111	34.6% (111/321)	

Quality –impact of research produced

Bornman et al., (2009) defined scientific excellence as high performing authors whose work received high numbers of citations (Bornmann and Daniel, 2009). Therefore, to examine the impact of research produced in Uzbekistan (1) average citations by affiliation, and (2) affiliations of the most cited researchers and publications were collected. Based on Ministry of Health categorization the author affiliations were organized by institutes and research centers (see Appendix C). In total, 128 articles were identified that involved international collaboration with authors from other countries. Entities active in

international collaboration were counted based on their affiliation and the impact of their research produced in terms of journal citation impact factors (Tab 5.6).

Table 5.6 Uzbekistan research producers that have collaborated with international research partners *1991 to 2015, WoS, PubMed data*

Study publication patterns	journal impact factor 0-1	journal impact factor 1-2	journal impact factor 2-3	above 3	Total[6]
Specialized clinical centers	4	4	1	1	10
Clinical research centers	0	0	4	7	11
Specialized research institutes	3	6	2	3	14
Republican Specialized Scientific and Practical Medical Center	2	3	5	3	13
Practical medical centers	1	2	5	0	8
Educational establishment university/academy	15	6	14	9	44
Government – Ministry of Health (MOH)	3	9	15	13	40
Other NGO/private clinic/bilateral organization (but Uzbek author)	3	4	14	11	32
Total	30	26	38	34	128

This table shows where those researchers are located in Uzbekistan and their collaboration with international partners. The findings demonstrate that collaboration involves diverse partners, from specialized centers to officials from the Ministry of Health (MOH). Educational entities such as academies and universities were the most proactive in collaborating with international research partners in Uzbekistan. The specialized institutes established in the Soviet past were not active in research collaboration (10, 11, and 14 research articles in total) compared to that of educational establishments (44 research articles).This mirrors the results from the previous section, in which Tashkent Medical Academy was the most productive entity. Based on the impact factor analysis, of all the domestic actors Tashkent Medical Academy research was the most highly cited with an average of 4.39 citations per publication.

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[6] Some articles involved more than three institutes. Therefore, the counts for affiliation are not exclusive.

Specialized institutes on average had 1.22 citations, which places them lower in ranking and in making an impact in their field than the academies and universities. What is particularly interesting about this result is that the authors from the ministry of health (MOH) ranked as second highest in collaborating with international partners in research (40 research articles). Although MOH is not a research- producing entity, one explanation behind this phenomenon could be that international research in Uzbekistan requires administrative approval from the authoritative entities and requires supervision from the ministries, which explains their involvement in authorship. Moreover, officials of MOH hold multiple posts, such as researcher for the Academy as well as a post in the Ministry of Health, which could explain their scholarly involvement. For research that involved international collaboration, the research impact and its quality increased. As more than 56% of these articles published in journals with a higher impact factor than the articles authored only by Uzbek authors, where most of the publications have minimal impact factor (further analysis in the next section).

The most cited authors among all articles (Fig 5.3) further elaborate the impact of international collaboration. The work of the three most heavily cited Uzbek authors was the result of a collaborative project with Nagoya University of Japan and the Centers for Disease Institute in Norway respectively. This also applies for the most cited publications among all research articles that involve international collaboration. Unlike the journal choices for publication of research activity conducted by only Uzbek authors, collaborative research publications aim for more visibility in their work, hence they aim for more high-ranking journals (Fig 5.4).
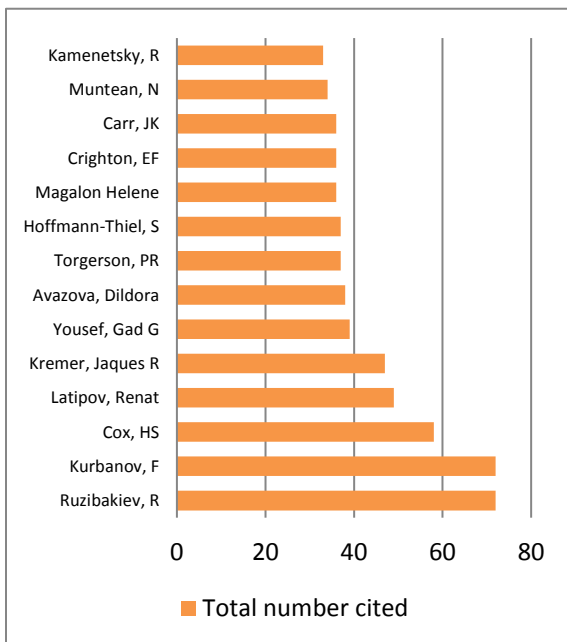
Figure 5.3 Most cited authors based on WOS data 1991-2015
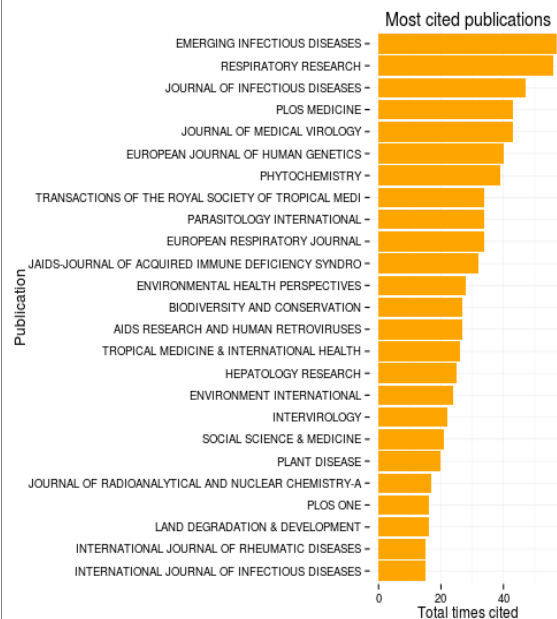
Figure 5.4 Most cited publications based on WOS data.1991-2015

5.2. Re-creation

5.2.1. Publication strategies

Another aspect that needs further exploration is the publication strategies undertaken by Uzbek researchers in the health research system. These strategies correspond in part to the re-creation component from the analytical framework (chapter 3) that discusses institutional factors that influence publishing behaviors in research publications. To examine whether there are any institutional factors that influence publishing practice, this section examines research articles authored only by Uzbek authors. Each of the journal where Uzbek authors published was scanned to review its peer review process and publishing fee. The purpose of this analysis was to understand why Uzbek authorship is not as visible. Additionally, this analysis explained the strategies Uzbek authors took under the pressure to publish that ensued after changes in legislation.

The results indicate that Uzbek researchers publish outputs in journals edited by Russian publication channels. After the breakup of the Soviet Union, these established

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publication pathways maintained without much impetus for change. Russian journals such as *Gigiena i sanitaria* (Hygiene and Sanitation), *Meditsinskaia parazitologiia i parazitarnye bolezni* (Medical Parasitology and Parasitic Diseases), *Voprosy onkologii* (Research on Oncology), are translated into English. This satisfies the legislative preference that authors publish their articles in English in peer-reviewed journals. This case has also been argued in Karaulova's study on the Russian nanotechnology research system (Karaulova et al., 2014; Karaulova et al., 2016b). Moreover, most of the members of the editorial board of the top journals that publish in Russian revealed affiliation with institutions located in Russia or the former Soviet Union (Table 5.7).

The Russian publication channels give authors from Uzbekistan the opportunity to communicate their research findings more easily, as language would not be such a hindrance and the journal assumes its readership will understand the Central Asian context and network. Moreover, findings indicate that 31% of the journals with which Uzbek authors communicate (17 out of 55 journals) are not explicit about whether the journal is peer reviewed or not in their publishing process. Most of the journals indicated that they were peer reviewed (69.1%), although not all were specific or detailed with their peer review guidelines. Examining the publication fees, while 31 journals (56%) were not explicit on publication fee, while 15 journals stated there was no publication fee unless the authors opted to publish for open access. The journals from Russia, Turkey, Bosnia, and Poland were explicit in stating that publication fee was charged for each article (7 out of 55 journals). Therefore, this also invites the question about research quality, research integrity, and motives of researchers to choose this way of communicating their research findings.

Table 5.7 Journals in which Uzbek authors published *1991 to 2015, WoS, PubMed data*

	Journal	Publication numbers	Peer review process?	Publication charge?	Country of publication
1	*Gigiena i sanitaria (Hygiene and Sanitation)*	10	Yes	Not stated	Russia
2	*Angiologiia i sosudistaia khirurgiia*	7	Not stated	No fee	Russia
3	*Problemy sotsial'noi gigieny i istoriia meditsiny*	7	Yes	Not stated	Russia

4	*Meditsinskaia parazitologiia i parazitarnye bolezni (Medical Parasitology and Parasitic Diseases)*	6	Not stated	Not stated	Russia
5	*Voprosy onkologii (Research on Oncology)*	6	Not stated	Not stated	Russia
6	*Milli Nevrologiya Jurnali*	6	Not stated	Not stated	Azerbaijan
7	*Problemy tuberkuleza*	5	Yes (single blind review)	Not stated	Russia
8	*Likarska sprava / Ministerstvo okhorony zdorovia Ukrainy*	5	Not stated	Not stated	Ukraine
9	*Zhurnal Mikrobiologii Epidemiologii I Immunobiologii*	4	Yes	Not stated	Russia
10	*Kardiologiya*	4	Yes	Not stated	Russia
11	*Voprosy pitaniia*	4	Yes	Fee charged	Russia
12	*Problemy tuberkuleza i boleznei legkikh*	3	Yes (single blind)	Not stated	Russia
13	Burns	3	Yes	Open access fee (waived for lmic)	UK
14	*Terapevticheskii arkhiv*	3	Yes (single blind)	Not stated	Russia
15	Turkish Journal of Gastroenterology	2	Yes (double blind)	Fee charged	Turkey
16	*Klinicheskaia laboratornaia diagnostika*	2	Yes	Not stated	Russia
17	*Urologiia (Moscow, Russia : 1999)*	2	Yes	Not stated	Russia
18	*Zhurnal Nevrologii i Psikhiatrii imeni S.S. Korsakova*	2	Yes	Not stated	Russia
19	Georgian medical news	2	Not stated	Not stated	Georgia
20	*Voprosy kurortologii, fizioterapii, i lechebnoi fizicheskoi kultury*	2	Not stated	Not stated	Russia
21	*Turk Kardiyoloji Dernegi Arsivi*	2	Yes	Not stated	Turkey
22	Cytology and Genetics	2	Not stated	Fee charged	Russia
23	International Journal of Collaborative Research on Internal Medicine and Public Health	2	Yes (double blind)	Fee charged	Bosnia and Herzegovina

24	Journal of Acute Disease	2	Yes	Open access fee (waived for lmic)	Singapore
25	*Bulletin de la Société belge d'ophtalmologie*	2	Not stated	Not stated	Belgium
26	*Meditsina truda i promyshlennaia ekologiia*	2	Not stated	Not stated	Russia
44	International Journal of Biomedicine	2	Not stated	Not stated	United States
27	*Anesteziologiia i reanimatologiia*	1	Yes	Not stated	Russia
28	Cutis	1	Yes	No fee	USA
29	The Turkish Journal of Pediatrics	1	Not stated	Not stated	Turkey
30	Cardiovascular Imaging	1	Yes	Open access fee (waived for lmic)	UK
31	*Vestnik oftalmologii*	1	Yes (single blind review)	Not stated	Russia
32	HeartDrug	1	Discontinued	Discontinued	Germany
33	European Journal of Public Health	1	Yes	Open access fee (waived for lmic)	UK
34	Public Health	1	Yes	Open access fee (waived for lmic)	NLD
35	Journal of Plastic, Reconstructive and Aesthetic Surgery	1	Yes	Open access fee (waived for lmic)	UK
36	Cardiovascular Therapy and Prevention	1	Yes	Not stated	Russia
37	World Journal of Endocrine Surgery	1	Yes	No fee	India
38	*Postepy w Kardiologii Interwencyjnej*	1	Yes	Fee charged	Poland
39	Chinese Medical Sciences Journal	1	Yes	Open access fee (waived for lmic)	China

40	Rational Pharmacotherapy in Cardiology	1	Yes	No fee	Russia
41	Pediatric Surgery International	1	Yes	Open access fee charged	Germany
42	Reumatizam	1	Not stated	Not stated	Croatia
43	Drugs in R and D	1	Yes	Not stated	UK
45	Planned Parenthood in Europe = Planning familial en Europe	1	Discontinued	Discontinued	UK
46	*Eksperimental'naia i klinicheskaia gastroenterologiia*	1	Not stated	Not stated	Russia
47	The Journal of Burn Care & Rehabilitation	1	Yes	Open access fee charged	USA
48	Disability & Society	1	Yes	Open access fee charged	UK
49	*Khirurgiya*	1	Yes	Not stated	Russia
50	*Cocuk Sagligi ve Hastaliklari Dergisi*	1	Not stated	Not stated	Turkey
51	*Ceska a Slovenska Gastroenterologie a Hepatologie*	1	Yes	Not stated	Czech Republic
52	*Arkhiv patologii*	1	Yes	Fee charged	Russia
53	Current Orthopaedic Practice	1	Yes	Open access fee charged	USA
54	*Zhurnal voprosy neirokhirurgii imeni N. N. Burdenko*	1	Yes	Fee charged	Russia
55	European Journal of Pediatric Surgery	1	Yes (single blind)	Not stated	Germany
Total		127			

Based on the country of publication, it is clear that Russia is the predominant choice of publisher for Uzbek scholars. From year 2010, there was a growing trend to seek publication in international peer reviewed journals to increase the visibility of their research, as shown in Fig 5. Although there is a predominant trend for choosing journals published in Russia, the trend towards publication in the UK, USA, and other countries is slowly increasing (Fig 5.5).
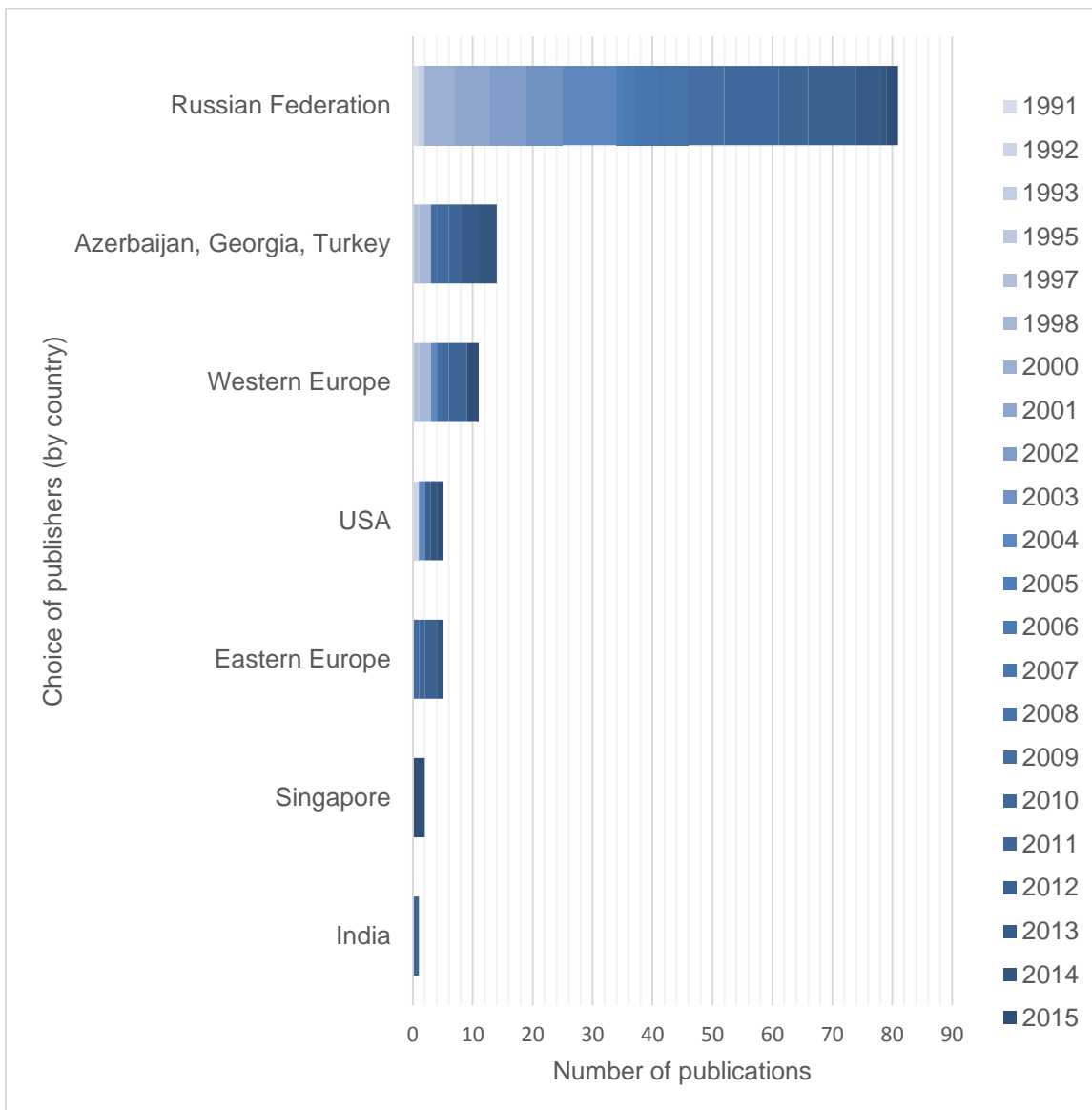
Figure 5.5 *Choice of publisher (by country) in medical and biomedical journals 1991 to 2015, WoS, PubMed data (by Uzbek scholars only)*

5.3. Centrality

The re-creation component demonstrated researchers' reaction to legislation changes in journal publication channels and the language barrier. To examine whether there is a geographical tendency as well as a research tendency, this section examines the centrality and isomorphism component of the analytical framework. Centrality shows the research production tends to gravitate to a particular geographically central institution.

Institutional network, collaboration competence, and autonomy were components that were also considered to demonstrate the embeddedness or diffusion of an institution in both national and in international networks (Vincent and Malbas, 2015; Sooryamoorthy, 2015).

5.3.1. Geographical centrality

First, geographical centralization demonstrated an interesting pattern centered in the capital of Tashkent. As implied by the results of Table 5.5, analyzing the geographical affiliation of research publications revealed that most of the publications originated in Tashkent. Figure 5.6 shows the number of articles in the selected years according to where the authors' corresponding address was located. Academies and research institutes are located all across Uzbekistan, but the most productive entities in research were all located in Tashkent (Fig 5.6). The academies and institutes who have their own nationally recognized journals include the Uzbekistan Academy of Science, likewise located in Tashkent (Appendix D). Analysis of the corresponding author addresses from WoS data indicate that Tashkent-affiliated authors accounted for over 60% of the research output of health research papers published between 1990 and 2015. Scholars in the Tashkent area were most productive during the early 2000s, publishing twice as much as other regions. Research production from other regions manifested when the research support was from international agencies such as the HIV/AIDS studies in Karalkalpakstan (Fig 5. 6).
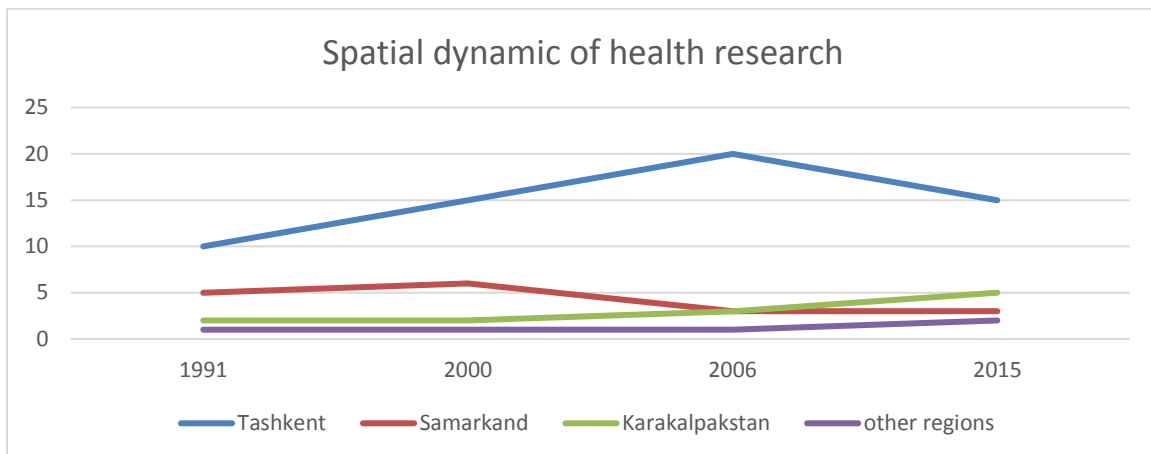
Figure 5.6 Spatial or geographic dynamic of publications from health research settings in Uzbekistan, 1991–2015[7]

5.3.2.   Thematic centrality

The assumption of thematic centrality starts with the premise that the scientific priorities of the USSR –specifically "basic medical sciences"--would exert strong presence in the post-independence health research production of Uzbekistan (COHRED, 2002). Therefore, as indicated above, the fields of biotechnology, immunology, virology, hematology and blood transfusion, endocrinology, psychiatry and narcology, gastroenterology and cardiac surgery are the strongest for both national and international collaborative research production (COHRED, 2002).

On an exploratory basis, two local journals were analyzed to examine whether the priorities of research established during the Soviet past have persisted in current research topics. The two local journals were *Journal of Dermatology (JD)* and *Medical Journal of Uzbekistan (MJU).* The analysis included the text analysis of the frequent word mentioned from the 208 articles from JD and 530 articles from MJU over the period of 2011 to 2015. As Hong et al., (2016) argue, the frequency of word occurrence in the literatures typically reflects the significance of the themes in the analyzed literature (Hong et al., 2016). The frequent word pattern of the local journal implied both path dependence and the effect of internationalization when new topics and methodologies start to appear (Tab 5.8-Tab 5.9). Due to the exploratory nature, the trend was not comprehensive enough to support the

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[7] Source: Web of Science and PubMed. See text for details. N = 321 publication records

argument of path dependence. Various topics emerged from the frequent word analysis of the articles from JD and MJU. The publications dealt with various topics with everything from infectious diseases to surgery topics (Tab 5.8-Tab 5.9, Fig 5.7-8). From Table 5.8, we see that the communicable diseases such as syphilis, herpes, and leishmaniosis were the most frequently studied topics over the 5 years of JD articles. From Table 5.9, we see that the frequency of use of particular words showed a more varied pattern ranging from maternal child health conditions to surgery complications.

Table 5.8 *Frequent terms from the included publications from 2011 to 2015, from Journal of Dermatology of Uzbekistan (article n=208)*

No	Term	Frequency	Diseases/health conditions topics	2015	2014	2013	2012	2011
1	Syphilis	65	Communicable diseases	31	9	9	0	16
2	Atopic dermatitis	48	Other	4	17	13	10	4
3	Acne	39	Other	4	0	3	3	29
4	Psoriasis	70	Other	24	4	14	5	23
5	Herpes simplex virus	61	Communicable diseases	13	0	3	25	20
6	Arthritis	22	Other	4	0	0	0	18
7	Alopecia	32	Other	9	0	5	3	15
8	Hypertrichosis	14	Other	0	0	0	0	14
9	Leishmaniosis	16	Communicable diseases	3	0	0	6	7
10	Hypercholesterolemia	2	Non-communicable	0	0	2	0	0
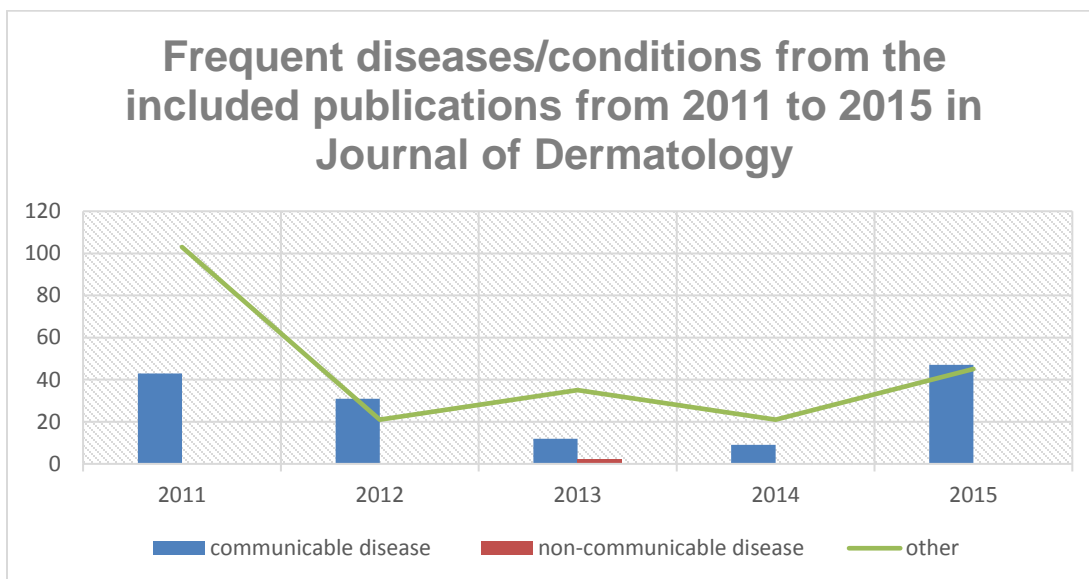
Figure 5.7 *Frequent terms from the included publications from 2011 to 2015 in Journal of Dermatology of Uzbekistan*

Table 5.9 *Frequent terms from the included publications from 2011 to 2015 in Medical Journal of Uzbekistan (articles n=530)*

No	Term	Frequency	Diseases/health conditions topics	2015	2014	2013	2012	2011
1	Cholecystitis	10	Other	0	0	0	10	0
2	Pregnancy complications	55	Maternal and reproductive health	14	21	7	13	0
3	Cardiovascular (ischemic heart disease)	39	Non-communicable	21	1	1	11	5
4	Perinatal hypoxia	13	Other	0	4	0	9	0
5	Giardiasis	10	Communicable diseases	0	0	0	10	0
7	Parasitic diseases	12	Communicable diseases	5	0	0	7	0
8	Inflammation	19	Other	1	0	2	14	2
9	Metabolic syndrome (including diabetes mellitus)	27	Non-communicable	4	8	15	0	0

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10	Surgery complications	32	Other	0	9	22	0	1
11	HIV/AIDS	12	Communicable diseases	1	9	0	0	2
12	Hepatitis c	7	Communicable diseases	1	6	0	0	0
13	Menopause	6	Other	0	5	0	0	1
14	Pulmonary disease	2	Communicable diseases	2	0	0	0	0
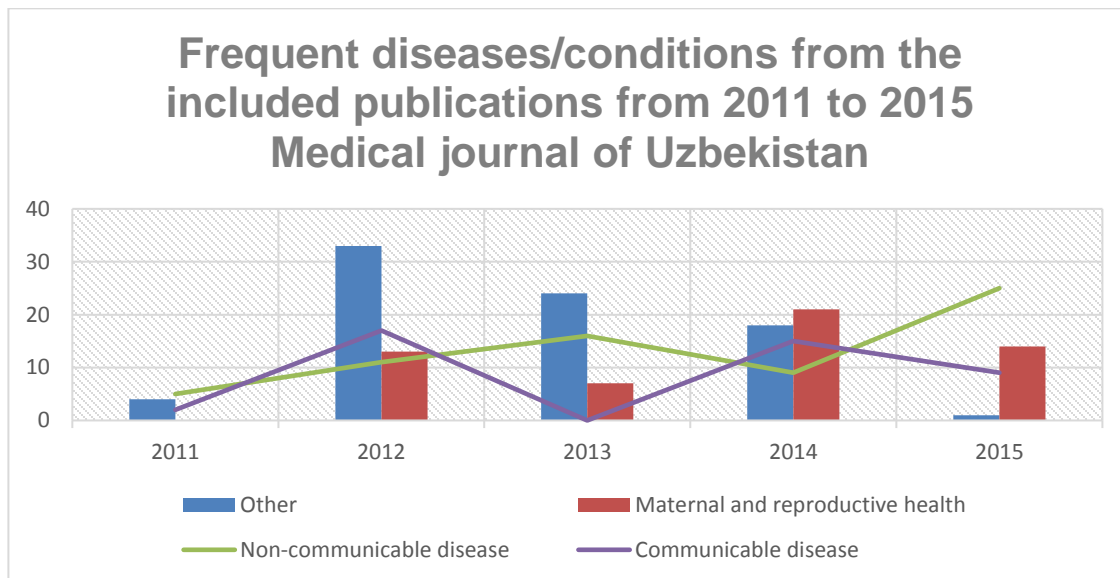
Figure 5.8 *Frequent diseases/terms from the included publications from 2011 to 2015, Medical Journal of Uzbekistan*

While the analysis of word frequency demonstrated the diverse issues researched by Uzbek researchers over a 5-year span of time, it did not give much evidence on path dependent publication practices nor any insight on internationalization. Therefore, following the argument of Vlassov (2000) on research practices within Russian health studies (Vlassov, 2000) local journals were analyzed to see which types of study designs were the most dominant among the research publications of Uzbek researchers.

Vlassov's study (2000) used bibliometric analysis of Russian medical journal, both indexed MEDLINE bibliography as well as the non-indexed local journals. The purpose of his study was to determine the frequency of use of advanced study design such as cohort, prospective, follow up, or longitudinal studies as well as clinical trials. In health science,

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the studies are ranked by their credibility and reliability of "evidence," based on the research types (Burns et al., 2011). The hierarchies of the studies depend on the potential of bias (Tab 5.10). Therefore, randomized control trials (RCT)s are given the highest rank due to their design that limits the risk of systematic errors and bias (Burns et al., 2011) (Tab 5.10).

Table 5.10. Levels of Evidence in health literature from (Burns et al., 2011)

Level	Type of evidence
I	High quality prospective cohort study with adequate power or systematic review of these studies
II	Lesser quality prospective cohort, retrospective cohort study, untreated controls from an RCT, or systematic review of these studies
III	Case-controlled study or systematic review of these studies
IV	Case series
V	Expert opinion; case report or clinical example; or evidence based on physiology, bench research, or "first principles"

Vlassov (2000) study of local Russian journals found that clinical trials and studies of longitudinal design were rare in USSR/Russian medical research (Vlassov, 2000). Vlassov's (2000) argument on the reason behind such a lack of studies with high-ranking evidence was that it was due to the costly study design of clinical trials as well as of longitudinal studies. His study also pointed out the archaic methods of epidemiology being taught as a science in Russia focused only on infectious disease while other countries have adopted a more "state of the art" approach to researching epidemiology (Vlassov, 2000). In Western countries, courses of epidemiology and biostatistics teach epidemiological conceptions, study design, and statistical analysis of the data. Vlassov's (2000) study also found that there were no schools of epidemiology course in Russia, and not one university has a department of clinical epidemiology and biostatistics such as is typically found in Western universities.

The local Uzbek medical journals' publications mirrored the above aspects (Tab 5.11). Based on the studies from both the *Journal of Dermatology* and the *Medical Journal of Uzbekistan*, there were no high-ranking evidence-based studies that used methods such as Meta-analysis, Systematic review, and Randomized control trials. The predominant studies were study designs of case series/case reports, and these consisted

of more than half (61%) of the total publications. Moreover, more than third of the studies (37%) were on animal research, which is basic research and considered as the lowest in the research/evidence hierarchy when it comes to evidence use in health care.

Table 5.11 *Study design[8] by year from Journal of Dermatology and Medical Journal of Uzbekistan 2011-2015 (n=738 articles)*

Types of study design	2015	2014	2013	2012	2011	Frequency	(%)
Meta analysis	-	-	-	-	-	-	
Systematic review	-	-	-	-	-	-	
Randomized control trial	-	-	-	-	-	-	
Cohort studies	5	2	1	-	-	8	**1%**
Case control studies	8	-	3	-	-	11	**1%**
Case series/case reports	112	90	86	72	88	448	**61%**
Animal research	55	65	49	39	63	271	**37%**
Total	**180**	**157**	**139**	**111**	**151**	**738**	**100%**

This result is similar to the arguments made by Vlassov (2000), in which he suggests that the absence of research such as clinical trials and cohort studies is due to lack of funding; such studies need long term and high investment. Therefore, researchers tend to produce descriptive and retrospective studies (Vlassov, 2000). The above results show a similar trend. Moreover, the search revealed misguided study designs as well as misinterpretation of statistical analyses from the local Uzbek journals. These aspects contribute to issues of lack of credibility and methodological fallacy in health research in Uzbekistan, conclusions that mirror Vlassov's (2000) study.

[8] http://guides.mclibrary.duke.edu/c.php?g=158201&p=1036068

5.4. Competence and autonomy

5.4.1. Institutional diffusion

Bibliometric studies have emphasized growth of in-country as well as international collaboration in a given time period. This type of analysis explores institutional collaboration and relevant discipline and knowledge dissemination. Therefore, this section analyses the publication patterns of institutions, collaboration patterns of authors by organization, as well as national and international collaboration patterns. First, this section examines the international collaboration trend in both overall science research production and specifically in the medical discipline research collaboration from SCIMago data (Fig 5.9a). From 1996 onward, medicine and international collaboration based publications increased increased over the years. The discipline of medicine shows a higher rate of collaboration rate; scholars maintained a rate of over 40% of research being co-authored with an international author but the nature of international collaboration patterns has fluctuated between a 40 and 90 % share of the total research output (Fig 5.9b). This could be due to political stability or to the lack of transparency in research collaboration, as other authors have argued there are difficulties in conducting research in Uzbekistan (Oberkircher, 2011; Ulikpan et al., 2014; Markowitz, 2016). Another explanation of this trend could be the brain-drain that former Soviet countries have experienced, with scholars going to Europe, America, and Russia, and as well as other systemic problems across the region (Karaulova et al., 2016b).

(a)   (b)
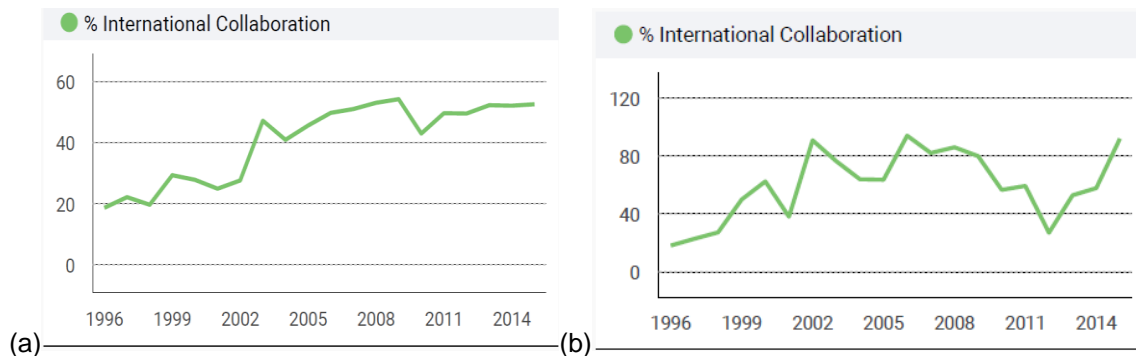
Figure 5.9 Overall international collaboration percentage in the Uzbekistan science system (a); *Medicine collaboration percentage pattern of Uzbekistan (b)* [9]

In-depth examination of the foreign corresponding author affiliations based on Web of Science data shows that the three countries/entities with the highest number of publications were from Japan, United States, and Medical Sans Frontier (MSF NGO). Japan's Nagoya Medical institution 3% (11/321) has collaborated mainly with the Institute of Immunology of the Academy of Sciences in Tashkent and Samarkand State Medical Institute. MSF has reported studies on Tuberculosis and MDR-TB with the Ministry of Health in Karakalpakstan and the MSF program implementation team in Uzbekistan. The Centers for Disease Control (CDC) of the United States has worked with the National Reference Laboratory of Uzbekistan and Samarkand State Medical Institute. The London School of Hygiene has collaborated mainly with the Tashkent Medical Academy, the Tashkent Institute of Postgraduate Medical Education, and the Tashkent Medical Pediatric Institute in Tashkent (Table 5.12). Research collaboration networks shows similar patterns to those of bilateral donor projects or foreign relations network

Table 5.12 *The top 12 leading international collaborating institutions for health research in Uzbekistan* [10] **1991-2015**

no	International collaborating institution (top of 12)	Location of institution	Number of papers by corresponding author affiliation	Percentage of articles	Any Uzbek author affiliation	Percentage of articles
1	Nagoya City University Graduate School of Medical Sciences	Japan	11	3.43%	11	3.43%
2	Centers for Disease Control and Prevention, Atlanta	United States	7	2.18%	6	1.87%

[9] source: http://scimagojr.com The SCImago Journal & Country Rank is a publicly available portal that includes the journals and country scientific indicators developed from the information contained in the Scopus® database (Elsevier B.V.). These indicators used were to assess and analyze scientific domains.
[10] Source: Web of Science and PubMed.

3	Médecins Sans Frontières	International NGO	7	2.18%	4	1.25%
4	London School of Hygiene and Tropical Medicine	United Kingdom	6	1.87%	5	1.56%
5	University of California, La Jolla, California	USA	5	1.56%	5	1.56%
6	WHO	Multilateral	5	1.56%	5	1.56%
7	Charité - Universitätsmedizin Berlin	Germany	4	1.25%	3	0.93%
8	Gynuity Health Projects, New York	United States	3	0.93%	3	0.93%
9	Korea-Uzbekistan Friendship Hospital of Korean Medicine, Wonkwang University	Korea	3	0.93%	2	0.62%
10	Project HOPE Tuberculosis Control Program for the Central Asia Region	International NGO	3	0.93%	2	0.62%
11	University of Texas, Austin, Texas	United States	3	0.93%	1	0.31%
12	US Naval Medical research Unit-3, Cairo	United States	3	0.93%	3	0.93%
Total			60	18.7%	50	15.6%

After the fall of the communist regime, international collaboration networks could have widened to other (scientifically stronger) countries. International co-authorship relations—especially with countries such as the USA— increases the visibility of one's research, thereby improving the citation impact (Karaulova et al., 2014). Based on the analysis, it can be seen that Uzbekistan's international collaboration took a different route compared to that of researchers from other post socialist countries like Eastern Europe or other Central Asian countries who mainly collaborate with Germany and the USA (Karaulova et al., 2014). Whereas the Uzbekistan health sector depended for some of its activities on donors from Japan, Korea, Europe, and the USA, Uzbekistan international collaboration in the health sector depended more on international donor partnership, and they have remained the largest collaborative partner throughout the post-Soviet period.

International collaboration in health research showed different priorities in health research topics compared to publications by Uzbek-only researchers (Tab 5.13). Based on the WoS data, the bibliometric results show that overall communicable disease were most researched (36%). This may be due to bilateral aid (or foreign aid) projects on topics relevant to HIV/AIDS, TB, and vaccine preventable diseases. This aspect is further shown as the research articles with international collaboration are higher (67 articles) than that of Uzbek- only authors (24 articles). Non-communicable disease studies were the second most research topic (28%). Uzbek authors have published more on non-communicable disease (52 articles total) compared to articles that show international collaboration and international-only authors (30 articles). Research on health systems numbered 39 publications, a relatively low number of publications compared to 290 publications on topics related to disease conditions. There were more studies on health systems topics in international collaboration research and by foreign-only authors (total of 27 articles) compared to Uzbek-only author publications (12 articles) (Tab 5.13).

Table 5.13 Research by subject area from 1991 to 2015 in Uzbekistan [11]

Subject Area (categorized based on research article topics) [12]	Uzbek single author studies	Uzbek multiple authors	Uzbek authorship total	International collaboration research	Foreign authors only	International authorship total
Communicable diseases	6	18	24	67	14	81
Non-communicable diseases	20	32	52	18	12	30
Maternal and reproductive health	2	2	4	10	8	18
Injuries (burn) and traumas	6	5	11	5		5

[11] Source: Web of Science and PubMed
[12] Some articles were counted more than once as they fell into multiple categories.

Occupational health, sanitation, hygiene, and environmental health	3	3	6	9	6	15
Other health problems (e.g. nutrition)	6	15	21	17	6	23
Health systems topics	6	6	12	16	11	27
Diseases/health conditions topics (total)	43	75	118	126	46	172

The scholarly contributions of Uzbek authors revealed the extent of collaboration and diffusion within the national network of the Uzbek health research system. Further analysis was done on research articles that were published by Uzbek-only authors to study the publication practice of Uzbek authors for research communication (Tables 5.14 and 15). The results indicate that about 92 % (118/127 articles) of the articles authored by Uzbek-only authors were published in journals with a minimal impact factor (less than one). Most Uzbek researchers published in journals published in Russia (45.5%). In total, there were 55 journals based on the 127 articles published by Uzbek authors. The 'educational establishment university/academy' was the most productive research organization of Uzbek-only authored publications (48 of 127 articles). This result is similar to the international collaboration pattern, as 'educational establishment university/academy' was the most productive entity. Educational entities also rank higher than other research-producing entities, as they have authored publications in journals with an impact factor above one or two while other entities have published in journal with much lower citation factors. What is interesting is that, while international collaboration showed high involvement of MOH affiliated authors, Uzbek-only authored publications showed MOH's minimal productivity (9 articles out of 127). Republican-specialized centers ranked second highest as research-producing entities (34 articles out of 127) (Table 5.14).

Table 5.14 Collaboration pattern, Authorship, and their Impact factor (Uzbek researchers) 1991-2015[13]

Study publication patterns	journal impact factor 0-1		journal impact factor 1-2		Total
	No	%	No	%	
Uzbek single author (total)	42	33%	3	2%	45
Specialized centers	5	4%			5
Research centers	3	2%			3
Research institutes	7	6%			7
Republican Specialized Scientific and Practical Medical Center	7	6%			7
Practical centers	1	1%			1
Educational establishment university/academy	12	9%	3	2%	15
Government MOH	7	6%			7
Uzbek multiple authors (total)	76	60%	6	5%	82
Specialized centers	10	8%			10
Research centers	3	2%			3
Research institutes	7	6%			7
Republican Specialized Scientific and Practical Medical Center	26	20%	1	1%	27
Educational establishment university/academy	28	22%	5	4%	33
Government MOH	2	2%	0		2
Total publications (Uzbek-only authors)					**127 articles**

As implied in Table 5.14 above, Uzbek authors have not been active in cross-institution collaboration within Uzbekistan, that is, research done between different institutes and research centers. Table 5.15 summarized this aspect, which shows research performance within a single organization (21%) or with same type of organization (17%). Only 7% of the studies were studies that involved various national organizations of different types (Table 5.15). Although not shown in this table, the publication citations showed that studies that involved various national organizations collaborating resulted in

[13] Source: Web of Science and PubMed 1991-2015

publications with higher impact factor journals compared to those collaborating within similar organizations. Most studies done by Uzbek authors lack institutional diffusion, meaning there is lack of collaboration among institutes within similar disciplines. Collaborative research tends to result in publications with higher citation factors and impact. Therefore, better communication channels are critical to share best research practices; otherwise, the value of research will be lost.

Table 5.15 *Institutional diffusion of the Uzbekistan research output (Publications as percentage of total publications by an organization)* [14]

		(%)
Single author	45	14%
Multiple authors		
Single organization only	69	21%
With organizations of the same type only	56	17%
With various national organizations only	23	7%
With foreign organizations	128	40%
Total	321	100%

5.5. Conclusion

The chapter identified structural characteristics of the Uzbekistan health research system that have shown significant impact on health research performance after its independence from the Soviet Union. Studies on health research systems in low- to middle-income countries system tend to focus on infrastructure, funding, and educational training that focus the components of capacity building and are important in understanding issues of the health research system of a nation. Using bibliometric analysis, the findings drew attention to factors that seldom discussed in the health research literature. Comparing historical and contextual information with bibliometric patterns was necessary to understand health research and health systems and local changes and conditions in Uzbekistan.

[14] Source: Web of Science and PubMed 1991-2015

5.5.1.　Research performance

Structural elements of the health research system, such as publishing practices and choices of communication, need further attention. Specialized institutes in Uzbekistan are structures of scientific research institutes from the Soviet past of the 1920s. The term "scientific-research institute" (*nauchno-issledovatel'skii institut*) had a stature and a meaning in the Soviet Union that it does not have in any Western country (Yegorov, 2009). Uzbekistan maintained most of the research organizational structures of the Soviet science era including the institute system, which separated teaching (universities) and research (specialized research institute) during the Soviet era. Currently, scientific research institutes in Uzbekistan deal with a specific set of diseases or topics, such as virology, epidemiology, or occupational hygiene. Universities and academies serve as educational hubs for future generations of doctors and nurses in health as well as research hubs for the fulfilment of Masters and Doctoral degrees. However, the low publication records from these specialized institutes imply that there is a need for a better research-producing structure as the past legacy and the purpose of specialized institutes do not seem to serve the current needs of research production. Analysis of the research-producing actors revealed educational entities (i.e. academies) as the highest research-producing entity compared to specialized institutes.

5.5.2.　Recreation

Uzbekistan government like many other low- to middle-income countries have reformed their health research in two broad directions: the reform of research-performing organizations, and the reform of the funding system. Legislation has reformed the higher education sector, mandating foreign language acquisition (e.g. English). Moreover, Uzbek post-graduate-level scholars are now required to publish in international peer-reviewed journals to qualify for graduation (Resolution of the Cabinet of Ministers of 18.08.2009 № 233; Resolution of the Cabinet of Ministers of 28.12.2012 № 365.[15]). The new policy reforms of the Uzbekistan science and health sectors need to consider caveats of existing established practices that would require long term planning. The

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[15]Source: "On measures to further stimulate the research of employees," Resolution of the Cabinet of Ministers of 28.12.2012 № 365; "On measures to further improve the system of post-graduate education and attestation of scientific and scientific-pedagogical personnel." www.lex.uz accessed on June 16, 2016

results of this research demonstrates the somewhat stagnant science management approaches of the Soviet past (Graham, 1975). There are systematic multi-level factors in the structure of the health research system that limit research performance as well as limiting the changes needed to take place as part of policy reform.

The implemented policies are well intended, but the consequences of such reform seem to have had little success in building a better-educated and better-trained cadre of researchers. Such high standards in fulfillment criteria push scholars to get anything published anywhere in a given time, making scholars more likely to approach spurious journals. The same issues have been raised recently in Kazakhstan, India, and Oman (Al-Adawi et al., 2016; Kana, 2016; Groves, 2016; Yessirkepov et al., 2016). As argued by Laruelle (2010), the lack of means and avenues to publish research as well as difficulties in accessing research information in Western languages due to poor library information systems (Laruelle, 2010; Johnson, 2013; Johnson, 2014b) has prevented the health research system of Uzbekistan from participating in contemporary ways of doing research. Most low- income country researchers are "doubly burdened" by already existing barriers from producing high quality research. These barriers are low research funding (at a national level), lack of internet access; language barriers; and low quality research methods and technology (Pager et al., 2012) on top of the pressure to "publish or perish" to meet international academic standards (Groves, 2016; Kana, 2016). More than 43% (140/321) of the publications in the health sector had Uzbek authors as corresponding authors, which implies great progress in the field. However, most of the publications were in low impact factor journals mainly published in Russia. Moreover, a growing trend demonstrated researchers publishing in journals whose peer review process was not clearly stated and that had less strict review process guidelines.

Another characteristic that is distinct in the Uzbek health research system is the governance of the research publication channel by the Higher Attestation Commission of Uzbekistan. The higher attestation commission guides the certification of scientific and scientific-pedagogical personnel matters. The commission sets guidelines and shows influence over the scope of published research areas. These guidelines set the direction of research publication by suggesting potential journals of publication for meeting the demands of scientific achievements along with ambiguous policies on what counts as peer

review and thus peer reviewed journal. Hence, each university and institution interprets the guidelines on ambiguous ground of what constitutes as a peer-reviewed journal and what is not. The observations and feedback from university and institute researchers backed up this observation, as most were unaware of what an impact factor is and what peer reviewed journal articles are in a given context. The commission suggests that publication in a local journal satisfies the requirement that doctoral candidates to publish scientific articles (Appendix D). Further examination of these show that 17% (5 out of 29 local journals) of editorial boards or founders of Uzbek journals belong to ministerial government body such as the Ministry of Health or the Ministry of Agriculture. This implies strong government presence and oversight of the content and context of research, which could mirror similar findings in Karaulova's study on the Russian nanotechnology research system where the content and quality of research was under the purview of the Russian Academy of Science (Karaulova et al., 2014). In 2015, the Uzbek Higher Attestation Commission established comprehensive guidelines regarding which journals are peer-reviewed journals, listing journals from Russia, CIS countries, Europe (mainly Germany, Italy, and the UK), USA, Japan, and Korea, but the standards and reasoning behind such choices of publication are unclear.

5.5.3.   Centrality

The geographic centrality of Uzbek health research showed the centralized governance of the research system in Uzbekistan. The centrality demonstrated that the majority of the research producers were located in the capital of the country. The centralized governance of research implies continuing government dominance, which influences research grants and research practice. On thematic centrality, the topics from the publications did not show strong patterns of path dependency. However, the antiquated approach to research, which dates back to the Soviet approach to science in research design and analysis in health, was prevalent in Uzbekistan local health research literature. Similar to Vlassov's 2000 study, there was limited advanced design of health research, such as clinical trials or systematic reviews (Vlassov, 2000). The most prevalent design was case reports. The statistical methods used in Uzbekistan's local medical journals were limited to simple retrospective/descriptive statistics. Additionally, these types of studies were the most prevalent choice of analysis, with a few exceptions of

studies using an advanced method of analysis such as regression analysis, which only starts to appear in the late 2013-2014 year journals. Even some of the interpretations of such statistical analysis or the interpretation of findings from these studies were not rigorous, implying misunderstanding in adopting international definitions of study designs and statistical analysis in health research.

5.5.4.   Competence and autonomy

Publication topics and patterns show the consequences of lack of research priority. For instance, the international collaboration in research projects focused on communicable disease compared to that of non-communicable disease. Uzbek-only authored publications reported more on non-communicable disease topics. One possible explanation of this is that there are fewer opportunities for international collaboration on non-communicable diseases as international funding projects tend to focus on health conditions related to Millennium Development Goals (MDG). Projects in Uzbekistan on which there is international collaboration tend to focus on MDG-relevant health conditions. Therefore, the research activity involving international research partners may have focused more on HIV/AIDS or TB as per the MDG agenda, as Dieleman et al., (2013) argue. His study showed that development assistance projects do not necessarily meet the recipient country's disease burden (Dieleman et al., 2013). The studies on health systems topics such as health policy are more pronounced in international collaborative research or research authored by only foreign authors. One explanation of this is that social science aspects of health research has not gained popularity among Uzbek scholars. For instance, the public health school itself established in the country in 2004 [16]. Integrating the social science aspect of public health in health research is still a relatively new concept in post-Soviet medical academies. At the international level, various development projects have taken place that have directly or indirectly affected health research in Uzbekistan. For example, the UNICEF projects have enhanced the data collection process for assessing health status of households (World Health Organization Regional Office for Europe, 2014). The UNDP held a series of workshops in 2011 that offered statistical training for health professionals (World Health Organization Regional

[16]Source: www.lex.uz Uzbekistan decree No. 99 from March 3, 2004 accessed on May 13, 2016

Office for Europe, 2014). Likewise, several EU projects have been launched in Uzbekistan to improve library information systems and electronic communications (Johnson, 2014b; Johnson, 2013).

For the past two decades, the lack of priority given to the health sector, the Uzbek science system's lack of international collaboration, along with a focus on restructuring the economy of Uzbekistan after the collapse of the Soviet Union have together left the Uzbek health research system in institutional stasis. In the ever-changing globalizing research of the health sector, it seems that Uzbekistan has lost the opportunity to follow the trend in international publishing opportunities. As seen from the publication trends documented earlier, two fifths of all research publications appear in Russian language-based journals as well as the local journals that have not been part of the reputable web of science publication list. Additionally, as seen from review of local journals, Uzbek authors tend to publish in their own institutes' journals and other publications. The results shows the distinct path dependent publication patterns that constrain interdisciplinary and international institutional collaboration. The current science system of Uzbekistan limits or hinders access to prestigious international and indeed nudges many researchers to publish in more local but less rigorous journals. The research shows that researchers in Uzbekistan have limited interaction with the health research system beyond their own (and Russia's) borders, most notably with peer-reviewed publications and other international collaborators. In terms of institutional strengthening, the Uzbek science system should engage more with collaborative networks and through research collaboration. The national research system and the health research system would do well to work collaboratively for better diffusion of best practices and to improve standards of research s. Internationalization of research is critical for Uzbekistan, as for the greater part of the 1990s to early 2000s it has been isolated from the international research arena.

5.5.5. Limitations

As shown from the results, most of the authors from Uzbekistan communicate their research findings in Russian or in Uzbek. Consequently, even though the SCIMago, WoS, and PubMed language settings include Russian language, not all articles may have been included as none of the above databases comprehensively indexes the Russian journal

database. Furthermore, there are many studies published in local Uzbek medical journals in which Uzbek authors publish. However, these non-indexed journals are non-existent in any international database. For example, the only Uzbek journal indexed in WoS is one in chemistry. Consequently, the number of Uzbek authors and coauthors may be underestimated in this thesis. Moreover, incorrect reporting of authors' nationality and affiliations manifested in a few papers in the present study as well as Uzbek authors affiliated with international academies and institutes. This may further contribute to the underestimation of Uzbek-authored publications. Although the citation index journal impact factor (JIF) was used to compare the impact of research published by Uzbek authors, JIF has its own limitations. By definition, the Impact Factor (IF) counts the citations within Thomas Reuter's JCR database. Thus, not all the articles searched in this study had impact factors that were included, further underestimating the impact of publications by Uzbek authors not included within the indexed database (Hong and Gasparyan, 2015). Besides, the IF of a journal is independent of factors such as peer review, as it calculates the average number of citations to articles published in journals within 2 years. Despite such anomalies, IF is still widely used as a reflection of research work being widely communicated based on indicator status. The purpose of this chapter was to examine and identify the research production and research practice in Uzbekistan. The next chapter delve further into the institutional dynamics and limitations of reform and research practice in the Uzbekistan setting.

Chapter 6.   Mapping the capacity of health research systems: focus on recreation and competence

The previous chapter examined health research performance, with a specific focus on the type of research undertaken, and the (institute)'s productivity, credibility, and legitimacy. Examining outputs and performance, re-creation (more specifically path dependence), centrality/isomorphism, and collaboration and diffusion of the health research system demonstrated path dependent traits of institutional change within the health research system of Uzbekistan. However, it did not adequately explain research funding, human resources, and the innovation component of the health research system within organizations.

This chapter examines in depth the research organizations and their activities by taking a closer look at researchers' research practices. Analyzing the institutional assessment within the health research organizations in Uzbekistan this chapter traces their historical contexts and their past institutional arrangements. Such analysis reveals how the Soviet legacy has shaped the current research practice and developments of today. The following section of this chapter will introduce the research organizations chosen for the case study. Then through a qualitative approach, the "recreation and competence" component of the analytical framework will be explained. Along with interviews and insights from practicing researchers, this chapter will supplement the findings taken from respondents' responses with documentary evidences.

6.1. Organizational characteristics of health research in Uzbekistan

In the sixty-six years of Communist rule, health research in Uzbekistan took place within the threefold structure inherited from the Soviet science system. These consist of the Higher Education sector (HE) that mainly functions to provide education to develop

cadres of health professionals; the Uzbek Academy of Science (UAS)[17] that is responsible for basic research[18]; and the government-supported research institutes and specialized centers where more applied research is undertaken In this context, governmental research institutes and specialized centers relate to research institutes and specialized centers under the Ministry of Health, and these mainly deal with applied research[19]and clinical research.[20]

A total of 33 specialized research institutes, educational academies, and specialized centers report conducting scientific research under the Ministry of Health (Appendix 3). The Republican center is a national level treatment center and serves as a research unit for specific disciplines. Based on this classification, there are seven institutes in the category of "research institutes" of Uzbekistan. They are the Institute of Health and Medical Statistics (IHMS), the Research Institute of Virology (RIV), the Scientific Research Institute of Hematology and Blood Transfusion (SRIHBT), the Research Institute of Sanitation, Hygiene and Occupational Diseases (RISHOD). The Research Institute of Traumatology and Orthopedics (RITO), the specialized Research Institute of Epidemiology, Microbiology, and Infectious Diseases (RIEMID), and the Research Institute of Medical Parasitology (RIMP) are also within the category of "research institutes". Except for IHMS, the rest of the institutes have a clinical and scientific department in which organizations treat patients, and thus the institutions act as tertiary medical healthcare facilities as well as having a scientific department that does academic research according to their specialty.

Table 6.1 listed the cases examined for this thesis. The categorization of these organizations was based on the categorization of the Ministry of Health in Uzbekistan as well as assessment reports on the health research system of Uzbekistan(COHRED, 2002; Ahmedov et al., 2007). Further details in Appendix C describes all organizations' characteristics including the human resources, types of departments, and number of

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[17] Formerly the Russian Academy of Science (RAS).
[18] Research conducted to increase the base knowledge and understanding of the physical, chemical, and functional mechanisms of life processes and disease. It is basic research, and is not directed toward solving any particular biomedical problem in humans or animals.
[19] Research that is directed towards specific objectives, such as the development of a new drug, therapy, or surgical procedure.
[20] Using the knowledge gained in basic and applied research to conduct research (generally with humans) in treating disease or dysfunction in a new way.

research outputs of each organization. An overview (Table 6.1) highlights some of the characteristics of these organizations with the number of interviewees from each organization and their respective codes. Except for RISHOD (which was the partner organization of the capacity-building project), the research organizations were chosen through a snowballing technique, based on their interview willingness, and information given in a semi-structured questionnaire (Table 6.1).

Table 6.1 Overview of case study research organizations in Uzbekistan[21]

	Name	Date of founding	Type of Institution	Research Focus 1	Research Focus 2	Interviewee/observations	Interviewee code
A	Tashkent Medical Academy (TMA)	1920	University	Various Disciplines under Medicine	Mixed - basic and practical	Management (faculty at rector level) Professor (Senior Faculty)	A1 A2
	TMA School of Public Health	2005	University	Public Health	Practical	Professor (Senior Faculty)	A3
B	Tashkent Institute of Postgraduate Medical Education (TIPME)	1932	Post Medical Training (Education)	Disciplines under Medicine	Mixed – basic and practical	Professor (Faculty)	B1
C	Specialized Research Institute for Sanitation, Hygiene, Occupational Health (S-RISHOD)	1934	Specialized Research Institute	Sanitation, Hygiene, and Occupational Health	Mixed – basic and practical	Research team manager (3) Research team members (3)	C1-C3 C4-C6

D	Specialized Research Institute of Virology (S-RIV)	1978	Specialized Research Institute	Virology	Basic	Research team manager	D1
E	Specialized Research Institute for Parasitology (S-RIP)	1923	Specialized Research Institute	Parasitology	Basic	Research team manager	E1

As seen from the Table 6.1, most of the institutes (except for the school of public health) originated in the 1930s and 1940s, that is, in the Soviet era. Scientific research institutes deal with specific set of diseases or topics such as virology, epidemiology, or occupational hygiene. These are disease specific institutions geared to understanding the epidemiology of the diseases and its medical characteristics. RISHOD (hereinafter referred to as Organization C) for instance, started during the Soviet era in line with the Decree of the Council of People's Commissars of UzUSSR № 685 as of 16 June 1934. According to the Ministry of Health, the structure of the scientific part of this Institute consists of 12 specialized laboratories; the clinic consists of a hospital of 100 beds with its own laboratories and pharmacy. The total number of personnel was at the time reported to be 231 members[22] of whom 45 are research staff and 33 are medical personnel. The institute also has seven Doctors of Medicine, 21 Ph.Ds. and 24 medical doctors who have achieved the highest category of training according to the local medical education system. The remainder of the 108 staff work in research units or the clinic in management or support functions. The main scientific research activity of this Institute focuses on aspects of hygiene, such as communal hygiene; hygiene of labor and occupational diseases; hygiene and the toxicology of pesticides and mineral fertilizers; hygiene of children and adolescent; and nutritional hygiene.

The Research Institute of Virology (hereinafter referred to as Organization D) was established on December 27, 1978 as a branch of the Institute of Virology of the USSR Academy of Sciences. On March 11, 1994 through Decree №134 of the Cabinet of Ministers of the Republic of Uzbekistan, it became an independent scientific research

institute of virology under the Ministry of Health. The focus of the Institute is on implementing scientific methods and coordination of research in the field of virology and giving assistance to the population of highly specialized medical care for diagnosis, treatment, and prevention of viral infections.

The Research Institute of Medical Parasitology LM Isaev[23] (hereafter referred to as organization E) is the oldest scientific institution in the country, and in 2016 celebrated its 93rd year of foundation. Founded in 1923 in Bukhara[24], the institute deals mainly with the diagnosis and study of parasitical diseases.

Tashkent Medical Academy (hereafter Organization A) originated in 1920 under the name Institute of Medicine of Central Asia, a higher education institution for general practitioners and dentists. In 1935, Tashkent Medical Institute separated from the medical institute of sanitation, pediatrics, and dentistry. However, based on Resolution 178 of the Cabinet of Ministers of the Republic of Uzbekistan dated July 29, 2005, both facilities combined again and renamed itself as Tashkent Medical Academy. The integration of this academy was an outcome of health system reform in Uzbekistan as of 1999. This reform introduced general practitioner and higher nursing education to medical education, which meant combining with the First Tashkent State Medical Institute, the Second Tashkent State Medical Institute[25]. The academy serve as educational hubs for future generations of doctors and nurses in health as well as for research through Masters and Doctoral degrees. Their research work thus links to educational degrees and to a lesser extent to the research endeavor itself. There are more than 3,250 students, as well as Masters Students of more than 34 specialties. Based on the Ministry of Health report, there are 803 faculty members including 2 academicians, 97 professors, 183 docents, 357 lecturers, 176 doctors of sciences, and 396 Ph.Ds.[26]. TMA public health school, established in 2005, is a relatively new establishment compared to other academies and institutions in Uzbekistan. World Bank supported the school's establishment in cooperation with the

[23] The institute is named after the renowned physician
[24] According to the decree of the Presidium of the Council of People's Nazirs Bukhara Peoples' Soviet Republic
25 This reform also resulted in establishing regional Urgent Care branch of the First Tashkent State Medical Institute, and a Fergana branch of the Second Tashkent State Medical Institute medical faculty
26 according to the 2011 official reports of MOH www.minzdrav.uz accessed on April 25, 2016

University of Kentucky-School of Public Health. TMA public health school has three major divisions: clinical epidemiology, higher education in nursing, and health care management and economics[27].

TIPME (hereafter organization B) was established by Decree of the Presidium of the Central Asian Council (number 459, June 22 1932), and its activities extend to all the Central Asian Soviet republics. This secondary specialized educational institute offers re-training (similar to in-service training) for health professionals who have graduated. The institute has four main departments with its corresponding programs (preventive health and training of GPs, therapeutic, surgical, and pediatric departments). The institute hosts joint training programs with other research institutes and research centers under the aegis of the ministry of health (e.g. the Research Institute of Hematology and Blood Transfusion, dermatology and venereology, pediatrics, tuberculosis and pulmonology, and traumatology and orthopedics, the V. Vahidov Scientific Center of Surgery[28]). The Institute also oversees doctoral and master's theses in the specialty areas of neurology, psychiatry, and necrology.

6.2. Features within the health research system of Uzbekistan

Uzbekistan's research management structure is characterized as centralized and hierarchical (COHRED, 2002; World Health Organization Regional Office for Europe, 2014). This type of management and organizational structure can be traced back to past Soviet research management styles. The following arguments made by Soviet history scholars explain the difference between the Western science management style and the structure of Soviet science management (Graham, 1975; Mezentseva and Rimachevskaya, 1990; Graham, 1992; Rabkin and Mirskaya, 1993; Geltzer, 2012). Rabkin et al., (1993) and Graham's 1975 and 1992 studies on the history of Soviet science present insight into distinct characteristics of research management and organizational structure. Some of its characteristics are still present in the structure of the Uzbek health

research and science management, namely the public sector management of research and organizational structure, such as scientific research institutions, academies, and republican (state/national) centers (Graham, 1975, 1992; Rabkin and Mirskaya, 1993).

Graham (1975, 1992) argued that in the 1920s, the Soviet Union (SU) government stance towards research had an objective to eliminate private capital from science. This entailed eliminating or diminishing all private, philanthropic influence from science to maintain government control and leave the funding and infrastructure provision responsibility within the government (Graham, 1975, 1992). This helped the government to have authority and power over the Academy of Sciences of the SU. Most of the research entities outside of the Academy of Sciences were in the end nationalized. Therefore public sector nationalized research producers and the academy of science held much authority in terms of building and developing research (Graham, 1992).

In addition to the above, there was another distinct organizational structure of Soviet science that Uzbekistan inherited– one that separated teaching (conducted in universities) and research (conducted in specialized research institutes). During the 1920s, the structure of having scientific research institutes was quite rare and the term "scientific research institute" (*nauchno-issledovatel'skii institut*) had a stature and evoked a sense of pride and respect in the SU that it does not have in any Western country (Yegorov, 2009). Almost all outstanding scientists and engineers in the SU were members of an institute or had connections with one. Graham argues that the reasoning behind separation was a political attempt to find an administrative model that fit the purpose of the state exerting centralized control over research while yet striving for innovation in science (Graham, 1992).

However, in a highly centralized planning system, there was little need for research commodification nor intellectual property protection. The state exerted control over almost all R&D results and their utilization (Rabkin and Mirskaya, 1993). The planning system could not react satisfactorily to new challenges and could not redistribute resources effectively to new areas of science and technology (Kassel and Campbell, 1980). As a result, the SU started to lag behind in some key and fast-growing disciplines, such as electronics and biotechnology, while its position in mathematics, physics, and new

materials remained relatively strong up to the late 1980s and even the beginning of the 1990s. Moreover, the system of regulation of scientific activities and the corresponding rewards were quite different from those that existed in Western countries (Graham, 1992). All this left Soviet scientists largely unprepared for the fundamental changes in the economic and social spheres that took place in the early 1990s (Yegorov, 2009).

Moreover a political approach was taken to control the unorthodox political ideas of researchers (that at the time were deemed distrustful) in separate research institutes and to prevent the scientists from teaching at universities(Graham, 1992). The universities would be under the control of the Academy of Sciences, where the spirit of socialism prevailed and instructors of the university were monitored. This centralized control of planning spread into most sectors, from industrial technology to basic sciences. The execution of such centralized planning was a criticism of and counterpoint to what was deemed to be "wasteful" competition in the Western decentralized science system, whereas the funding system of Soviet science was guaranteed and achievements would be made available to all the associated research institutes through the centralized research institute. However, such a centralized system hampered industrial research by bureaucracies and distanced research and industry (Graham, 1992; Rabkin and Mirskaya, 1993). Such distancing of industries and research institutes made a lasting impact on innovation in the sciences. Only a small percentage of Soviet research scientists and engineers have been employed directly in industry (Graham, 1992; Rabkin and Mirskaya, 1993). Even as late as 1982, only three percent of Soviet researchers with the degree of *kandidat* (roughly equivalent to the American Ph.D.) were employed by industrial plants (Graham, 1992; Rabkin and Mirskaya, 1993). This organizational structure from the 1930s lasted and remained constant until the end of the Soviet Union in 1991 despite numerous subsequent reforms (Graham, 1975, 1992).

So how are these past structures relevant to the health research system in Uzbekistan? As previously mentioned, the governance structure of research in Uzbekistan varied little from the structure of Soviet Union science management. Even though the health research system was not fully developed at the time of independence, there were structures and human resources already in place that were inherited and then carried forward after independence (COHRED, 2002). Many of the organizations maintain a

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hierarchical structure with functions that overlap with universities and other tertiary treatment facilities. The centralized control of human resources and the concentration of research personnel in the academy and at the research institutes during the Soviet era persists in the current Uzbek science system. The overall research governance is highly centralized, with the Ministry of Health having a great deal of authority as a supervisory agency, partly due to already established institutional set ups and partly to maintain state legitimacy.

As seen from the historical overview of some of the key establishments in the health research system of Uzbekistan (Table 6.2), the institutional structure remains active. For instance, the oldest existing research institutes date back to the 1920s and the first scientific journal is still actively publishing medical research and currently is under the purview of the Ministry of Health (Tab 6.2). In addition, Uzbekistan followed the pattern of Soviet science management in which government was the major player in research and education supervision. Thus, no distinct business enterprises and private non-profit actors set up research and development units since independence in 1991. The maintenance of the former research system in central Asian context has also been discussed with regard to the agricultural research system, where strict state control and conservatism in management structure were also observed (Morgounov and Zuidema, 2001)

Table 6.2 Historical overview of the health research organizations in Uzbekistan

Historical overview	Entity
Date (decade) of establishment of first research institute (s)	1923 LMIsaev Research Institute of Medical Parasitology
Date of establishment of first medical academy	1920 Tashkent Medical Academy (then Institute of Medicine of Central Asia)
Date (and name) of first scientific journal	1922 Uzbekistan Medical Journal
Date of establishment of academic of science and/or first professional association	1992 Uzbekistan Medical Association[29]
Date of first science policy and health research related policy documents	1990 (after independence)

[29] http://www.avuz.uz/about.html accessed on April 3, 2016

6.2.1. Gradual adjustment to new realities: Learning, Innovation, and institutional agency

It has been argued that the institutional framework within research systems allows creation of dynamic capabilities through a network of all actors promoting knowledge and learning (UNESCO, 2015b). Recently OECD has also portrayed higher education institutions (HEIs) and public research organizations (PROs) as central actors in research development (OECD, 2016). While the higher education system in developed countries was responsive to globalization and economic changes, developing countries have been slow to respond (Varghese, 2013). Even within these slow reforms, some of the policies adopted by developing countries, such as countries within Africa, have led to deterioration of infrastructure and academic standards, and this has negatively impacted their quality of teaching and research (Varghese, 2013). Uzbekistan in this case is no exception to this debate. Uzbekistan has gradually introduced changes in the higher education sector, the research and development sector, as well as changes in research communication and practice to promote scientific rigor, competence, and international recognition. The field observations as well as interviews with case study organizations revealed various aspects of struggles that have limited or advanced the researchers and students of these entities. All of the issues addressed in this section were inevitably linked with past Soviet legacies, demonstrating how past institutional structures have limited researchers in adjusting to new societal demands. The following section will outline the common issues that emerged from these case study organizations.

Educational reform: For better or for worse?

The past practices of Soviet education have not been encouraging. Slow progress in changing curricula, lack of modern technologies, and top-down institutional structures have affected higher education in post-Soviet republics (Heyneman, 2010). The case study organizations have shown signs of top-down management. Several central ministries oversee the academies and universities' activities. For instance, in current Uzbekistan, the Ministry of Higher Education administers 32 universities and institutes that offer a variety of programs including economics, engineering, finance, languages, oriental studies, architecture, chemistry, and technology. Of these, the Ministry of Health administers seven institutes for medical and pharmaceutical training.

The accreditation of post higher education degrees that was relevant during Soviet times consists of five-year degree courses, and *aspirantura* (first post-graduate education level, equivalent to Ph.D. programs) and *doktorantura* (highest-level post-graduate program, equivalent to *habilitation* that exists in a number of countries) programs. Slow progress was observed switching from the Soviet system of education system to that of the Bologna system, which officially commenced in 2012 (e.g. accreditation of postgraduate degrees) (Ruziev and Burkhanov, 2016). Albeit slow in its implementation, these changes were beneficial and necessary for Uzbek students and potential scholars in order to adapt to international standards.

> We adapted to the Bologna education system in 2012.[30].This has reduced the number of years it takes to get the doctorate degree as PhD compared to the Soviet system. Of course, it would depend on the person but I think it reduced the number of years of getting the doctorate. I think the Bologna system is a necessary reform, especially along with the reforms for instruction of education (e.g. English language). Before there was no standard or mandate on what the doctors should know before they graduate. They also did not have any way of or exposure to learning about international journal articles or publications on research work. It may be difficult at first, but having a mandate for foreign language will definitely bring improvement for future generations of doctors and researchers … For doctoral candidates they choose their own topic. The higher attestation committee confirms whether such a topic has been written about or not and approves the topic for a thesis" (Interview with A2 Sep 10, 2015)

To meet the demands of the market economy, the government has taken other measures. For example, Uzbekistan has reformed its educational sector, such as by changing the language of instruction from Russian to Uzbek or giving priority to acquiring English rather than Russian as a foreign language, or changing the Uzbek (Cyrillic) alphabet to a Roman alphabet. Despite these legal reforms, the public sector continues to control the higher education sector (Turturica, 2007; Matthews, 2012). While changes in degree accreditation was a sign towards the right direction, several reforms in language requirements have created barriers for researchers in the health sector. Before independence, Russian was the only official language for education and official correspondence (Platonova and Semyonov, 2014). Russian was considered to be the

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30 Based on official legislation, the reform took place in 2013, but pilot reform programs began earlier in 2012.

most commonly used language, although Uzbek remained widely used even after independence (Johnson, 2013). However, there have been various language reforms since independence. For example, in 1989, a language law made Uzbek the official state language although Russian was widely predominant in communication (Johnson, 2014b). Then in 1995, the revision of law revoked the special status given to Russian. According to Wei and Kolko's study (2005), most school children have no proficiency in Russian (Wei and Kolko, 2005). Even the script used has changed over time from Arabic in 1917 to Russian Cyrillic in the Soviet era to the Roman alphabet in 1997 (Myhill, 1997; Wei and Kolko, 2005; Johnson, 2014b). Further reforms occurred in the higher education sector to improve the scientific personnel's practices by encouraging them to publish research articles in international journals along with passing foreign language requirements such as English (Resolution of the Cabinet of Ministers of 18.08.2009 № 233[31]). Because of such language requirements, researchers from most of the organizations in the case studies were struggling to adapt to the above changes.

> This is my second time that I failed the English language test. I also have to pay a fine to retake the test again. English is difficult to fulfill on top of other requirements (Interview with C2 Aug 20th, 2015.)

Based on the field observations and encounters with the Uzbek Masters students in case study organizations A and D, the capability of students to communicate in English was better in universities than among students in specialized research institutes. The education reform in this sense has effectively pushed the younger generation to adapt to international standards.

Research discipline: Following past trajectories or strengthening specialization?

Radosevic and Yoruk (2014) argue, "the former-USSR region has not gained new major areas of comparative advantage and remains, at [an] aggregate level, specialized in fundamental and applied sciences and de-specialized in life and social sciences" (Radosevic and Yoruk, 2014), p 1912). This also applies to the current Uzbekistan health

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[31] "Source: www.lex.uz On measures to further stimulate the research of employees," Resolution of the Cabinet of Ministers of 28.12.2012 № 365, "On measures to further improve the system of post-graduate education and attestation of scientific and scientific-pedagogical personnel." Accessed on Aug 16, 2016

research sector as it remains focused on specialized fundamental sciences but lacks strength in application of health (Radosevic and Yoruk, 2014). This suggests that scientific specializations are historically rooted and highly path dependent even in regions that have undergone major changes in terms of economic regime and openness of their science system.

As seen from Chapter 5, the majority of the research outputs focused on basic sciences rather than on application-based health research. Organization D, whose institute mainly deals with occupational health and hygiene. The interviews from the research scientists from Organization C revealed that the hygiene and occupational disease studies dealt more with basic science aspects of occupational health, which involved pesticides, toxicology, and chemical studies with animal testing such as mice.

> I work on hygiene and toxicology in pesticides laboratory. Our laboratory reviews whether such pesticides are safe or not. The Ministry of Health reviews our work and gives approval for such pesticides (Interviewee with C 4 Aug 3, 2015).

The specialization of research institutes from the Soviet period had advantages in recruiting specialists and promoting the specialties to their highest possible levels. However, this also created research silos, isolated researchers according to certain practices and contexts in research development. For instance, detection and diagnosis of the disease field improved Uzbekistan's surveillance sector but it narrowed the scope and maneuver for different approaches to researching diseases. Practicing the ways of research already established by the previous generations do not invite new ways of research and management, as pointed out by a researcher from Organization C.

> I do not think the level of research or the capacity within our department is as competent (on an international level). We cannot learn or be innovative as much in Uzbekistan compared to overseas. At least I would like us to be at the same level as Moscow. The level of experiments we are using now is the same approach that has been used with mice since 1945. I have read that there are ways to learn new techniques using only cells and a non-invasive approach on animals to test the same toxicity of experiments. I would prefer to go to Russia (to learn) (Interview with C3 Aug 3, 2015).

Furthermore, this type of preference and way of business has created path dependency to research agenda setting and funding priorities. Convergence of research skills and priority perhaps comes from the conformism created by the scientists who received their degrees in the Soviet Union. The networks of Soviet Union graduates enjoyed authority over other USSR regions (COHRED, 2002; Y.M. Komarov and V.E. Tcherniavskii, 2006). Therefore an Uzbek scientist from the Academy of Science or a specialized institute network had much control over the development of scientific medical research (including resources, types of information, and award of scientific degrees) in Uzbekistan, and this hindered scientific innovation and skill building (COHRED, 2002).

> From 1986-1990 the development of scientific medical research in Uzbekistan was determined by the scientists sitting at the top of a "science pyramid" in Moscow and by the basic levers of management – the distribution of resources, including information, and the award of scientific degrees. It was enough that the scientist belonged to this or that hierarchy and was obliged to show loyalty to it. It created conditions that interfered with the blossoming of alternative approaches and frequently resulted in stagnation in science, reduced creative potential and innovative research, interfered with the interests of practical health care, and put a brake on the development of scientific research appropriate for the health needs of the population of the region. It all served to magnify scientific conformism (COHRED, 2002), p3)

The context and characteristic of Soviet influence over science and its influences on the present generation of researchers in Uzbekistan is perhaps best illustrated by the case of the former RISHOD director, Tulkin Iskandarovich Iskandarov[32]. Based on the documentary evidence[33], he graduated from the department of hygiene and sanitation of Tashkent Medical Institute in 1962 and defended his thesis in the topic related to hygiene laboratory pesticides and toxicology (1967-1972) in Moscow. From 1989 to 1995, Tulkin Iskandarovich served as Director of Research at the Sanitation Institute of Hygiene and Occupational Diseases (RISHOD), a part of the Ministry of Health of the Republic of Uzbekistan. His direction and focus on dealing with problems of environmental health and human ecology, in particular, hygiene, air, and protection of water sources from various contaminants, hygiene, and toxicology of pesticides and other important areas of sanitary science is still effective within RISHOD. While the documentary data revealed an example

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[32] based on 2014 Uzbek Medical Journal vol 2 accessed on Feb 2nd, 2016
[33] based on 2014 Uzbek Medical Journal vol 2 accessed on Feb 2nd, 2016

of one director with much influence, in the field, it showed Iskandarov's networks and influences within RISHOD had more prestige and infrastructure compared to that of other departments. According to information divulged by other interviewees in other departments, the toxicology of pesticides department has a national grant project with more active researchers than other departments.

Another aspect of the specialization in research discipline is the persistence of thinking about a specific disciplinary approach with less room for interdisciplinarity. Although researchers from organizations A, B, D, E, and F had grants and studies in the field of epidemiology, most of them were accustomed to considering research in terms of single disease rather than a more comprehensive approach when such approach was asked for. It was therefore not surprising that attempts to explain an integrated research approach to the researchers of these organizations were encountered difficulties. Researchers' own interpretation of their research approach mirrored the specialization of the organization (such as virology and parasitology) and was hard to detach from the practices of the discipline as a whole.

> If it is new and involves various research institutes from different sectors (or even within the same sector) to do interdisciplinary research I think it is a difficult challenge for us. (Informal interview with Organization B Oct 17, 2015)

As seen from chapter 5, involving various partners for holistic approaches to health research is more likely to improve research output, as it will typically lead to discussions of new perspectives to a research problem and identify new priorities that differ from existing practices and priorities. Despite these benefits, difficulties in integration and collaborative approach in science mirrors back to the past practices. During the Soviet era, there was a heavy emphasis on basic sciences (such as chemistry, geosciences, mathematics, and physics). USSR Academy of Sciences performed basic sciences with projects in the fields of biotechnology, immunology, virology, hematology and blood transfusion, endocrinology, psychiatry and narcology, gastroenterology, and cardiac surgery. Medical science in the Uzbekistan thus developed in two ways. A significant portion was done as basic research, and a part of the work was applied research (COHRED, 2002). So, for example, if Uzbekistan health research topic priorities were in the basic sciences, such as immunology or surgery skills, it was more likely that there

would be significant financial and educational research support in that area of research. Radosevic and Yoruk (2014) did a regional comparison of world science through bibliometric analysis revealed that Central Eastern Europe (CEE) and the former USSR (including Uzbekistan) (Radosevic and Yoruk, 2014). Radosevic and Yoruk (2014) argued that former USSR countries were excessively specialized in the basic sciences during the Communist period. Whereas the CEE reduced its specialization in the basic sciences after independence, the former USSR continued with its excessive specialization. The findings of Radosevic and Yoruk's study suggest that former USSR countries uniquely performed below the world average[34] in all areas of science in terms of absolute increase in the number of papers, showing a strong case of "falling behind." (Radosevic and Yoruk, 2014)

The governance structure and managerial power in Uzbekistan lies with the central government or Cabinet of Ministers, and the execution of that power relieves heavily on the Ministry of Health and more specifically the Scientific Medical Council of the Ministry.

> The Ministry of Health decides on the research priorities and subjects. For example, based on a parasitology-disease prevalence report and the Sanitary Epidemiology Services prevalence report, if the information on parasitical disease seems to be insufficient, Ministry of Health would make it a priority for us to research such diseases (Email response from E1 Aug 27, 2015)

Observations from the field revealed that each research organization even if they have the same area of research, collaboration among different entities seemed to be impossible. This was because to the researchers, collaborative projects would not create new incentives, just more administrative hurdles. Even if such collaboration succeeded, it was unlikely that it would change the power dynamic of the hierarchical management system of health research (field observation notes from Nov 15, 2015). Therefore, it seemed that for most research organizations, the application to do research became perfunctory and the priorities given by the ministry of health did not necessarily meet the demands of the population. In summary, the cost of trying innovative management alternatives were observed to be too high to change the existing practices of planning, funding, coordinating, and evaluating research management. Individuals and

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[34] Compared to North America, the EU, Central and Eastern Europe (CEE), Latin America, the Asia, Pacific, and the Middle East.

organizations' management conservatism seemed to have a pervasive influence, hampering the attempts to implement the new management approach to impact research efficiency.

Research communication: Hindrance to learning new approaches?

Back in the Soviet era, it was reported that separation of the academy (universities), educational institutes (specialized research institutes), and industry (as well as between industries) split the scientific community into different groups, each strictly regulated but with weak communication (Kuzminov et al., 2013). Analysis of science and innovation during Soviet times revealed the structure of the Soviet R&D sector to be dominated within the public sector and "exceptionally inflexible and unable to respond to new demands of society and science itself" (Schneider, 1994), p67). Academic research communications, such as journals, conferences, and Soviet publishing practices had their limitations. In the iron curtain era, there were limitations to access foreign literature—books, journals, and other writings (Vlassov, 2000). Moreover, language limitations, such as being unable to understand English, was a major obstacle in being able to read the findings of international research(Vlassov, 2000).

The Soviet past of management also seriously hampered research communication especially on the library management. The past control of information dissemination played a major role in limiting the progress of research communication as publishing, printing, and financing along with the language and the contents of the publications (Myhill, 1997; Johnson, 2014b). During the soviet times, publisher served the needs of a particular Ministry or the research institutions which were supervised under the Ministry (Myhill, 1997)[35].

Johnson's study argues that the underlying causes for such lack of communication need further exploration as research and publications by Uzbek authors do not appear in substantial quantities in high quality English language journals(Johnson, 2014b). Johnson's study shows that a significant concern is that a high proportion of citations of papers by Uzbek scientists are self-citations by the authors, suggesting that their work has

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[35] Appendix D shows that the publishers of local medical journals are either educational entities or research institutes under the aegis of the Ministry of Health or the Ministry itself.

made little impact on their peers within the country, let alone internationally, and that their limited international research collaboration is partly to blame (Johnson, 2014b). There is little progress in raising international awareness of health research outputs in Uzbekistan such as by creating online document repositories or providing indexes and abstracts in major international languages to promote exchange among research communities (Johnson, 2013; Johnson, 2014b). Such findings show negative impacts among researchers from the organizations studied, as they reveal lack of research quality, unfamiliarity with international research trends, and inexperience with communicating their findings abroad.

> I believe there should be better criteria for science to enhance the quality of articles published in our local journals. The doctors in other specialties, such as pediatrics and surgery, among others, are not well equipped with the necessary skills when it comes to data analysis and research writing. Unfortunately, our researchers are not even aware of the concept of absolute and relative risk when it comes to discussing medical cases such as a basic understanding of epidemiology requires (Interview with A3, Nov 25, 2015).

> I sent my research work to a German toxicology-related journal but it was rejected; they said they were not interested in the topic. It is hard to publish in international journals (due to language difficulties). (Interview with C4, Aug 3, 2015)"

> I would like to know what type of immunology and toxicology studies are done in other countries, especially on pesticides, and how [other countries] they prevent pollution from the pesticides (Interview with C6, 2015).

This further applies to Russia or post-Soviet countries that have a long history of Russian-speaking epidemiologists and health researchers who in turn contribute to the professional literature in Russian (Baussano et al., 2008; Vlassov and Danishevskiy, 2008). Therefore, for Uzbek researchers contributing to their country's journal may risk isolation. Moreover, researchers seem to use the opportunities that arise when there is an international conference in Uzbekistan to share information. The reason behind this may be that it is difficult for Uzbek experts to go overseas to attend such events. The bureaucratic procedures of acquiring and paying for visas and getting approval to leave

the country for a conference may also make it difficult for researchers to present their work overseas (Informal conversations with C2, Aug 3, 2015).

For these reasons, the most commonly used source of information for researchers were websites of Russian institutes with a similar function and structure,[36] and international journals mainly from Ukraine and Russia (Field observations, June 27, 2015). These sources support Uzbek researchers to stay up to date on research methods on their topics of interest. Additionally, local journals act as a main channel of research communication. There are some concerns over these phenomena. If scientific information circulates from Ukraine, Russian, and other Slavic language journals, many of those who read them miss much of the advanced and up-to-date research issues and methods already published in English. This issue has been raised in Baussano et al.'s (2008) study that compares the German, French, and Italian public health epidemiology journals (Baussano et al., 2008). Baussano et al., (2008) argue that there is a dichotomy of international English language research journals and local native language journals for scientific communication in the era of globalization, and that this creates a dilemma for local language journals that have a much more restricted circulation among a local readership.

Bibliometric analysis of health research outputs of local and international journals demonstrated such changes in language (chapter 5.2.1). The analysis revealed a growing trend for articles in the local journal to be in Uzbek and English rather than Russian after 1991. The restricted research communication environment also influenced research outputs. Research outputs from 1991 to 2015 revealed that research about Uzbekistan health published in international journals in the English language were from researchers based in the USA, Russia, and the EU.

In other aspects of research communication, research utilization shows a hierarchical knowledge flow between ministries and relevant government agencies. Most of the research results and communication pathways remain in the public sector. For instance, specialized research organizations' grant projects are obligated to be reported to the respective ministries, and every quarter there is (booklet) "methodological

[36] For instance, a researcher from RISHOD mentioned Nizhny Novgorod Research Institute of Hygiene and Occupational Pathology (http://nniigp.ru/) of Russia as a main source of information for updated research information.

guideline." (Informal conversations D1, Sep 17, 2015). All (national) grant research projects' results should produce methodological recommendations as well as communicate them through local journals. Further steps include sharing results with Sanitary Epidemiological Services. For instance, in Organization F, the methodological recommendations were in a book format after the research project completed (Based on email response from Organization F) (Fig 6.1). All of the respondents have mentioned academic conferences and various governmental ministries as their main communication channels. All the respondents however made no mention of the communications of the research findings to the community or the population. Therefore, they implied that there were limited opportunities to inform the population at large of relevant health issues.
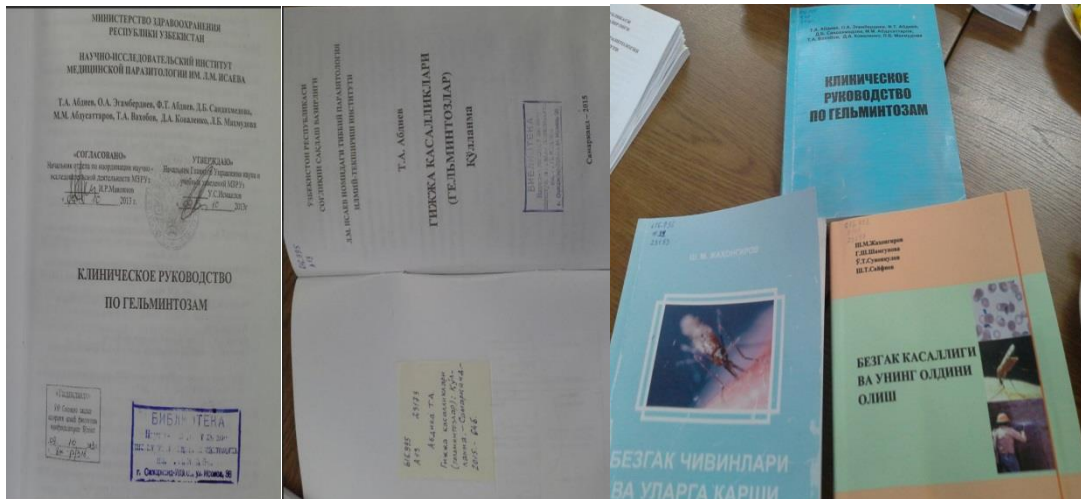
Figure 6.1 Methodological Recommendations from Organization F

6.2.2. Research finances and infrastructure

Research funding and economic incentives are critical components to examine when it comes to the health research system. The necessary infrastructure to conduct research as well as the environment for competitiveness enables a more diverse research environment. Before independence, Uzbekistan's research funding came directly from the Soviet Union (mainly Moscow), depending on the Uzbek branches of the USSR's specialized centers of science (COHRED, 2002). Basic research infrastructure was also dependent on central specialized research centers of the USSR (COHRED, 2002). This centralized management style of Soviet science created a dependency and lack of opportunities for Uzbek scholars to seek out independent funding opportunities.

Currently in Uzbekistan, the main funding for the research institutes in the health sector comes from the government. To overcome the managerial bureaucracy and to enhance the competitiveness and competencies of researchers in Uzbekistan, the national grant system initiated in 2006. The Committee on Science and Technology Development (Coordination Committee), based within the central government (Cabinet of Ministers), organized the grant system. This committee coordinates research, including health research, funded through the central government. The competition for grants announces annually and the guidelines are available at the National Academy of Sciences.[37] The themes for 2016,[38] for example, were the practical and the innovative research. Health research goes under the category of "Innovative: Medicine and Pharmacology." However, the specifics of topics under this criteria are unclear and the selection process needs to be more transparent, as pointed out by a UNESCO assessment (UNESCO, 2015b).

All the case study organizations reported that they have applied for the grants or are participating in national grant projects. The researcher depending on department's own topic and specialty chooses research topics (interviewees A2, B1, and C2):

> Every department within the university chooses their own topic depending on their specialty. Ideally the topic should be what is most urgent[ly needed] in Uzbekistan and worldwide, if applicable. There are two types of grants: the national grant and the international grant. Not all research is from the state grant. Usually around 10 departments (within organization A) obtain grants by the national scientific state committee; the other departments (around 50) are without national grants or funds. (Interview with A2, Nov 25, 2015)

Despite the liberty to choose a particular topic during the interviews, the evidence from the National Academy of Sciences on grant research topics revealed that the topics funded were heavily weighted towards basic science. The grant projects approved from research organizations D and E between 2012 and 2014 are such examples (Table 6.3). The projects of these organizations are clinically oriented, with a heavy emphasis on diagnosis and detection. One explanation of such a trend is that during the Soviet era, the

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[37] Based on national academy of science grant portal website : http://fan-portal.uz/Contests/ accessed on June 10, 2016
[38] Described in Appendix E

activity of these centers' specialty was with the topic of epidemiological studies on the population, elaboration of mechanisms for early diagnosis, and the use of new methods of treatment and rehabilitation. The current research mandate states that the past research practices and priorities remain the norm.

Table 6.3 Research grants made during the period from 2011 to 2015[39]

Research organization	Type of Research Grant received
Research Institute of Virology	FDSS 12-11 "Identification of significant mutations in the genome of the virus and the patient, determining the efficacy of therapy for HIV infection and chronic hepatitis C," Rukovoditel Grant, Professor EI Musabaev
	ATCC 21.1 "Identifying the factors affecting the level of viral load as an indicator of disease progression and treatment efficacy in patients with HIV infection and treatment optimization" Rukovoditel grant Ph.D. Baizhanov AK
	ATCC 21.2 "The development of new approaches to forecasting, prevention, and treatment of chronic viral hepatitis transition to cirrhosis of the liver on the basis of identification of gene polymorphism IL28V and serum markers of liver fibrosis." Rukovoditel Grant MD Abdukadyrova MA
	ATCC 21.3 "The development of new approaches to the diagnosis and treatment of viral diarrhea in children based on molecular genetic technologies." Rukovoditel Grant MD Asilova MU
	ATCC 21.4 "Ecology of pathogens West Nile fever and hantavirus infections, and their clinical and epidemiological features in Uzbekistan." Rukovoditel Grant MD Mustafayev HM
Research Institute of Parasitology	2009-2011 Leishmaniosis Malaria Helminthiasis
	2011-2014 Malaria Helminthiasis
	2015

| | Echinococcosis: Namangan area prevalence study |
| | Skin Leishmaniosis Kashkadarya prevalence study |

The rigidity of the grant system indicates the lack of diversity in the research and the prevalence of barriers to applying new approaches in research. According to the World Bank report on higher education evaluation, Uzbekistan currently has a state-centered quality assurance system that resembles the early Soviet system. The State Educational Standards, developed and approved by the Ministry of Higher and Secondary Specialized Education (MHSSE) sets standards and requirements for bachelor's and post graduate programs but also for each specific professional education field (World Bank, 2014). This includes the structure, content, and implementation of curricula(World Bank, 2014). Consequently, higher educational institutions such as Organization A have limited flexibility in curriculum management and may introduce only a 5 percent change in the standard curriculum. The inflexibility of this system makes no condition for optional subjects. Interviewee from Organization A shares the adverse side of such management:

> The grant (application) is based on already established departments and research subjects (or approaches) in that department. If I apply for a grant in medicine but propose using methodological approaches from oriental medicine, I will not get the grant. I have already tried and I did not get it. This is because there are not many experts in this field who can properly evaluate a proposal in this area. However, in order to have such experts, you need the educational departments to train them and get the knowledge circulated. We do not have an oriental medicine department within TMA. There are students who are interested and want to learn both medical and oriental medicine, but that is impossible. To have a subject established we have to get it approved by the Ministry of Education and the Ministry of Health. If I teach the course without such approval, it is illegal. This not only affects the teaching curriculum but also affects applying for grants. No department leads to no grant, no grant leads to no department, no department leads to no education, and no education leads to no students (future experts): it is a vicious circle (Interview with A2 Sep 10, 2015).

Moreover, it was evident that administrative bureaucracy rather than the research itself bogged down the researchers of the grant projects (Observation field notes, 12 July 2015). The interviewees had to create quarterly reports of their activities during the funding period along with budget reports. Moreover, the finances of the grant focused more on infrastructure and labor costs rather than research activity itself. These grant projects could have succeeded in creating an independent competing environment of research

grants but in fact have become ways to pay for the salaries and infrastructure for research (COHRED, 2002; Ahmedov et al., 2007).

> In my case, the distribution of grant projects are as follows: labor costs (around 42 percent); expenses for the purchase of equipment, machinery, and other fixed capital assets (about 29 percent); the rest on employer contributions and office expenses. The grant projects usually last one year, but can sometimes last two. (Informal conversation with B1, Aug 27, 2015).

As Uzbekistan is in the transition period from being a controlled economy to becoming a market economy, the minimal guarantee of salaries and payment structure have kept the scientific entities functioning only modestly. Average pay for science workers in Uzbekistan is far less than that in developed countries. As seen on the table, the salary structure is not high; the director at professor level receives 768,825 Soum (less than 300 USD) per month (Appendix F, based on the official 2009 exchange rate). However, there are no appropriate incentive measures for developments in science. Only after independence, Uzbek scientists had right to patents, as any scientific results and inventions immediately became common property, that is, property of the state before the independence(COHRED, 2002; Ahmedov et al., 2007). It was reported that measures have been taken to allow medical research institutes to introduce incentives for the staff and to direct the development of scientific activity in a practical way (Ahmedov et al., 2007; Rechel et al., 2014), although how much of this will be effective in this situation remains to be seen.

Rejuvenation –human resources

Recent analysis by UNESCO showed that in Uzbekistan more than 78% of the researchers (in all disciplines) work in academia, a rate that is higher than in other Central Asian countries (UNESCO, 2015b). The argument from the UNESCO report views the high employment in higher education as problematic because this translates as less diversity in research management and research output. Moreover, higher education sector in Uzbekistan is public and state governed which means that there is heavy reliance on salary and funding support from the government sector in order to maintain its researchers. Based on field notes, eight of the interviewees had worked over 30 years in their profession. Moreover, the departments were lacking in young professionals to the

respective departments. The human resources vacuum could be a problem in maintaining a stable scientific workforce for future generations of health researchers in Uzbekistan (Based on field observation notes June 23, Aug 3, and Oct 22, 2015).

The reforms in legislation and policy for the current structure of the Uzbek health research system have not been very progressive compared to other sectors, where merging of research institutes or closing down research institutes that essentially duplicate functions has taken place, especially in the fields of physics and agriculture (UNESCO, 2015b). Even in other Central Asian countries there has been a decrease in research institutes, while Uzbekistan has retained the same number of research institutes it inherited, and has been able to increase the number of research institutes in some other sectors (UNESCO, 2015b). There is an initiative to merge the overlapping functions of research institutes with tertiary clinics to reduce bureaucracies and increase efficiency as medical centers (Ahmedov et al., 2007; World Health Organization Regional Office for Europe, 2014). Though such a change has been stated as being in progress, for the past 25 years no significant and radical changes have taken place compared to other countries' initiatives for reforming their health research system (World Health Organization Regional Office for Europe, 2014).

6.2.3. Conservative management in research: traits of path dependence?

Analyzing responses from actors allows one to understand the challenges and pre-conceived notions and values that stem from pre-existing institutional arrangements and practices. There were two distinctive reactions observed from the field. First was political self-correctness, which leads to resistance to change. Second was a persistent political undertone in decision-making. The case study research organizations revealed that compared to the previous research culture, individual researchers in this new culture face a new set of challenges, as administrative reporting and a punitive culture prevents the progress of research capacity in terms of transparency and open collaboration. This section therefore explores this concern, using published data from the Soviet era health sector and observations from the field.

Research culture (i.e. Control of research - political self-awareness)

Evidence suggests that in the health sector, the punitive research culture dates back to the Soviet period. As one example, the document records about the anti-plague movement during Soviet times reveal the political correctness of science reports and the type of punitive culture that existed in the USSR era:

> "From 1966 to 1969, the Uzbek MOH did everything in its power to keep me from informing Moscow of some cases of cholera in Tashkent and other areas, something I was required to do," plague specialist A.I. Dyatlov recalls. "They called me in to the Council of Ministers, pleaded with me, and then threatened me. The issue went all the way to Sh.R. Rashidov [the First Secretary of the Uzbek SSR], to whom I spoke by telephone from some minister's office, where I was admonishingly told that this was our internal affair. I agreed, but the information was sent to Moscow immediately anyway." … It did not matter that these "specialists" knew absolutely nothing about the plague; at least they were obedient. The desire to "look good" was still alive and well among the Uzbek leadership 20 years later. (redacted) (Mahoney and Toppin, 2013), p 218)

> Domaradsky's study in 1968… (Redacted) reported that his team discovered that Y. pestis cells contain plasmids several months before this discovery was announced in the West, but he was forbidden to publish his results. In addition, whereas the Anti-Pandemic system published some information on vaccines in the open literature, studies that dealt with the development of new vaccines were classified (Mahoney and Toppin, 2013), p38-39).

As these examples from the published articles' records show, despite new diagnosis methods and disease management strategies, scientists were restricted in communicating their findings due to the oppressive or secretive culture that existed during the Soviet science era. Therefore, important discoveries or valuable new methodologies for disease detection remained unknown to the international scientific community. In addition, these illustrations that one scientist's discoveries preceded the same findings in the West, but he was not allowed to publish his results. As Mahoney and Toppin (2013) argues there are many other classified important discoveries by Soviet scientists. Such fabrication or self-censoring practices have continued even after independence, thus hindering the sharing of research results and research communication (Mahoney and Toppin, 2013).

Examining to what extent the above premise has affected current practice is a difficult task. However, based on the responses from the researchers from case study research organizations, the responses generated varying degrees of complexity in their research practice. The complexity in this context implies the persistence of a cautious culture of the Soviet past clashing with current standards and approaches of international cooperation for the advancement of science. For instance, based on the responses of researchers from organizations D, E, and F, the responses showed a clear distinction in the reluctance to accept new research approaches. For instance, during the implementation of the HEALTHCAP project there was a discussion on adopting a new research approach for data collection (e.g. using mobile phones for data collection). Researchers from organization D showed a clear penchant for resistance when new approaches to research methods were in discussion to implement a project.

> This (mobile phone data collection) is too new and against our society. We will get in trouble (from the Ministry). (From informal discussions with C6 July 12, 2015).

Such comments were the general sentiment, and in several cases interviewees directly expressed concerns about the Ministry's disapproval if they were to apply such a new approach, concern that implied resistance to change (Field observation notes on organization D on July 22, 2015). Moreover, even during the field research, interviews with researchers at organization C were under the supervision of another researcher from organization C, who recorded every detail of the interview to report to relevant directors and ministries.

On the other hand, some educational entities, such as Organizations A, B, and C, were more open to adopting change due to their frequent exposure to international collaboration research projects and donor projects. Yet in some instances, awareness of authority was the norm. For instance, when co-authored publication was under discussion with one of the high-ranking researchers/professors in Organization A, the faculty carefully advised that the materials need approval from the ministry of security. The respondent mentioned one could submit one's name in an international journal with international collaborators only after approval. Even though the ministry of security would make no changes to the data or the research content, the researcher mentioned that such reporting

was mandatory as per administrative procedure (informal discussion with A1 Nov 21, 2015). Another example comes from observations made during the course training exchange at organization A where a student was obliged to report to the rector (or vice rector) of the academy about what had been taught and what ideas exchanged each day (field observation notes on organization A Aug 12, 2015). This cognitive awareness of not wanting to raise questions, of needing to seek additional approval from the ministry, and of daily reporting of the day's activities mirrored the past Soviet control of knowledge. Such self-censorship and bureaucratic processes hinder the progress of research development. The historical memories of "the desire to look good" and "self-censure" as practiced during the Soviet past reiterate the lack of transparency and researchers' unwillingness to attempt new ways of thinking.

Past approaches to health research management vested power and responsibility in the hands of ministerial organizations in the health sector. Such pre-existing power relations and a tendency to use power to defend one's interests is a form of political path dependency (Gómez, 2011). As seen from the field, this aspect was prevalent in everyday practices by the maintenance of specialized topics of research within the specialized institutes and facilities. This has influenced the choice of organization for hierarchical leadership of research organizations as well as treatment facilities in Uzbekistan. Such a style of management forces the researchers and managers to follow the bureaucratic procedures of reporting and conducting research. For example, local researchers have a hard time taking any initiative without the approval from ministries, thereby imposing the non-written rule of approval regulations. Likewise, the bureaucratic hurdles to getting a research project approved takes a long time. Any research projects (even projects with international partners) that lack ministerial approval arouse suspicion and lead to a reluctance to cooperate. Therefore, innovative research or horizontal sectoral collaboration or cross-departmental collaboration within the same institute is difficult to attempt as "everything needs to be approved by the ministry of health" and discussions could not be "detached from bureaucracy" (interview with A2 from organization A, Sep 27 2015).

The political awareness of the difficulties of conducting research in Uzbekistan is neither a new phenomenon nor unique to the health sector in Uzbekistan. Challenges in

research have been reported in field research among the agricultural sector of Uzbekistan (Wall, 2006; Wall and Mollinga, 2008b). Wall and Mollinga (2008) argue that political correctness in responses to research and resistance to sharing data were evident as was the authoritative role of the ministry of security in research reporting. Taking initiatives in research collaboration or new approaches that are not common in the Uzbekistan health sector seem inherently difficult to deal with without necessary approval. What's more, these difficulties contributed to or reinforced the legacy of centralized management.

The impact of this political siege is more apparent in national statistics and census. Uzbekistan ranks as one of the top countries not to have created a common and open census of their population data since 1976 (Chandy and Zhang, 2015). The World Bank indicates that on statistical data capacity[40], Uzbekistan scored 48.9 in 2016 consistently dropping since 2005 (score 59.6) and ranks lower compared to average of Europe and Central Asian region (77.8 in 2016) (World Bank, 2016). The only available data in regards to health is that funded by collaborative international projects such as UNICEF[41] and WHO[42]. One interpretation of this fact is that transparency in health data may open up to public scrutiny and criticism the country's negative health issues. Because this could be used as a political tool for dissent, there is a tendency to keep such data hidden or unreported (McKee et al., 2012; Johnson, 2014a).

Is the research culture hampering improvement in research ethics?

The National Ethical Committee of Uzbekistan (NECU) was setup in 2000 under the Ministry of Healthcare of the Republic of Uzbekistan (Chaschin et al., 2008; World Health Organization Regional Office for Europe, 2014). The ethical review process was created in accordance with WHO recommendations and included leading scientists of the Republic of Uzbekistan (Mukhamedova, 2015). The bioethics committee focuses on human rights, security, and social moral values as well as ensuring ethical practices in

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[40] Statistical Capacity Indicator (SCI) Country Dashboards provide individual country scores for the overall SCI average as well as for the 3 categories, i.e. Methodology, Source Data, and Periodicity. For comparison reasons, the dashboards furthermore provide respective average scores for IDA/IBRD countries as well as the regional scores. Source: http://datatopics.worldbank.org/statisticalcapacity/SCIdashboard.aspx accessed on June 10, 2016

[41] UNICEF Multiple Indicator Cluster Surveys http://mics.unicef.org/surveys Uzbekistan is available for 2000 and 2006

[42] WHO Uzbekistan data http://www.euro.who.int/en/countries/uzbekistan/data-and-statistics

research, medical practice, and disclosure of medical information and bioethical concerns in Uzbekistan. The bioethics committee strives to nurture a national, enlightened medical society that, without copying it, is nonetheless modeled on best overseas practices (Chaschin et al., 2008). The study of bioethics in Uzbekistan began in 1998 when it was included in the philosophy curriculum in the humanities and social sciences department as part of the bachelor's degree curriculum at the first Tashkent State Medical Institute (currently Tashkent Medical Academy) (I. Kubar and L. Mikirtichian, 2010). A bioethics course for the master's degree began in 2000, offering individual topics. The Doctors Training Department (DTD) set out at the first Tashkent State Medical Institute (currently Tashkent Medical Academy) in 2003, and from 2004, bioethics course launched as an elective course(I. Kubar and L. Mikirtichian, 2010).

The course for the master's degree was prepared in both Uzbek and Russian to address the philosophical issues of biology and medicine (I. Kubar and L. Mikirtichian, 2010). Whether the desired outcome of such training and courses has taken place in practice is questionable. Mukhamedova's review states that various efforts took place to assess students' current understanding of bioethics through surveying them and reviewing their dissertations. Her review, however, does not reveal detailed results of these findings. Nonetheless, her study does highlight that the majority of healthcare personnel, including authorities of health institutions, are not aware of basic bioethical principles and patients' rights (Mukhamedova, 2015).

Such an ethical caveat also plays a major role in research integrity. Ethical review needs a strong system of accountability and a long-term vision for it to become researchers' everyday practice. However, during Soviet times delivering results in a timely way took precedence over research quality and ethics. In short, there was pressure to finish the project on time or deal with the necessary bureaucratic procedure to seek special approval for a research extension and additional financing (COHRED, 2002). Moreover, due to the authoritative management style of science, some research work showed questionable co-authorships, specifically ones considered to be plagiarism (COHRED, 2002). Undoubtedly, in the past there was a widespread lack of awareness about norms in research ethics. Despite government efforts, whether or not and how to follow widely accepted research ethics still remains a dilemma among researchers in Uzbekistan. Such

issues were noticeable during an informal interview with one of the grant project researchers:

> I worked on a project run by the State Committee for the Advancement of Science. [Much about how a project is run] depends on the project manager and the Commission of the State Committee…[S]adly, most of the reports were not based on actual research but were plagiarized to write reports (without much work on research program or research devices). I personally saw two reports of two different projects carried out in xxx, the content of which is a replica of several online articles (in which the "Republic of Belarus" was replaced with "Republic of Uzbekistan," and stuff like that). So most of the money wasted… [There] is a lot of plagiarism (Informal conversation with researcher from the field[43]).

Most of the interviews with research respondents made no mention of research ethics. A review of the most recent doctoral thesis and local journal articles also failed to reveal whether studies that involved actual human patients went through ethical clearance procedure or not[44]. Ethical review of research is obligatory for pharmaceutical drugs and clinical trial. According to the latest legislation,[45] Ministry of Health should review ethical standards of research. Yet, it does not yet seem to be applied to the practices of individual researchers. This may be a challenge in the future: to make research ethics a common practice for all institutes and academies conducting health research. Since the 2013 reform of the Ph.D. degree, as students are now required to publish in journals that are peer reviewed, it is going to be more difficult to overcome this standard if the current practices do not take into account or assume such ethical reviews. Already, bibliometric analysis shows an increasing trend among Uzbek authors of writing to spurious journals, and this practice is more common in the central Asian context (Yessirkepov et al., 2015).

[43] Asked for anonymity of organization and status.
[44] Based on review of local journals in Tashkent Medical library
[45] 05/01/2016 Legislation no 186 on medicines and pharmaceutical activity.

6.3. Conclusion

An institutional perspective on the recreation and competence components of the health research system

This chapter examined the various issues that are emerging in current research organizations of Uzbekistan. Based on the narratives of the researchers and academics in practice, the various issues surfaced by the different path dependent traits. The gradual, albeit, slow progress in any institutional change in the health sector shows path dependent traits dating back to more than 60 years of Soviet science management. Besides the organizational structure, the funding mechanisms, post- graduate education, and research communication also showed varying aspects of path dependencies. Governance of the health research system has improved with the revision of research system legislations. The establishment of the national ethics committee regulates the conduct of research and of the National Sciences Research Committee ensures technical and ethical rigor of research protocols and proposals. These reforms were attempts to follow the global norms of research practice. These changes, however, launched without much consideration of existing research practices, research accountability, the limited funding environment, quality, or efficiency with universities and research institutes. The pervasive research culture remains one in which there is a lack of willingness to be transparent, including regarding research collaboration, and this is detrimental to advancing science to the next level.

Although the above issues fit well with the path dependent traits of Soviet science, some overlaps need to be further explored. The institutional logic and the responses from the actors ultimately touch upon the issue of power and political undertones. As pointed out by the interviewee from organization B, "Researchers are not familiar with the social science way of thinking about public health research, and within research management they tend to do what they are comfortable with (Interview with A3, Nov 25, 2015)." The desire to defend existing interests within their research organization or entity reinforced such way of researchers' decisions. Based on the empirical data, when path dependencies exist, the tendency to reinforce resistance to change follows. For example, when there was a discussion about using a smart phone for data collection for the survey,

both aspects of path dependencies were evident: the existing institutional resistance of the hierarchical management of the Ministry of Health, and the resistance to trying something new (not wanting to go through the bureaucratic hurdle). However, the resistance to trying new approaches to research was subtle among the younger generation of students, who have less power or authority over the field. By contrast, individuals or organizations that hold power over certain sectors of health research and of the health care sector were reluctant to engage in new initiatives for research management. This arises not just because of their perceptions and preconceptions about health research approaches but also because of the maintaining existing interests. The new process may result in new priorities that diverge from one's existing plans and interests, therefore, the cognitive and political motives reinforce each other.

Naturally, one may argue that resistance to change or reluctance to support something new or different may not be a negative sign or be simply a matter of protecting one's interest. For instance, in the case of decision makers, the reluctance to change may be an indication of critical reflection or comment by the healthcare leadership, which translates into careful consideration before commitment to any change (Palmer et al., 2009). Therefore, further exploration is necessary to understand different levels of institutional logics and different perspectives of actors involved in the research system, such as that of the decision makers, to understand the issues emerging within the health research system. In line with this logic, the next chapter deals with the decision-making processes within the health research system of Uzbekistan. It will further delineate the idiosyncrasies that were observable in the field on the role of research, and the limitations that the current research management structure offers to meet the demands of the decision makers who are involved in a national policies and planning agenda.

Chapter 7.   Health research system governance

7.1. Introduction

The previous chapters have demonstrated the research production of Uzbekistan, which accounts for 320 articles on various kinds of health research as indexed by PubMed and Web of Science from 1991 to 2015. There has been a growth in the number of publications but stronger political will and efforts are necessary to enhance research productivity in the country. The empirical findings also have demonstrated that while the research environment, the organizational structure, the funding mechanisms, postgraduate education, and research communication were all progressing, they were struggling to meet the demands of the society. While examining the research production and the research environment within the health research system sheds light on the research capacity and its practice, it gives little insight into the details of the policy making process. Literature on the national health research system suggests that it has four functions: governance, developing and sustaining resources, financing, and producing and using research for health (IJsselmuiden and Matlin, 2006; Kirigia et al., 2015a). The national health research system in Central Asia set out recommendations that Uzbekistan develop national research strategies and platforms to bring together policy-makers, experts, and researchers to communicate research and thus inform policy and practice (COHRED, 2002). Currently MOH has a research policy department in place (World Health Organization Regional Office for Europe, 2014, 2016). The intended function of this department was to foster and govern researchers as well as to become a focal point in the utilization of health research findings in practice and in policy formulation. Despite the establishment of this research policy department, it has not yet done much to investigate the production and use of research for health, especially not regarding the relationship between the decision makers in policy and researchers as regards evidence-based policy making in the Uzbekistan context.

In light of this reality, this chapter explores the final component of the analytical framework, namely the research-to-policy evidence use component, and in particular the principal agent when it comes to health research system governance. Following Meulen's

argument on principal-agent theory, principal in this chapter refers to the decision makers within the national government and agents represent scientists and scientific organizations (Meulen, 1998). In this study I've adopted the working definition for the term "governance" by Gomez (2011). Governance in this study refers to the process of decision-making and the formal and informal processes of how decisions are made as well as a process that incorporates the contribution from civil society as well as international institutions (Gómez, 2011). In order to understand the roles and responsibilities of the actors within these systems in a more concrete way, an institutional perspective was necessitous. The institutional approach helps us understand how societal actors shape the principal-agent dynamic within the health research system (Hyder et al., 2007; Brinkerhoff and Bossert, 2014). Rules in health research systems are both formal, such as parliaments, courts, and specialized ministries; and informal, reflected in perceptions and behavioral patterns that mirrors trust and civic-mindedness.

With Brinkerhoff and Bossert's (2014) argument on principal agent relations within health systems as a model, a similar perspective can be adopted for the health research system (Brinkerhoff and Bossert, 2014). This means that each actor in the health research system –parliamentarians, ministry officials, researchers, and academics—all play a role in producing and utilizing research for the decision-making process within the health research system (Brinkerhoff and Bossert, 2014). Each group of actors has different interests and views with respect to research and policy. If this is the case, the core question is: Are researchers able to give what the decision makers want? To examine this, the chapter starts with narratives of policy outcomes which are 'live-cases' of health-related policy decisions. The narrative approach has been adopted from Kothari et al., (2011) who have used this approach to allow the respondents to retell in their own words the process of public health program planning (Kothari et al., 2011). In this study, the narratives will offer different perspectives of actors to illustrate the gap between the ideals of scientific evidence-based policy and the reality.

The objective and the methods used for this chapter are as follows (Fig7.1):
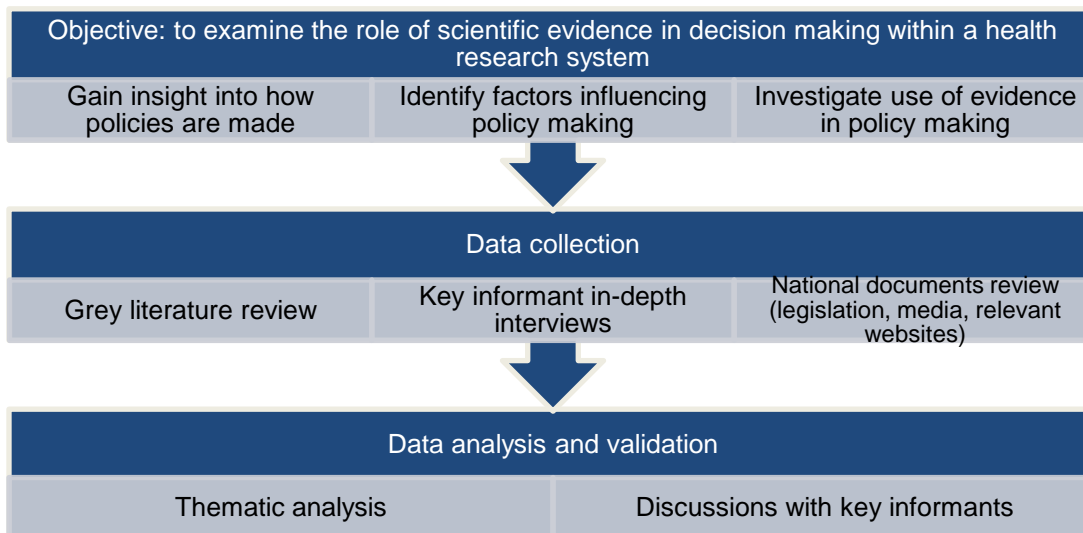
Figure 7.1 Objective and methods used in the chapter

Through a snowballing technique, the key informants were selected based on their willingness to participate in the research and were interviewed with a semi-structured questionnaire. The exploratory nature of this study led to limited number of respondents. However, the key informants were elites in national decision-making or experts in epidemiology, medicine and/or policy. All respondents had over 10 years' experience in policy development at the national level (Table 7.1).[46]

Table 7.1 List of Key Actors

Code	Description 1	Description 2	Corresponding narratives
G1	Government official	Former district head of Ministry of health	Narrative 7.2.4
P1	Politician	Parliamentary member	Narrative 7.2.1, 2, 3
P2	Politician	Former parliamentary member	Narrative 7.2.3
I1	Independent expert	Consultant for international agency	Narrative 7.2.4

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[46] All interviews were face-to-face. There was no communication between the interviewer and the participants prior to the study. To ensure confidentiality, all interviews were in the participant's own office or in a meeting room with nobody else present. Interviews lasted between 36 and 92 minutes (58 min. on average). Verbal informed consent was obtained before recording the interviews by an electronic voice recorder. Russian interviews were translated to English. The transcripts were coded manually.

A1	Academic – member of expert group related to health policy in parliament	Academic at Medical University	Narrative 7.2.4

7.2. Producing and using research within the health research system

In this section, the examples of the policy making process are presented from the decision makers. Understanding the law process will shed light on whether the principal is using scientific evidence provided by researchers in policymaking. The cases represented here focus on waste management, veterinary health, and sanitation hygiene and services. Two of these laws were in direct relation to the health sector and the other two cases were in tangential relation to health sector. All four cases aimed to explain the contextual influences that incur in making decisions. The following narratives are in first person perspective followed by the explanation and analysis of the context.

7.2.1. Policy example on centralized decision making

Waste management initiated by State Committee for Nature Conservation (in reference to Ruling Cabinet of Ministers on Approval of the Regulations on the Implementation of Waste Management of State Accounting and Control Collection of Legislation of the Republic of Uzbekistan, 2014, number 44, p. 535)

"This legislation on garbage management by public (citizen) involvement was passed recently. This movement started from the NGO work on public waste management. The priority was to make the waste management follow the international standards of waste management. We also looked into other developed Asian countries' laws, such as China, Korea, and Japan, to gain the 'Asian' perspective. The revision began in 2012. It took various hearings at the Tashkent city *hokimyat* (city council/town hall) to make people aware of the expectations from them to follow the law. There were various problems with appropriate waste management. For example, some sites where people threw garbage and there were people affected due to these dumpsites. The members in the parliament and the committee (Ecological Movement party), and other relevant stakeholders visited these sites. They took photos, and talked to the people who are in charge of cleaning up the district (the workers in orange vests cleaning the streets and maintaining the city's garbage, trees, gardens, streets etc.) and invited *hokimyat* people to the places to raise awareness. This is advocacy work. The Ecological Movement party from Uzbekistan arranged all the

meetings with the local *hokimyat*. This included people responsible for waste management (at the local level), key people from *mahallas* (division unit in local community), housing associations, the environmental NGO, *masustrase* (a state organization responsible for collecting/ transporting garbage from and to designated points) to create more garbage collection points to reduce illegal garbage sites and involve public in garbage management. This movement was a really effective way of involving all relevant stakeholders (i.e. *hokimyat*, *mahallas*, etc.) to improve the environmental situation in their district (micro rayon)." (P1 Sep 16, 2015)

"These waste management issues were raised even before 2012 by the deputy (elected parliament member from Tashkent city) member in the parliament. I have asked the mayor of Tashkent city for active involvement along with written requests to be accountable. Various roundtable discussions took place in the parliament with representatives of the above-mentioned stakeholders with the members of the Ecological Movement members of the parliament. There were also many hearings with the Tashkent city *hokimyat*, and the Mayor of Tashkent city started to respond to this issue, followed by several public hearings, parliamentary hearings, and other hearings." (P1 Sep 16, 2015)

"During the hearings people (representatives from *mahallas* and house owners) raised their everyday issues. Local population – public hearings were a venue at which to receive proposals for further amendment in the legislation. The law will roll out on a national scale. Local governmental persons and the *hokimyat* of Tashkent city have created special garbage points and models for collecting, recycling – paper, organic materials etc. —with various models in different locations in Tashkent. The law requires people (citizens) to do some type of sorting of their garbage before throwing it out. There are special people employed doing this sorting work and there are different companies doing recycling, yet only 10-15% of garbage is being recycled in Tashkent city. This type of evidence comes from a report of the 'state nature protection committee' in Tashkent city. Everyone worked together solving those problems. Everyone discussed on when the progress will be made. Such hearings/movement started during the 2013-2014 year in the Tashkent city *hokimyat* and then involved all the districts within the Tashkent oblast. After many revisions and improvements, the law was finalized in 2014." (P1 Sep 16, 2015)

Analysis

Two main issues need to elaboration in this context. First, the evidence described by the parliamentary member in this narrative was far from what the literature recommends as the "gold standards" of evidence. The literature often cites 'hierarchies of evidence' for rigorous research methodologies, which often place randomized controlled trials (RCTs) or meta-analyses at the top of the hierarchies (Liverani et al., 2013; Parkhurst, 2017). The

type of evidence used in this context is the report from the national committee. Existing reports, rather than specifically designed field studies, were the main sources for the policy process. Another aspect that stood out from this narrative was the usage of international law as a resource. As the narrative indicates, waste management laws from Russia, Korea, and Japan served as sources of inspiration for this particular law revision, according to the respondent. The respondent also acknowledged following international norms and standards of waste management, which the respondent said contributed to framing the legislation. As a low- to middle-income country, Uzbekistan is in its nascent stages of policymaking. This type of application to foreign policies could be considered to be "emulation" (Voegtle et al., 2011), p82). Voegtle (2011) argues that emulation tends to occur because of time and resource constraints, which drive policy makers of a country to emulate other countries' policies (Voegtle et al., 2011). This line of argument fits well with the narrative presented here, as the respondent stressed throughout the interview referring to already implemented policies from developed countries establishes a guide for the local policies, as the more developed country already has the resources to research and implement such policies. The narrative demonstrates that the source of information and much of the validity of legal revision comes from international experiences and some reference to local evidence.

The second issue is the centralized dynamic of policy-making, in which the power and resources come from Tashkent rather than other regions. Though the initiative for this legislation came from the Tashkent region, the legislation's application was on a national scale. This is despite the fact that the feedback and most of movements and discussions transpired within Tashkent city (the capital) or Tashkent oblast. The respondent also hinted at how parliamentary members, namely politicians, aimed to meet the demands of the constituents to gain votes and electoral advantage for promoting such sanitation works for their region and area. Such responses revealed how political factors like in-house preferences and their constituents came into play in the policymaking process. This law provision started by the deputy member of the Tashkent city before 2012 (who was a representative of Tashkent city defending the interests of the electorates of city districts). Even if the parliamentary members followed up with this agenda, the parliamentary members from Tashkent oblast/city were defending the interests of their constituents (of Tashkent city). This brings us back to its justification on a national scale. Waste

management issues do apply everywhere in the country, but even if a resolution was made through many hearings and involvement of the public voices of Tashkent city this does not necessarily mean that this applies, for example, to the cities of Ferghana or Jijak oblast (both less advanced locales than Tashkent and located much more rurally). This mirrors Weidman and Yoder (2010) and Urinboyev's (2015) arguments that most public policy come from central government (Weidman and Yoder, 2010; Urinboyev, 2015).

7.2.2. Policy example on expert opinion and constituents' (business) interests over relevant evidence

Veterinary health legislation (in the process of revision as of 2016) initiated by the Ministry of Agriculture (On the Quality and Safety of Food Products; Bulletin of the *Oliy Majlis* of the Republic of Uzbekistan, 1997, №9, Article 239, 2003, №5, Article 67; Collection of legislation of the Republic of Uzbekistan, 2006, №14, Article 113, 2016, number 52, Art. 597)

"This law is still in revision and it involves medicine (drugs), prevention, control activities, some functions of governmental private institutions, entrepreneurs, and others. New additions to the law were necessary to address perspectives of entrepreneurs (manufacturers). I have stopped two articles from the first legal revision in order to represent not only the medical perspective but also the interests of business people. The current legislation demands veterinary inspections to take place by both private veterinary inspectors and Hazard Analysis and Critical Control Points (HACCP)[47] inspection from the Sanitary Epidemiology Service (SES) on the production lines of private meat (sausage) companies and dairy companies. In my opinion, this is duplicated work and a burden for private business companies. I have suggested that private veterinary inspection should only apply to live animal health and not at food company production lines. Sanitary Epidemiology Services (SES) inspection is sufficient to determine the quality and safety of meat and dairy products. In the current law there should be some legal boundaries of when and where veterinary inspectors' functions end, otherwise if both (SES and veterinary inspection) come to the production line for inspection, business will suffer due to double control inspections and it will create more work (burden) for companies to get approval. I raised these issues based on the instincts from my medical background. On the other hand, I have raised concerns about this legislation to protect the rights of the business sphere. I need to protect the interests of my constituents. I think controlling organizations is not necessarily a good thing. There need to be clear criteria for monitoring these businesses." (P1 Sep 16, 2015 interview)

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47 HACCP is an international standard for food safely. SES- Sanitary Epidemiological Services (SES) also controls food safety.

Analysis

This narrative presents as an example of how a parliamentary member with a background as a medical expert utilizes his/her tacit knowledge. This was the case where the decision makers rely more on their experiences. The 2011 study by Kothari et al., uses a working definition of tacit knowledge that includes past experience, organization-specific knowledge, and community contextual knowledge, among others (Kothari et al., 2011). The 2011 study by Kothari et al., found that personal and professional experiences were a source of knowledge for public health program planning. As the narrative of this case mentions, no evidence or research work was in consideration to offer an opposing view of the legislation during the revision process. This confirms that experiential knowledge from professional knowledge played an important role. Studies have shown that prior knowledge in the form of tacit knowledge is the primary filter through which members interpret information (Kothari et al., 2011; Kothari et al., 2012; Mbachu et al., 2016).

Secondly, this narrative brings out the contradicting types of legitimacy, as argued by Koch and Weingart (2016). Based on the narrative it is evident that politicians shape or influence policy objectives of their party that have to do with a variety of different sectors, not only health and environmental issues but also other issues that concern their constituents. Politicians are legitimated by popular vote and are supposed to represent the interests and preferences of their respective voters (Koch and Weingart, 2016). Therefore, interests of the business community were considered in the decision making process. This shows how political interests, rather than actual scientific evidence, may be another key factor in policy revisions in such situations. For politicians, the legitimacy of decisions relies on their constituents' interests. This contradicts the legitimacy of scientists. Researchers' legitimacy relies on specialty of knowledge, which is supposed to provide answers to factual problems. Therefore as Koch and Weingart (2016), argue the logics of politics and science do not coincide; they may diverge and even be contradictory (Koch and Weingart, 2016). This is further complicated when context (ways of practice in law making and hierarchical management of policy) comes into play, as we see in the next narrative.

7.2.3. Policy example of revision from inherited soviet law

Law on sanitary epidemiological safety of population initiated by Ministry of health (MOH) Law of the Republic of Uzbekistan On The Sanitary-Epidemiological Welfare Of Population (Collection of legislation of the Republic of Uzbekistan, 2015, number 34, p. 451)

"This law was requested to be revised by the Ministry of Health (MOH) but was initiated by the Uzlidep (a ruling party in the country) deputy group members from Karalkapakstan, who formed allegiances as a working group with other factions of the parliament (the Ecological Movement party, People's Republic Party, and the National Renovation Party). The MOH did not want to make any amendment to sanitary rules, but I initiated this based on my experience from my previous career – the old law focused on monitoring sanitation activities. We the working group and myself decided the monitoring should come not only from government control but that the public should also participate. People should have rights and obligations to know what is going on. The previous law addressed to organizations based on old Soviet-style law. It also did not have a business aspect. Now it includes the business sphere such as LLCs[48] and private entrepreneurs. It also takes into account the International Health Regulations from the WHO guidelines along with prevention of epidemics, process of prevention, and disinfection. This was because the previous law had only sanitary measurements but no epidemiological aspects developed by sanitary and hygienists educated from the Soviet times (i.e. Dr. Iskandarav (the founder of Sanitary Hygiene occupational disease institute).

The suggestion for revision was not welcome because people who trained in the Soviet era were resistant to change. The current revision of the law also takes into account that the research institutes support SES services. We (the party and I) initiated and arranged several meeting with the MOH, with the deputy minister of the MOH in charge of the SES, working personnel of the SES, the department in charge of SES in the MOH, scientists from Tashkent Medical Academy, and scientists from the Tashkent Institute of Post Graduate Medical Study, to name a few. Also several meetings with experts from the republican SES, oblast level SES – oblast SES collected opinions from rayon SES[49], what they know in everyday practice, what is lacking for everyday improvements were organized. After MOH decided to send this as a legal draft in 2013 (to coincide with the celebration of 2013 as the Year of the Healthy Child), the cabinet of ministers requested revisions. Working groups were involved in the revision process of this legislation. The working group members were government representatives along with experts in food safety, communal hygiene, the director of the Republican SES, the director of the School of Public Health at Tashkent Medical Academy, and deputy minister Saidaliv came for panel sessions along with various experts representing ecology and health. The revised law

48 Limited Liability Company (LLC).
49 Rayon - districts / oblast - state

encourages public participation, meaning it enlists the social partnership of citizens and entrepreneurs to keep places clean with sanitation/hygiene and ecological control by waste management in mind. We are using mass media, internet, radio, TV, different type of mass media, writing newspapers articles, preparing different types of booklets, every means to communicate this law to people." (P1 Sep 16, 2015 interview)

(In regards to the revision of the law :) "I will give you an example. This year the SES adopted a law concerning the sanitary wellbeing of citizens. Before, the SES did not consider ….they did not need new laws, but all of a sudden, they adopted the new law. (*In explaining the initial resistance*) The head of the SES function at MOH and the head of the SES had two different opinions on this. On the one hand, they recognized that some changes were necessary, but on the other hand, they were afraid because it could turn out to be ineffective and it also involves some troublesome issues that would necessitate structural changes. It was the push from the president. This mandate of a strong state body with great hierarchical power instructed MOH to introduce the amendments at SES *(in contrast to P1's response)*. They changed their mind. As people are used to the way they work, a lot of people (whenever instructed by a strong state body that is more powerful and has the power to introduce amendments) react in a different way." (P2 Oct 17, 2015 interview)

Analysis

This narrative presents several aspects of policy decision making in Uzbekistan: 1) challenges in revising inherited law from Soviet times; 2) recognition that revisions to past policies present challenges not only for the decision makers (politicians) but also those who are impacted (in this case the MOH, SES, businesses, and relevant personnel). This policy revision took international guidelines by WHO into account, the various opinions from relevant parties (such as MOH and SES employees), but similar to the previous case, scientific evidence does not necessarily play a role in policy-making. The particular epidemiological monitoring aspects of the previous laws and the shortfalls were recognized as problems by all parties concerned (politicians, MOH, SES, to name a few), but as noted by the second narrative, revision of past law created both resistance and concern.

This sense of resistance stems from the path dependent practice that has been in place for a long time since the Soviet era. This mirrors the arguments made in the previous chapters of institutional Soviet legacy and the resistance to change. Yet the concerns of those who need to implement these laws were also valid since some policies result in

ineffective interventions. That is why exploratory studies or exploratory policy experiments are used to provide evidence in policy implementation (Capano and Howlett, 2009; Howlett and Mukherjee, 2017). However, in Uzbekistan's case the lack of resources in performing these studies and lack of capacity of policy makers to understand such research evidence presents a challenge. Consequently, in the current state, as seen from these several narratives, revised policies referred to the best examples of international practices or the working group of experts and professional providing their expertise. The parliamentary members refer to experts working in the field, either contacting those ad hoc or organizing committees of highly trained doctors, professors, and researchers from universities or the Academy of Sciences.

Politicians also considered the risk aspect, meaning how much it will cost for implementation and what the potential costs or losses would be if such a policy were implemented (narrated by P2). As presented, policy making is complex and not straightforward, and such issues have been a concern in other low- to middle-income countries where decision makers continuously need to seek a balance between increasing clinical and public health demands and having scarce resources to do so. In addition, the decision makers have limited time to consider many contextual issues under pressure of making timely decisions (Haynes et al., 2011b; Haynes et al., 2012).

The decision makers also mentioned the issue of power dynamics and hierarchical relations when it comes to policy making. As discussed in the previous chapters (Chapters 5 and 6), this is inherent within their institutional structures. The institutional design of hierarchical 'top-down' management limits the actors' reactions. Even if a sentiment of resistance exists, as illustrated above hierarchical management takes precedence over resistance.

7.2.4. Policy example of implementation challenges in Healthcare Service reform

Presidential rural social sector infrastructure initiative, April 1996 ; Law on protection of population health, 29 August 1996, No. 265-I Presidential Decree on the state program for a reform of the health care system, 10 November 1998.

"I was involved in a major part of the reformation of the health system from 1998 in Urgench. My most notable work was to implement the President's health systems reform decree. Major work was to implement rural medical points for emergency care in rural areas. There is a hierarchy where any kind of law that proposed by cabinet of ministers and becomes a Decree. This decree goes to the Ministry of Health, and then Ministry of Health sends an order or regulation to the state/district Ministry of Health offices. Rural hospitals were not effective before the decree, but after implementation, they became effective. There were not enough financial resources to renovate rural medical facilities as per the recommendation of the new law's revisions. The difficulties in implementing those recommendations had to do with pooling resources at rural medical facilities. The logistics of delivering necessary materials and equipment to these facilities along with constructions of these rural facilities were challenges. Nevertheless, the government did a lot of work to create a budget for rural health service facilities. There was much coordination needed at the rayon (district), oblast (state), and hokimyat (governor) levels and at the regional level of Khorezm." (G1 Oct. 27, 2015)

Analysis

This narrative was by the former Ministry of Health official who explained the challenges of implementing the "Rural Health Service Facilities" –the major service reform in Nov 10, 1998—implementation process in the Khorezm state. The primary health care reform was the first of its kind; it was adopted as a response to the international norm as well as the fact that at that time rural health service locations were not adequately equipped for the poorest (World Health Organization Regional Office for Europe, 2014). The steering committee of the Ministry of Health in collaboration with WHO and World Bank consultants led the development of this law in 1998. Asian Development Bank (ADB), along with other foreign donor entities, and representatives from local communities joined the consultation process. The law was passed by the central government but as seen from the narrative above, there were challenges in the regional ministry of health (World Health Organization Regional Office for Europe, 2014).

This narrative brings out an interesting aspect of policy realization. Respondents pointed out the major challenges of implementation.

The problem is we have one of the excellent guidelines/legislations (at least among central Asian countries) but we lack implementation. If we implemented all the legislation and guidelines we have, we would be living in a perfect society. The standards of legislation are perfect but they result in very little." (I1 Oct 7 2015)

In addition, we have this kind of custom. Implementation of legislation is not straightforward. There are many by-laws and sub-clauses adopted in Uzbekistan. Yet, it is difficult to see these laws come into realization correctly. (P2 Oct 17, 2015)

These responses further support the reports of challenges in implementing laws, which were often unforeseen. Even though the planning and policy making may be sufficient according to international guidelines, the implementation process presented a challenge for parties that were involved in the process.

From the researchers' perspective, the same sentiment was evident. Despite mechanism for experts in health to work as ad hoc committees and share their views on health policy matters, respondents revealed that there were limitations to research implementation. Interviewees recognized that the ongoing challenge for researchers is to not only conduct research but also see the results implemented as actual practice or policy. Researchers who wanted their work to be implemented used strategies such as publishing monographs and books, although the impact of such work seemed to vary.

When we issue monographs approved by the ministry of health, for example, it means that it is a recommendation by the ministry (of health). Just a recommendation! It is not obligatory to implement. It is more like a guideline….just a recommended state order. It is difficult to implement research results as actual policy. For example, my doctoral dissertation was how to improve monitoring of the Sanitary Epidemiological Services (SES) when there are instances of sepsis50 of young children under 5 years old. I conducted cohort research of urban and rural regions of Fergana to improve the reporting system of SES. I completed the Ph.D. and published my work but it is not easy to get the ministry, or cabinet of ministers, let alone the president to listen and implement such research work and make it actual policy. The problem is that it takes so much effort to implement research. It takes time to see results. It takes time to implement. Unlike a visit to the hairdresser where you pay money and you see immediate results, medicine is different from the hairdresser in that the results are not typically immediate. If the result of the work is immediate and obvious, there is no problem with funding research and implementing it. My approach to it now is to work on implementing our research work in the education process. I hope that there will be an implementation on a wide scale. Once textbooks obtain an approval by the MOH and the Ministry of Higher Education, they will be in use at the university to teach students. (Interview with A1 Nov 25)

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50 Bacterial infection in the bloodstream or body tissues.

Having research communicated to decision makers for informed decision and better policy design is a complex process in both developed and developing countries (El-Jardali et al., 2014; Shroff et al., 2015; Harvey and Kitson, 2015). Smith argues that decision makers have a tendency to follow ideas and trends that represents their constituents' interest rather than the evidence itself (Smith, 2014). Due to the complexities of implementation of policy from the research findings, Shearer's (2015) study emphasized the emerging role of 'institutional entrepreneurs'. These individuals are the ones utilize their academic rank, seniority, and political networks to convince decision makers to consider the research evidence or hasten the bureaucratic approval process for implementation (Shearer, 2015). As in the case of Uzbekistan, these experts have long established careers in research institutions and are engaged in international research projects and program. Such experts use their positions, networks, and professional resources to connect with and convince the necessary bureau, such as the Ministry of Health and the Ministry of Higher Education, by knowing the necessary administrative procedures to get such projects approved. When considering enhancement of research capacity in Uzbekistan, there needs to be a better communication channel between the researchers and decision makers of the Ministry to promote better exchange of ideas and policies.

As a whole, these narratives demonstrate the limited role scientific evidence plays in policy making processes as well the process of implementation of such policy. The sources of knowledge suggested included expert groups, mandates/guidelines from international policies, evaluation reports from national entities, as well as tacit knowledge from the respondents themselves. Besides, the approved policies raised concerns over implementation and its effectiveness. Then, why is research evidence not actively pursued in policy planning? It makes one wonder how policy makers and relevant parties perceive research. Based on the analysis of the above narrative, the following section discusses the perspectives of research use in policy making in the context of Uzbekistan.

7.3. Discussions

7.3.1. Understanding of research within the health research system of Uzbekistan

All of the respondents were aware of research and its potential use for policy making. However, it was not always clear to what type of evidence they were referring. The differing views of researchers and decision makers perhaps stems from lack of common understanding of what constitutes research.

> Research for us is like the research they do in the academy. We collect samples, we analyze the cause of the disease, and then we report this as evidence to either ministry of health or other relevant parties. Is this not research? (I1 Aug 17, 2015)

> Research should be used for evidence-based medicine. I also consider case studies, experimental, clinical random controlled, non-controlled randomized, meta-analysis, and systematic review evidence as strong research methods. Unfortunately, not all the researchers or medical professionals are familiar with such concepts or terms. The methods they use are rudimentary, and not as advanced as the scientific literature describes. (A1 Nov 11, 2015)

The quotation above exemplifies how the term 'research' and 'research evidence' and its interpretation of research vary widely, illustrating the term as meaning everything from laboratory assessment of disease to the generation of knowledge that will perhaps be used for policy. The response above demonstrates that even amongst researchers, the definition of research varies depending on their disciplines. The researchers at a specialized institute that is part of the Ministry of Health understood research as basic research and did not connect research to policy. Meanwhile the health scientists considered research as operational (or applied), and were aware of its potential use for policy. The medical faculties used a mixture of both but the understanding of research was more clinically oriented and lacked the understanding that it had potential use for policy evidence. Respondents (from decision makers to researchers) construed and interpreted evidence and policy broadly and differently.

This issue has also been researched with regard to Nigerian researchers and decision makers in the health sector (Uneke et al., 2015). This issue was also observed

as challenge in a WHO assessment report of the Ministry of Health that stated that a common understanding of the definition of research and its use is lacking between organizations involved in research and relevant parties involved in the realization of research (World Health Organization Regional Office for Europe, 2016). This was one of the initial hindrances for understanding research capacity and its use in decision making in the context of Uzbekistan. Further, there is a gap between the established concept and definition of `evidence' in international health research and understanding of 'evidence' in researchers in Uzbekistan.

The decision makers considered research to be an academic activity that provided insight into the societal context and issues of disease prevalence. The decision makers also conceptualized research as a whole with inherent purpose to improve the health or the health services of citizens. The decision makers' preferences were towards applied research rather than basic research. The preference for evidence was those with direct relevance to health care issues and diseases. Narratives showed that although there was much need for various types of information in the health sector as well as other sectors related to health problems, there was a lack of collaboration between different sectors to gain better data and information.

> It is crucial to have local context survey questions from ordinary people. One should also look at infectious disease hospital to consider important health issues in Uzbekistan. Environmental issues as well as nutritional issues, water network issues, and water quality issues also need to be in consideration. Many different surveys are crucial in many different spheres. One should have a strategy to make these different functions and departments communicate with each other. Currently there is no strong initiative for multi-sectoral coordination for such health issues. (P2 Oct 17, 2015)

> We need precise data. We need statistics of different strata of the population. Before making any allegations or coming to a conclusion of some kind, we need reliable sources of information for research. The methods should be reliable and joint decision/agreement are obligatory among different experts so that the research creates reliable and accurate data. Without such partnerships, people may not trust the data. All parties need to agree on the methodology. Statistics, ecological indicators, and health indicators need baselines. We need clear definitions of medical problems, better analysis of health care spending, and the opinions of decisions makers such as economists and lawyers. Memoranda of understanding are necessary and methodologies need to be developed. (P1 Sep 16, 2015)

Awareness of research use for policy making existed, but overall the respondents understood research as some form of 'information'. The understandings of scientific evidence and research were conflicted but research that gives information on the population, like epidemiological studies, were highly valued and commonly understood by interviewees, whether researchers or decision makers. However, their definitions of epidemiology research were often vague. Some used the term to refer to any study that was 'applied' or relevant to policy or programming; others used it to describe small, quantitative studies. The long tradition and strength of medical science and basic science from the Soviet era has not opened up many opportunities for Uzbek researchers to be aware of the advancements in epidemiology studies or of current up to date research design and definitions. The out-of-date research approach to epidemiology studies with limited research communication efforts have been highlighted for post-Soviet countries (Vlassov, 2000; Vlassov and Danishevskiy, 2008). This could be the reason behind differing understandings of research and its purpose. Another issue that was that none of these interviewees, whether decision makers or researchers, mentioned qualitative study or other types of studies that could also be considered to provide rich information for decision-making. In bibliometric, analysis (in chapter 5) displayed this aspect, where the predominant studies until the early 2010s have been quantitative or clinical case studies.

7.3.2. Fragmented dynamic between research producers and principal: what is the gap?

Despite the contested understanding of what research is and its role in policy making, most of the respondents recognized the importance of research in decision-making. In reality however, the respondents noted that research is not always considered in decision making. Researchers expressed their mistrust, stating that policy makers were unlikely to use their research findings for policy making. Similar findings and responses were found in the case of Argentinian and Israel countries' researchers (Corluka et al., 2014; Ellen et al., 2016).

> Of course, all researchers publish their materials at conferences or offer guidelines, but after that where does it go? Where is it used? We do not see the application of our recommendations from the results of our research. We did a very comprehensive assessment of irrigation water and the environmental impact of dam building. However, no one asked

us what we have done. No one asked the type of data we have or asked us to share what has been done. We tried to involve different parliament members but received no feedback. (I1 Oct 7th 2015)

However, let us say for instance that you show some documents of recommendations to the deputy minister of health. In order to implement these recommendations, the deputy minister has to consider them in light of the already existing local law, plans, projects, in short, the already existing system, to see if they can be implemented directly. (Shortened) (A1 Nov 11, 2015)

The networks and the information shared by the research producing entities show vertical communication dynamics, according to the responses of the actors in the field. Figure 7.2 is the schematic of research governance adopted from the social mapping by Eröss et al., (2008) of the health sector and COHRED's mapping of Uzbekistan's national health research system, expanded further by interviews and observations (Fig 7.2) (Ahmedov et al., 2007; Eröss et al., 2008).
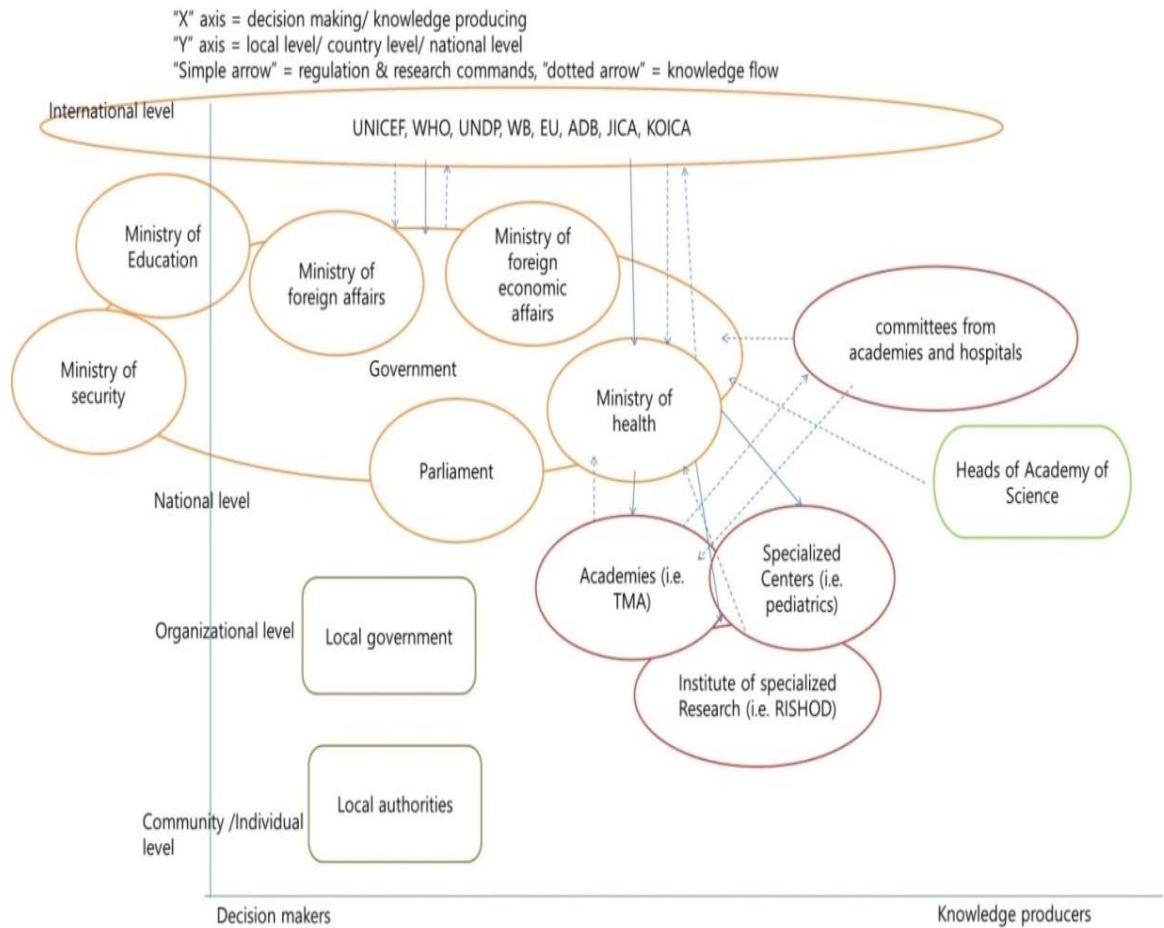
Figure 7.2 Research flow of Uzbek health research system modified from (Ahmedov et al., 2007; Eröss et al., 2008)

Figure 7.2 shows that in the health sector, several international agencies such as the World Bank, UNICEF, and the WHO play significant roles in carrying out initiatives related not only to strengthening the health sector but also in research strengthening efforts. UNICEF, for example, conducted household assessment survey projects in 2000 and 2006 that generated research-based knowledge on national maternal child health-related health care[51]. UNDP is another example of an organization that commands knowledge flow by organizing statistical training of Uzbek counterparts to build statistical capacity within the nation. At the national level, cabinet ministers and parliamentary

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[51] UNICEF Multiple Indicator Cluster Surveys http://mics.unicef.org/surveys Uzbekistan is available for 2000 and 2006

members carry the most weight and are the most effective in revising and pushing for policy agendas that require expertise and knowledge from expert committees and academies.

To understand why this is the case, the 2009 argument by Brownson et al., on the types of evidence produced in health as well as the different perspectives that policy makers hold when making decisions sheds light on this process:

> Public health evidence is usually the result of a complex cycle of observation, theory, and experiment. However, the value of evidence is in the eye of the beholder (that is, the usefulness of the evidence may vary by stakeholder type). Medical evidence includes not only research but also characteristics of the patient, a patient's readiness to undergo a particular therapy, and society's values. Policy makers seek out distributional consequences (i.e., who has to pay, how much, and who benefits), and in practical settings, anecdotes sometimes trump empirical data. Evidence is usually imperfect and, as noted by Muir Gray, "[t]he absence of excellent evidence does not make evidence-based decision making impossible; what is required is the best evidence available, not the best evidence possible. (Brownson et al., 2009b), p177)

As Brownson et al.'s (2009) study demonstrates, policy makers have competing interests, and seek to minimize risk (Brownson et al., 2009a). Therefore, empirical data may not be the best answer when making decisions. One respondent's narrative shares such a sentiment:

> No research is not always considered, and it is not their (other members of parliament) fault... Parliament represents (the national population) the people of Uzbekistan. [Therefore, not everyone has to be experts and consider scientific evidence in making decisions]. It also depends on the situation. Parliament consists of ordinary people, whose primary function is representing people. Its secondary function is making decisions, and its third implementing laws (P2 Oct 10, 2015)

> However, we have 150 members in parliament. This gives us a good probability of making a good decision, but sometimes it is not the appropriate decision for legislation. Only time will tell: problems will arise (if it was not appropriate decision) to change the situation or revise the law again. (P1 Sep 16, 2015)

> Research is not always considered. The exact percentage of how much legislation considers research is hard to say. Our parliament has 25 years of history. We started having professional expert members 11 years ago. We borrowed many laws from other countries. This process

of studying, consulting, making agendas has not been going on long. Many legal articles within laws may not be effective. They may not be suitable. They may not even be urgent. It really depends on the government bodies and parties that bring up the agenda. (P2 Oct 10, 2015)

The policy making process at the executive level is complex, since the decision makers are agents of their political constituents. The interest or view that they represent and aim to pass as policy may not necessarily require scientific evidence. In the murky space of decision-making, decision makers consider various circumstances, including the political, economic, social, and cultural context (Fig 7.3). Many other factors come into consideration, such as population, human resources, and the best available evidence.
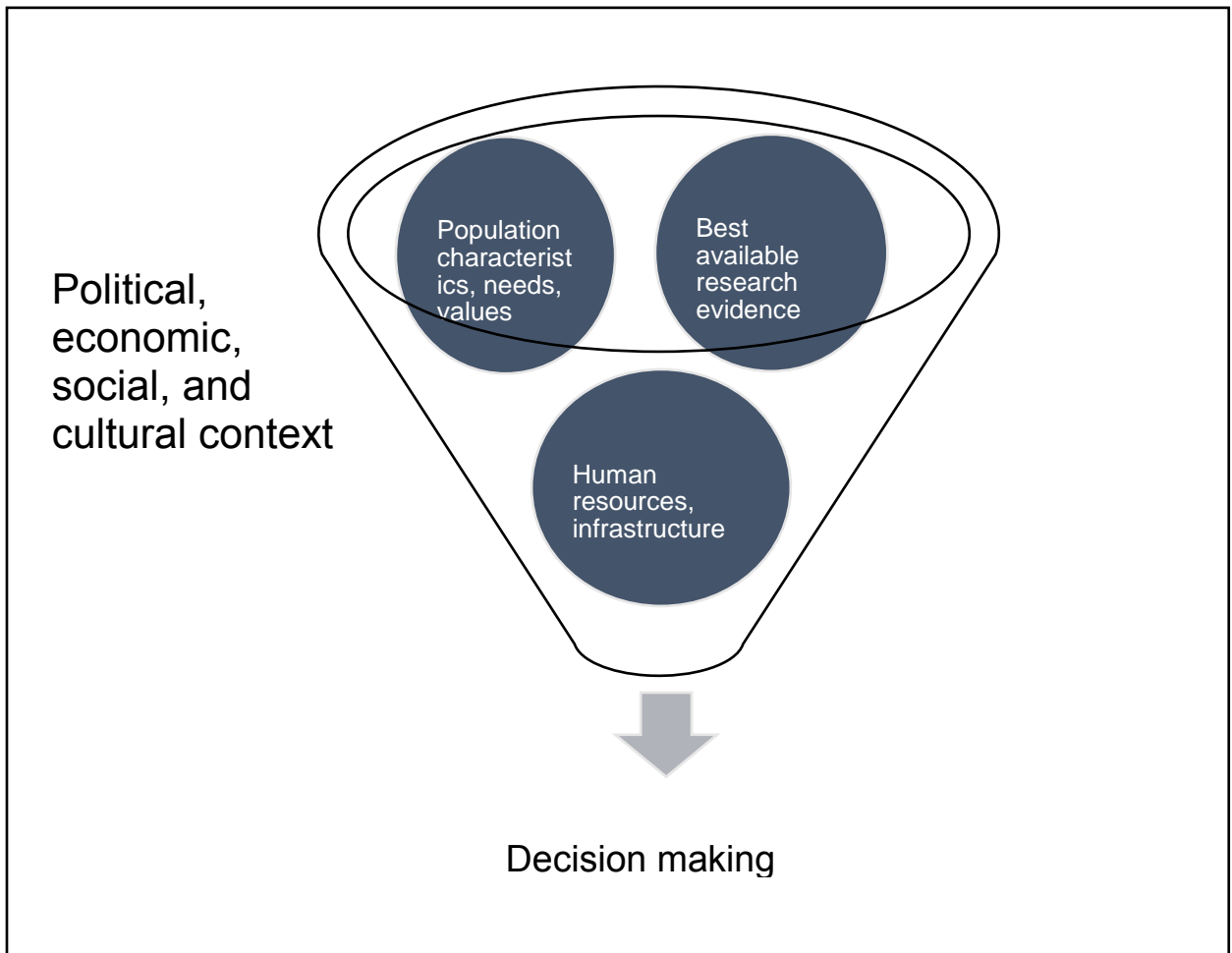
Figure 7.3 Domains that influence evidence-based decision making modified from (Satterfield et al., 2009; Brownson et al., 2009b)

This context-, practical-operational orientation of evidence could be the reason behind the lack of evidence-based policy-making and the divide between researchers and policy makers, as argued by Hyder et al., (2007) (Hyder et al., 2007). According to Hyder et al., (2007), the practical–operational orientation suggests that timing and context strongly influence the definition of evidence. The findings demonstrate that parliamentary members as well as ministerial officials recognized the importance of the relevance of evidence and have expressed openness to the types of evidence that are acceptable, including research studies published in scientific journals. But as reported by the parliamentary member, research-based evidence competes with other types of evidence and may be denied due to context and timeliness (Hyder et al., 2007).

These findings also reveal that at times the decisions made were more a result of social logic rather than what was sound and logical based on scientific evidence. As Koch and Weingart (2016) argue, the use of research depends on the degree of consensus on the policy goal; it is used if it supports the consensus, and it is used selectively if there is a lack of consensus (Koch and Weingart, 2016). This also mirrors the 2004 argument by Dobrow et al., that 'what constitutes evidence is context-based … and evidence is defined less by its quality, and more by its relevance, applicability, or generalizability to a specific context' (Dobrow et al., 2004). For instance, before the approval of tobacco convention legislation in Uzbekistan in 2012, there was a strong lobby from the tobacco company to delay this convention. Even though the adoption of such a law was opposed by the experts in the public health field, the president forced the head of the cabinet to make a decision (Gilmore et al., 2006; Gilmore et al., 2007). At times political environments and established practices of hierarchical management constrained the decisions made in the policy arena.

As research evidence is sometimes not utilized in policy making, at times informal evidence such as local reports or tacit knowledge of the policy maker may prove more useful (Hyder et al., 2011; Oliver et al., 2014; Ellen et al., 2014b). This also validates the varied forms of information used in decision making by the principals, information that ranges from objective evidence to a more subjective degree of evidence (Fig 7.4). The findings show that decision makers valued opinions and placed more trust and support in the deputies who are scientists (according to P1 response Sep 16, 2015). Being an expert as a decision maker and the opinions of other experts were valued within the parliament. Having expert status also increased the legitimacy and confidence of the potential constituents (according to P1 response, Sep 16, 2015). Yet which type of evidence (whether subjective or objective) is preferred in decision-making is not clear from the responses; it is evident that research is just one source of information for policymakers. Therefore, objective evidence alone may not be the necessary condition to make policy possible, as argued by Haynes et al., (2011). There were other factors, such as the interests of the constituents, political dynamics, external international conventions, and political pressures that may determine policy itself (Haynes et al., 2011b).

objective
- Scientific literature in systematic reviews
- Scientific literature in one or more journal articles
- Public health surveillance data (lack of trust)
- Program evaluations (from international donor agencies' research programs)
- Primary/Secondary data or evidence from other countries

subjective
- qualitative data
  - community members
  - opinions from stakeholders/experts
  - media
  - word of mouth
  - personal experience
  - hierarchichal decisions

Figure 7.4 Different forms of evidence in Uzbekistan; context model from (Brownson et al., 2009b)

The reality is that the decision-makers at certain points use readily available, albeit less scientific (ad hoc), unpublished literature and information from the internet and newspapers to make decisions. This issue related to the lack of proper research communication channels.

> There are multiple duplicate data and monitoring evaluations done by different ministries but there are no channels of communication or sharing between the ministries. Ministries may have access and share, but there is no systematic thinking behind it. Even local researchers like myself cannot access some data. (Interview with I1, Oct 7th 2015)

All of the respondents (P1, P2, I1, A1, and G1) have relied on unsystematic and ad hoc ways of hearing about research. For academics and researchers, the Ministry of Health typically acted as the source and the dissemination channel of information on new legislation, (inter)national conferences, and medical research, and international projects and activities. Based on the responses from decision makers (P1 & P2), there was no structured or systemic means of using research to facilitate decisions. Albeit decision makers convening for the expert group that based on the issues. Most of the information sources cited were on the internet. G1 also responded that internet, local medical journals,

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and international (mainly Russian) journals were sources of information, but such activity of seeking out information was the voluntary act of the interviewees rather than part of regular dissemination activities or structured dissemination strategies.

7.3.3.   Research capacity of researchers: are researchers able to give what government (principal) wants?

As the narratives of policy makers and researchers have demonstrated, governance, administration, and regulation of post-independent Uzbekistan has become complex. This has led to policy makers depending on (foreign) specialists who provide expertise for the formulation and execution of policies. According to Koch and Weingart (2016), the problem of the underlying conflict between governments' dependency on knowledge is its instrumental function, on the one hand, and the potential loss of control over decision-making to technocratic experts, on the other (Koch and Weingart, 2016). The lack of trust in their own national data only exacerbates this conflict.

The lack of trust between research evidence producers and policy makers presents a serious problem for decision-making. There was inherent understanding that data collected from the national agencies and the research evidence provided by research producers and local researchers lacked in quality and validity. This translated into putting more trust in the international work rather than the national statistics', research, and information capacity.

> Statistics in Uzbekistan are not always reliable.[52] [Although, quickly the respondent changed tack.] The most reliable data is medical statistics and epidemiologic statistics of the government data, of course. It is good data but… Medicins Sans Frontières (MSF) has excellent data. MSF had their own goals and data that they collected and provided to both of our ministries (Ministry of Health and Ministry of Agriculture) were shared, open, and reliable data. Data on TB and MSF data was better and accurate. This is because the survey was scientific and methodologically sound in that area. Detailed data like this can make decision successful. (P2 Oct 15, 2015)

> International organizations such as UNDP and OSCE are also sources of information and we have worked with them to implement former legislation [Did not mention specifically which legislation] (P1 Sep 16, 2015)

[52] In many instances, these are not easily accessible.

We also look to Korea, Japan, and Uzbekistan (to get a socialistic point of view of the law) … Rich countries—they have special expert support. These experts are paid for their work to provide best information. Therefore, I refer to international experience. These laws are open; we can find them on websites. (P1 Sep 16, 2015)

Uzbekistan, like other developing countries, has a weak local science base, as demonstrated by the previous chapters. Considering the weak science base, there is a contradiction in what information is trusted when it comes to political decision making. As demonstrated by the policy makers' narratives, the science-based policy advice that provided by foreign experts in the context of development aid is considered more trustworthy than local data.

This coincides with the argument by Koch and Weingart (2016), who have argued that foreign aid agencies have sway over certain policies, due to the lack of local research capacity (Koch and Weingart, 2016).The lack of trust in government data can be traced back to the Soviet legacy of data management. Back in the Soviet Union, all data were collected for political motives and/or to aid in decision making to benefit the social elites (Anderson et al., 1994). When such cases happened, the statistical office received an order from the Council of Ministers to prepare specific materials within a short timeframe, without consideration for the quality of that data. Moreover, there was a consensus that the publication or distribution of real data could be dangerous for the Communist regime. Therefore, the top hierarchy forbade disclosure of the data to the public and the state. Therefore, the major responsibility of the statistical offices was to limit access to data (Anderson et al., 1994).

The legacy of Soviet past had detrimental effects on the data collection capacity for post-Soviet countries. There were three major issues with soviet statistical research capacity. First, the statistical staff trained from soviet times were to give quick answers with low-quality data. Second, there was no developed practice for openly discussing definitions and data quality when distributing or publishing data. Finally, the statistical staff and scientists from soviet times carried out instructions from the Central USSR statistical government; where they inherited methods and statistics from the past that are often undocumented and subject to error. Taking the initiative to produce better quality or methodologically better research was intolerable, as was communicating ideas with policy

makers. Administrative and bureaucratic qualifications were reported to be more important than scientific training or perspectives (Anderson et al., 1994; Tolts, 2008). Much more data was collected internally and was made available for internal use by government or political party officials or approved specialists than was published for general use (scholarly or for public) during the Soviet era (Anderson et al., 1994). Studies have argued that the major problem with Central Asia was slow progress in changing population definitions or classification of data collection methods. This resulted in different number of deaths and specifically of infants death being reported (Anderson and Silver 1986; Baranov, Al'bitskii, and Komarov 1990; Ksenofontova 1994 cited in (Anderson et al., 1994)), which led to a decline in the reported infant mortality rate in new states of the Central Asian region.

Although how much of this legacy and practice has had an impact on Uzbekistan health data collection and capacity is yet to be explored, the lack of coordination of data collection and the lack of quality in data still persist (World Health Organization Regional Office for Europe, 2007, 2014, 2016). The distrust of the decision makers showed the lack of capacity in data monitoring, and this creates a cycle of distrust between the decision makers and the research producers. The lack of reliable data and the lack of research skills have also been discussed as weaknesses by the Ministry of Health of Uzbekistan in their self-assessment reports (World Health Organization Regional Office for Europe, 2016). The report highlighted the insufficient human resource capacity of research institutions/centers, medical institutions, and others who have advanced research knowledge, methodologies, and skills in public health (World Health Organization Regional Office for Europe, 2016). This mirrors the previous statements by parliamentary members on the lack of information based on rigorous scientific methods. This presents a serious challenge for health policy making in Uzbekistan as the insights from experts and decision making still is immature at large.

7.4. Conclusion

Referring back to the history of Uzbekistan (in Background Chapter 2), much of the law establishments and enforcements were focused on establishing state legitimacy, and have maintained the centralized management approach that was inherited from the

Soviet era. Even the initial approaches to health policy was largely focused on infrastructure building and training necessary human resources to meet the demands of the health services needed, such as emergency medical service or rural health care building. Support of multiple donors, such as the World Bank, ADB, and UNICEF initiated the majority of the health systems strengthening initiatives, such as improving primary, secondary, and tertiary care. The project outcomes and reports from the donor agencies were the basis for drafting and implementation of laws and revisions. Therefore, the pre-existing health policies in Uzbekistan already showed a penchant for evidence provided by donor agencies, with little regard for enhancing existing national capacities of evidence production.

This chapter uncovered policies and decisions at the parliamentary and national levels. Black (2001) argued that research evidence is more influential at the central policy than local policy level, for in the latter policy making is marked by negotiation and uncertainty (Black, 2001). What is interesting in Uzbekistan's case is that subjectivity and uncertainty were the basis for central policy level decisions. The 2003 study by Hanney et al., indicated that different types of research are likely to be most relevant for various levels and situations of policy making (Hanney et al., 2003). The opinions and ideas expressed by policy makers in this study provided a sense of the range and depth of issues considered in the research-to-policy interface.

The results of this study revealed few of the basic problems of research to policy and practice. First is 'evidence' means to different actors and the incongruences in perceptions of research. This is perhaps due to different approaches and (competing) disciplinary training by the researchers themselves, which results in producing different kinds of 'evidence.' Second, as the narratives have shown, the mistrust of local researchers' data and research, which decision makers deem not to provide sufficiently good quality research results, does not lead to research translating into policy. As Lassnigg (2014) argues, it is worth considering the limitations developing countries face to implement evidence-based policy as suggested and proposed by the international community. Lassnigg (2014) argues literatures on policy and practice have not considered the complexity of existing governance when it comes to evidence-based policy and

research dynamics. This is because Uzbekistan is still a 'young democracy'[53] going through changes in the policy environment and existing governance structures. Hence, the governance environment in Uzbekistan provides difficult realities to follow the evidence-based policy proposal. Therefore, a closer look at this process suggests that research to policy at this stage cannot be realized despite the benefits and significance of such suggested by the international community (Brownson et al., 2010; Smith and Joyce, 2012; Birbeck et al., 2013; Lassnigg, 2014).

The second issue that needs much attention is how to elevate the use of research and build trust in national data and research capacity. The challenges in research capacity building and its extension--research evidence in policy making--are not unique to Uzbekistan, as the challenges addressed above have been explored in other country contexts too (El-Jardali et al., 2012; Ismail et al., 2013; Ellen et al., 2014a; Ellen et al., 2016). Nevertheless, the issue presented here was not simply a question of research having a direct policy impact, but one of broader understanding of socio-political, economic, and cultural influence. This leads to questioning the domains of research relevance, impact and influence, and requires the adoption of a longer-term perspective where research may take a generation to exert real influence.

Producing scientific research involves much time, investment, and finances to design, conduct, write, peer review, and publish (Smits and Denis, 2014; Andermann et al., 2016). Each step of research involves various long-term strategies of planning, starting with education and capacity building of scientists and moving to educating and advocating for research use and data integrity (Hallonsten, 2014; Hallonsten and Hugander, 2014). Scientific evidence provides valuable insight into the issues of the society to improve the health of the population. However, even if it is well packaged and summarized for use by the right policy maker, this rarely happens (Strøm, 1995; Campbell et al., 2009), for there are political forces, competing agendas, and bureaucracies that take place in policy making (Hyder et al., 2011; El-Jardali et al., 2012; Walsh and Lee, 2015). Decision makers consider various circumstances including political, economic, social, and cultural matters,

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[53] Countries that experience a process of democratic transformation, irrespective of the year in which they have formally adopted 'democracy' as a form of government. As Koch and Weingart (2016) argued this categorization includes countries who have turned from authoritarian rule to one party democracy or to multi-party democracy such as Tanzania (Koch and Weingart (2016).

and window of opportunity in which research evidence appears may not be the top consideration for their decision-making. Also, based on the legislative environment and the legal decision making cases that have been examined, it is worth noting that even the decision makers may not have the necessary skills to analyze the information given to them to use it for policy (Cameron et al., 2010). Mutual training of scientists on research communication and training of scientific evidence-based policy is necessary for both researchers and decision makers alike.

In summary, the findings here confirmed the initial impression from the analytical framework that principals lack evidence from researchers, meaning there is a gap in knowledge production and policy making in the health sector. Even so, there is still a long road ahead in this theoretical reflection. There should be greater investment in empirical research that would help untangle the acknowledged complexity in the use of scientific knowledge for policy formulation and implementation (Almeida and Báscolo, 2006). The limitation of this chapter is the inherent variability of the in-depth interview approach. Differing contexts may have affected the type and depth of data collected, and translation of data from one language to another may have been a source of loss of information and culture-specific nuances (Corluka et al., 2014; Corluka et al., 2015). There could also have been potential bias among the respondents given the background of the researcher (myself). The interviewees may have responded in a way that their ignorance about what 'research' means was not apparent. This aspect has been highlighted as the reflexivity of the researcher from a high-income country that may have induced such bias (Uneke et al., 2012; Mbachu et al., 2016). While acknowledging these types of limitations, it is clear that there should be further research into these areas to overcome these limitations and address the issues revealed in this study.

Chapter 8.   Conclusion

The thesis set out to analyze the health research systems in Uzbekistan from an institutional perspective. The purpose of this study is to contribute to the debate on institutional reforms within public research systems, more specifically the health research systems. Like many other nations, Uzbekistan has made legislative changes to reform its research institutes and funding mechanisms with the goal of improving the performance of their own systems. In order to examine the institutional change within the Uzbekistan health research system, it was necessary to focus on three measurable components: (1) scholarly research production; (2) types of actors and institutions (organizations) in health research system; and (3) policy dynamics (a combination of regulatory and normative elements). The following section discusses the findings from the empirical chapters (section 8.1.1-8.1.3). It then addresses the theoretical contributions (section 8.1.4) and draws overall conclusions from this study through generalizing the results (8.2).

8.1. Synthesis of the key findings

8.1.1.   Interpreting the responses based on research outputs and research producers

The premise of this thesis was that research output is one way to measure health research-capacity and research producers' (including academies, research institutes', and researchers') responses to the health research system. Therefore, historical and structural features of the health research system influence the research producers' research outputs.

The first empirical chapter (Chapter 5) analyzed the research production by examining the absolute number of research outputs and subject areas of study. Further analysis involved factors such as affiliation, language, and home country of publishers. Overall, the study revealed considerable growth of publications in the Uzbek health sector over the past two decades. The chapter aimed to identify the major actors in the health research field and the research practices and collaboration patterns among Uzbek authors. Further analysis included articles involving single author and multiple authorships

in both national and international collaboration authorships. International collaboration with Uzbek authors brought cross-collaboration among different institutes in the Uzbek health sector and resulted in publications in higher impact journals. International collaborations varied but included those with partners in the US, Germany, Italy, Japan, and Korea, among others.

Most studies published by Uzbek authors lacked institutional or even departmental collaboration despite the fact that collaborative research among Uzbek authors resulted in publication in higher impact journals. The majority of the publications with Uzbek authors as corresponding authors accounted for 43% (140/321) of the publications and showed great progress in the field, but most of the publication channels were in Russian language-based journals or low impact journals. As mentioned in Chapter 5, the language barrier along with the pressure to "publish or perish" to meet the international standards resulted in researchers choosing quantity (number of publications published) over quality (good quality research). The bibliometric indicators show the historical information about the field of health research and about local changes and conditions. The stepwise growth path in absolute numbers of research projects showed relations to local conditions and events, in particular to research policy changes, educational reforms, and political environment. For instance, while publication practices demonstrate the tendencies are towards publishing in Russian journals with a strong preference for doing research in the basic medical science field, which implies path dependent practice. The publishing activities also show evidence of gradual changes in adapting to new guidelines. The bibliometric analysis revealed smaller shifts in the research focus related to international donor-funded projects. Case in point, maternal and child health as well as HIV/AIDS/tuberculosis related topics were among the topics that were increasing in publication numbers in peer-reviewed journals. This is perhaps more relevant for low to middle-income countries where areas of research funding are dependent upon donor funds (World Health Organization, 1996; COHRED, 2007). Mostly, this suggests that the bibliometric indicators are useful for analyzing the developments of research areas in the health research system as demonstrated by other country cases (McKee et al., 2012; Boyce et al., 2015; Santoro et al., 2015).

In regards to the international collaboration front, bibliometric study in peer-reviewed journals demonstrated the vulnerability of Uzbek researchers in taking the initiative regarding research directions and research design, implying the North-South power dynamic that exists in scientific collaboration. As Smith puts it, "Research is not an innocent or distant academic exercise but an activity that has something at stake and that occurs in a set of political and social conditions (Smith, 1999), p5)". Taking into account Smith (1999)'s argument, Uzbekistan is another example where research activity is bound by political and social conditions. Research collaboration – whether formal or informal, and whether driven by institutions or individuals – is expected to generate scientific papers in national and international journals that involve as co-authors both Northern and Southern researchers (Collyer, 2016). Jointly co-authored papers between the North and South show as evidence of strengthening research capacities. As Collyer (2016) argues, even stronger evidence of research capacity would be a research publication authored solely by southern researchers. Therefore, the implications of power dynamics (i.e. processes of indirect control exerted by the north over the south) were evident in the international collaboration of research where more authors from western countries were corresponding authors compared to the Uzbek authors based on the findings from Chapter 5. Other forms of power dynamics, such as publications in which authors from industrialized countries failed to acknowledge collaborators from developing countries (Dahdouh-Guebas et al., 2003; Boshoff, 2009) was not evident in the case of Uzbekistan bibliometric study. However, bibliometric analysis did reveal emerging issues that burden Uzbek researchers about making their research visible which are elaborated in following sections.

The pressures to modernize science and move towards the global norms and rules regarding productivity in scientific fields in Uzbekistan have pushed authors to publish in low quality or predatory journals. This tendency has been explored in Turkey, where Önder et al (2008) examined research productivity legislation changes due to the globalization (modernization) of science and its impact on publication activities (Önder et al., 2008b). The study showed great progress in absolute quantity but questioned the quality of research and choice of publication channels by Turkish scientists. The choice of which journals to publish and reactions to the changing external environment brings much needed awareness to research ethics and in research quality. More specifically, this

discussion focuses on the effects of recent (2012) legislative changes[54] in researcher qualification that have shaped public research practices and the micro-politics of research producers' responses in terms of their research output. Research producers (at both the individual and organizational levels) react to such processes of institutional change. The results indicated that research practices from Soviet times have become deeply rooted for more than five decades. While the research policy changes in 2012 set the direction towards global norms with the reforms' agenda geared towards research performance (such as publishing articles in peer reviewed journals with impact factor—or IF—), the implementation process may not produce the intended results. Based on the feedback session with the researchers at the Tashkent Medical Academy in Uzbekistan, it was clear that only a few of them were aware of appropriate journals. The feedback geared more towards the challenges of producing good research results and difficulties in complying with guidelines. The researchers said:

> We do not know what a good journal is. What is the exact meaning of IF? How does this matter? We want to produce good results but we lack good diagnostic methods or information or even infrastructure. We need better guidance. (Based on feedback discussion with medical researchers and doctors at Tashkent Medical Academy, Nov 2nd, 2016)

While the younger generation of researchers who need to meet the requirements of the new legislation expressed concerns, the senior researchers at such institutes tend to continue doing business–as-usual or reject new approaches to research. The responses from the research institutes that have been working since Soviet times seemed to invoke the tradition and legacy that all of their work is top quality and that nothing was in need of improvement. This of course was more prevalent with research institutes less exposed to international collaboration than those who frequently sought out collaboration with international partners (Observation notes Oct. 27, 2015). All of these reactions to the changing system are strategic responses that are situated between compliance and rejection. The reactions are the result of both internal and external pressures and motivations of researchers (Fig 8.1).

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[54] The legislation requirements include publishing in English among other languages and articulated publishing expectations such as designated peer review journals.
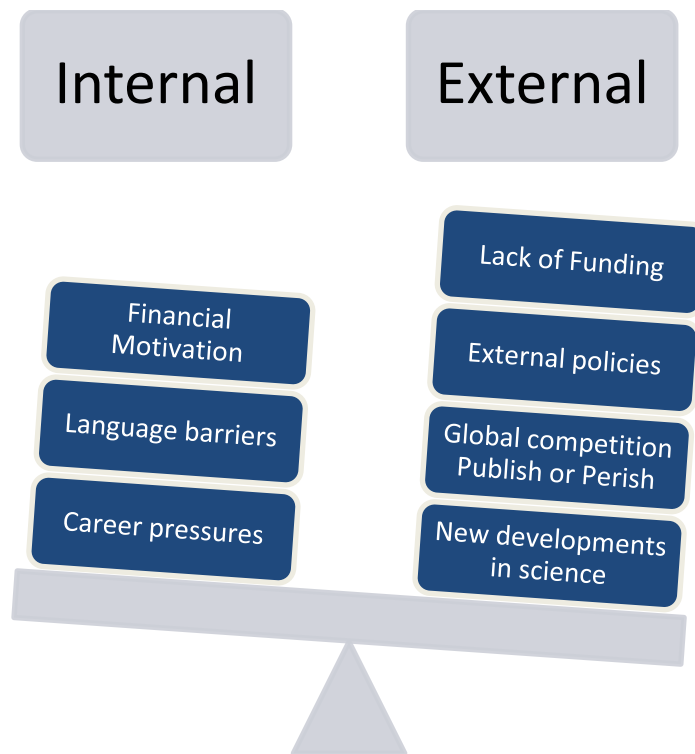
Figure 8.1 Researchers' internal and external pressures (modified from (Kyvik, 2013; Zalewska-Kurek, 2016)

Researchers in general strive to balance the multiple expectations of teaching, research, and administrative burdens and at the same time keep track of new reformed legislation on degree qualifications and assessment systems (Linkova, 2014). Therefore, the research output, as part of this response, results in researchers maneuvers across publishing in spurious journals and creating outputs that 'count' and yet have little merit, such as abstract submissions to international conferences or Uzbek patents. Linkova has discussed such practices in the case of the Czech Republic legislature's revisions on research productivity. As Linkova (2014) puts it, these practices clearly show that researchers are strategically adapting their behavior to the changing conditions, seeking ways to continue to do what they have been doing while still meeting the new demands (Linkova, 2014). The guidelines that have been established in order to improve their practice have left them on shaky ground, not knowing quite how to interpret things, which results in researchers having to negotiate between compromise and challenge, negotiations that sometimes involve questionable ethical issues (Wall and Overton, 2006; Linkova, 2014; Okonta and Rossouw, 2014).

Yet without a gradual and appropriate introduction to research integrity and to building research capacity, Uzbekistan will soon face difficulties in the Uzbek health research system. Like many other governments, that of Uzbekistan has introduced different strategies for benchmarking science policy to promote global competency and international visibility. As with the implementation of the recent Bologna system, the emergence of a regulatory evaluation scheme for faculty research productivity that measures very concrete outcomes such as publications in international impact factor publications and international patents and other applied results, has become a significant measure of scholarly output. Soon this will be reflected in the health research governance of Uzbekistan and will apply to peer judgments, individual performance, and the competitiveness of individuals' and institutions' research output. This will surely put stress on and have unintended consequences for those who produce research in Uzbekistan. Implementing a long-term strategy to strengthen research capacity as well as advocating and training the researchers of significance of research integrity as well as new skills in research methodologies are necessary steps for better quality research management.

8.1.2. Recreation and competence - Mapping the capacities of health research systems

While the quantitative results revealed major research producers, strengths and weaknesses in research capacity, and research communication issues, the results were not so good at explaining the perspectives of research producers (both at the individual and organizational levels) and of the research users, nor of research communication and use, nor of how policies govern the research production process. Consequently, the empirical findings in Chapter 6 focused more on research capacity aspect of Uzbekistan health research system.

The past Soviet practices of science management, especially those related to the institutional arrangement, helped to explain the current features of Uzbekistan's health research system. The Uzbek research system maintained most of its Soviet-era institutional arrangements as far as the organizational aspects of research were concerned. For instance, the research/academic structures and human resources that were in place before independence continued even after. Some of the specialized

research institutes have carried on the same functions since 1923 (Refer to Table 2 in Chapter 6). These research institutes and academies were supervised under the Soviet Union's Academy of Science in Russia whose centralized management determined the funding and scope of the research at these centers (COHRED, 2002). There had been little progress in reforming the regulatory and normative framework for structural organization of health research systems, and this resulted in research institutes and academies that were duplicating one another's work, which understandably raised concerns about research efficiency and management (UNESCO, 2015b). Based on the findings, Uzbekistan separated the functions of teaching (in universities) and research (in specialized research institutes), as practiced during the Soviet era. Under the aegis of the Ministry of Health, there are total of 33 specialized research institutes, educational academies, and specialized centers that reportedly conduct scientific research. With the exception of RISHOD (which was the partner organization of the capacity building project), the six case study research organizations were selected based on a snowballing technique, and on their willingness to participate in the interviews.

The empirical findings based on research organizations and individuals found various issues of health research system that have shown path dependent traits. The historical insights on 60 years of Soviet management have shown how organizational structure, funding mechanisms, postgraduate education, and research communications all influenced the current practice. On the educational front, the slow transition from the Soviet graduate system to the Bologna system created both positive effects in advancing education to meet international standards but also negative effects by creating language barriers and an unsystematic introduction to a new education system without exposure to international research skills and methods. This response was in line with other post-Soviet country settings, such as Russia's medical education system (Kuhlbrandt and McKee, 2013; Platonova and Semyonov, 2014; Denisova-Schmidt et al., 2015).

The research funding also stayed mainly under governmental supervision without much private funding involvement from the health sector. The Ministry of Health made the key decisions on the scope, budget, and priorities of health research. Such hierarchical management was likewise traced back to the past management style before independence. Although the national grant system initiated in 2006 increased

competitiveness and moved away from the Soviet past; based on the findings from case study organizations, the research scope and funded projects were less different from the past funded projects. For instance, despite the respondents stating that the researchers were able to choose their own topics of research based on the national grant scheme, the themes of funded research were rigid and centered on certain disease conditions and basic research methods that had been standard practice before independence. The findings suggest that Uzbekistan's public science system provides little motivation for reputational competition for either research institutes or universities. The responses from the researchers have shown how the public research system has affected individuals' intellectual research goals and collaboration between institutions to work on common problems. This results in less diversity and more barriers for new research approaches. The lack of diversity in research methods and the impact of past Soviet practices have also been argued to deter the advancement of health science in the Russian context (Markusova, 2012; Jsrgin, 2013).

8.1.3. Implications of research policy and decision makers

The third empirical chapter (Chapter 7) focused on policy and views of the policy makers. Based on the responses of the policy makers and the researchers, there was a mismatch between respondents´ understanding of research and how executive decisions were made by the research users. The purpose of analyzing narratives of decision makers was to understand the research governance dynamic within the health research system of Uzbekistan. Producing scientific research involves time, investment, and finances to design, conduct, write, peer review, and publish (Lavis et al., 2010). Each step of research involves various long term strategies of planning, starting with the education and capacity building of scientists and extending to educating and advocating for research use and data integrity (Orton et al., 2011). Scientific evidence provides valuable insight into the issues of the society to improve the health of the population. However, even if the researcher packages it well and summarizes it appropriately for the right policy maker, this connection rarely occurs (Strøm, 1995; Campbell et al., 2009). There are political forces, competing agendas, and bureaucracies that take place in policy making (Hyder et al., 2011; El-Jardali et al., 2012; Walsh and Lee, 2015).

The policy makers narrated the everyday challenges in decisions making everything from small legal amendments to large-scale reform. Based on the legislative environment and the narratives the decision makers offered, it is worth noting that even the decision makers may not have the necessary skill to analyze the information that researchers have given them in order to be able to apply it to actual policy. This is perhaps due to the fact that not much has been done towards strengthening the overall health research capacity and the governance aspect of health policy (World Health Organization Regional Office for Europe, 2016). This also explains the conflict of understanding in research definition between researchers and policy makers. Even the disconnect between national researchers and their policy makers and the lack of communication between the two groups partly explains the mistrust that has formed between the two groups. Mutual training of scientists on research communication and training of scientific evidence-based policy is necessary for researchers and decision makers alike.

8.1.4. Strength of the institutional approach to analyzing health research systems

The following section examines the extent to which institutional theoretical perspectives used to examine health research systems. The findings explored the implications for theorizing about institutional changes within the research system. This was to overcome the limitation of international health studies focusing on evaluating health research capacity with a lack of insight on the responses to the national political trajectory since Uzbekistan's independence from the Soviet Union. The broader social, historical, and institutional framework proved useful in analyzing the health research system. This elucidated how actions of decision makers are within the boundaries of the system.

Historical institutionalism

The historical development of the health research system in Uzbekistan highlighted the context of changing research policy paradigms and the path dependencies. First is the inheritance from Soviet science management. Second is the academic research culture where scientists defend their interests and often their legitimacy. The analysis of the health research system of Uzbekistan showed that the institutional approach helped reveal both the stability and the changes of the research systems which

mirrors Heinecke's study on Polish research systems (Heinecke, 2016). The observations based on the case study demonstrated the advantage of the historical institutionalism perspective to frame health research systems.

The path dependency concept fit well in analyzing the health research systems of Uzbekistan, particularly in explaining 'Post-Soviet Persistence.' In terms of research practice and culture, inertia in public sector research resorted to the Soviet legacy and history, which made change harder to implement. Institutions typically develop repeated patterns of behavior that may persist for decades not because they are the most efficient or equitable, but because the transaction costs of change (such as the financial cost of changing infrastructure, or the social cost of challenging existing norms and interests) are too high (Arthur, 1994; Schienstock et al., 2007). The formation of the legislative structure and funding scheme of a particular structure and organization of health was one of the distinct features of the Soviet health research system. This included specific forms of research organization, such as specialized research institutes that centered on diseases or topics with a research ideal based on progress along disciplinary lines and collegial recognition. The somewhat permanent structures, roles, and processes for long periods (even when opportunities for alternatives existed) hindered the development of health research systems.

The publication patterns also addressed the path dependency aspect. Findings revealed a couple of core publication patterns and institutional practices. Analysis of publications from 1991 showed strong dominance of Russian language journals as a choice of publication channel. Even in peer-reviewed journals, the publication pathways showed a strong tendency to submit research findings to Russian language-based publications. This tendency may be a path-dependency left over from Soviet times, when many scientists and researchers were part of the Soviet Union's Science and Technology system. The interviews from researchers also gave insight into the collaboration patterns as well as researchers' penchant to seek new knowledge in research trends. The Uzbek researchers often mentioned respective Russian scientific research institute or journals of Russian language-based outlets published by post-Soviet countries. Therefore, the institutional and personal links from Soviet times remained even after independence. This positive feedback and path dependence does not mean that this phenomenon is negative.

If effective institutions and organizations utilizes these avenues, it can create a positive cycle, such as incentives that motivate behavior with development (Schienstock et al., 2007). However, Uzbekistan missed an opportunity to establish this feedback in a more positive direction.

As the results show, centralized health sector remains without much movement towards decentralization. The research organizations and institutions were set up the way that as they had been in the Soviet past and the researchers followed that earlier research culture and past practices without much question. That they did so stems from various factors. First, is the inability to modernize the structure of their research and health systems in spite of the progress in the governance and legislative systems. Second, the remaining effects of the cold curtain or the iron curtain (Vlassov, 2000; Vlassov and Danishevskiy, 2008) were a major stumbling block in the health sector of Uzbekistan as there wasn't much engagement by external actors (e.g. international donors) that could have influenced the improvement of the health sector (Markowitz, 2016). Third, lack of political will in investing in health research (McKee et al., 2012), difficulties in the implementation of policies and regulations, and weak monitoring systems (World Health Organization Regional Office for Europe, 2016) reinforced inefficient behaviors that might have created a positive feedback loop had they been revised. Fourth, existing practices and norms influenced organizations and their ability to strengthen health research capacity by creating a less favorable environment for local engagement and learning. This mirrors arguments made by various scholars on the scientific research system of post-Soviet countries that highlight the institutional stagnation in academic research governance (Morgounov and Zuidema, 2001; Jabłecka and Lepori, 2009; Heinecke, 2016; Karaulova et al., 2016a).

Sociological neo-institutionalism

Hollingsworth argues that institutional environments influence the research organizations' culture and productivity. Based on his argument, centralized hierarchical institutional environments exert influence on following aspects. These include (1) the appointment of scientific personnel of research organizations; (2) determining existence of a particular discipline in a research organization; and (3) level of funding for research organizations. Institutional environments further influence the level of training necessary

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for a scientific appointment (e.g., the habilitation); and scientific entrepreneurship (e.g., the existence of norms of individualism that socialize young people to undertake high-risk research projects) (Hollingsworth, 2000; Hollingsworth, 2002; Hollingsworth et al., 2006). Similar arguments were made by Whitley, who argues that public science systems that are likely to be associated with distinct patterns of technological development have centralized decision making within employment organizations (Whitley, 2003). Both of these authors argue that the stronger centralization, hierarchy of research organizations, and organizational segmentation is likely to lower the intellectual pluralism and flexibility. What this means is that weak institutional environments lead to greater diversity, and flexible structures as well as organizational cultures eventually lead to scientific breakthroughs (Hollingsworth et al., 2006) (Fig 3).
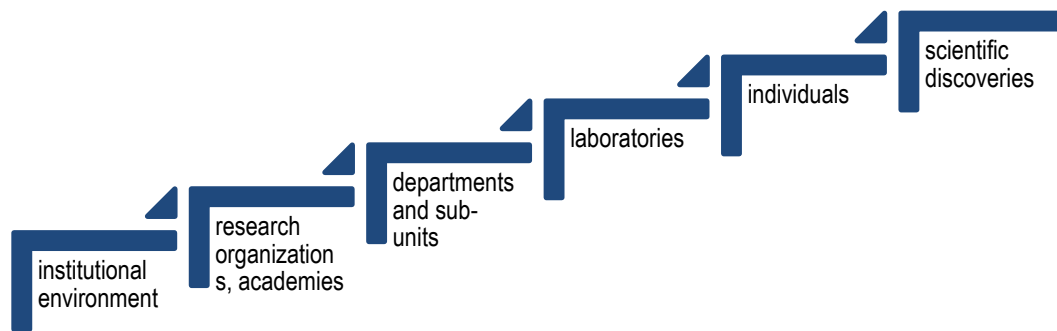
Figure 8.2 Co-dependencies of institutional environments leading to scientific discoveries from (Hollingsworth et al., 2006; Hollingsworth, 2008)

Uzbekistan can be categorized as a society in which external controls over organizations are highly institutionalized and strong, according to Hollingsworth's arguments on institutional environment (Hollingsworth, 2008). The bibliometric indicators, and more specifically the publication patterns, showed that during the early 1990s the strong areas of research were in basic science (i.e. biochemistry, microbiology, physiology, and pharmacology), for as much as Soviet health science was strongest in the same areas. This could be due to the lack of institutional diffusion in the Uzbek health research system, that is the result of academic practices of thematic segregation of research in the Soviet era, which fostered disciplinary divisions, narrow specialization in training, and limited collaboration (Graham, 1992; Rabkin and Mirskaya, 1993; Karaulova

et al., 2016b). This trend later took a moderate turn as research funding sources from international donors invited diversity of disciplines. The newly introduced research topics and methods involving international actors implied a lack of national drive in the kind of funding or investment that is necessary to improve and advance science.

Yet lack of funding cannot be the sole factor that contributes to the isomorphism of the institutional environment of the health research system in Uzbekistan. There has been less variation in the structure and behavior of research organizations of health research systems in Uzbekistan since independence. Hollingsworth argued that the stronger the institutional environment, the greater the organizational isomorphism and the stronger the pressures for organizations to converge in their behaviors and cultures (Hollingsworth, 2008). Conversely, the weaker the institutional environment in which research organizations have been embedded, the greater the variation in the structure and behavior of research organizations. Based on the empirical findings, Uzbekistan has demonstrated several instances of hierarchical authority, such as the decision-making process about research programs, decision making about the number of personnel, control over work conditions, and budgetary control of the research institutes in the education and science sectors. Bureaucratic coordination of research augments on to this process as research organization showed high levels of adherence for rules and bureaucratic procedures.

Over the course of time, however, these institutionalized routines will make it difficult to welcome highly creative sub-units or initiatives in science (Hollingsworth et al., 2006). For instance, in Uzbekistan's case the state-driven economy has led to shrinkage in industry's autonomy as well reduced links with the academy. Industries may not benefit from the restrictive intellectual entrepreneurship in a hierarchical environment. For instance, pharmaceutical industries in the health research system depend on knowledge of physical and biological phenomena studied in academia as other countries have more freedom in the case of Taiwan (Chen, 2014). The institutional capacity from the health research system showed that lack of pluralism and high centralization negatively guided the production of knowledge. The institutional isomorphism has been helpful in explaining why there was a convergence in academic disciplines as well as organizational isomorphism.

Rational choice neo-institutionalism – research governance and principal agent interface

The principal agent theory was helpful in exploring the relationship between policy makers and researchers within the health research system of Uzbekistan. Braun and Guston (2003) argues that there are four types of problems that typically occur in principal-agent relationships (Braun and Guston, 2003). First problem is having researchers to do what politics wants (problem of responsiveness). Second issue concerns with choosing the best scientists (problem of adverse selection). Third issue is making sure that researchers do the task delegated to them in best way possible (moral hazard). The final issue is deciding on priority-setting and decision making in research (Braun and Guston, 2003). This approach of principal agent relationships helped to explain the issues that emerged from decision makers and the researchers in Uzbekistan.

The findings revealed that the first issue of researchers' responsiveness as linear with little academic autonomy or bidirectional influence (from researcher to government and other stakeholders). Hence, there was no room to modify the research agenda or priorities. The researchers followed the government's directives as the government decided on research priorities and research funding and the research priorities. In general, the delegation of research in the health research system concentrated on the scientific elite, i.e. influential scientists at universities and national research councils. Within the health sector of Uzbekistan activities from independent think tanks or other entities were non-existent. The narratives of the members of parliament did not observe this lack of diversity in those producing research as being problematic. This structure of having research delegated and executed by academic and scientific elites of the nation remained steady with no indications of anticipated reforms at present based on the legislative review of the 2017-2022 national strategy.[55]

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[55] Source: Decree President of the Republic of Uzbekistan on the Strategy for the Further Development of The Republic of Uzbekistan (Collection of the legislation of the Republic of Uzbekistan, 2017, № 6, Art. 70.) www.lex.uz accessed on Nov. 10, 2016
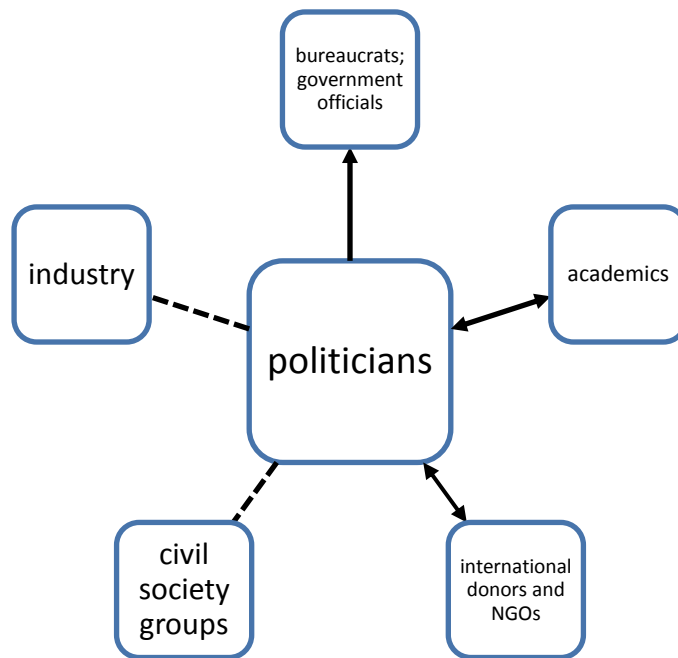
Figure 8.3 Mutuality in linkages between major players of the health research system in decision making, modified from (Field et al., 2016)

Further inquiry into this relationship showed that there was also little advocacy involvement in formal and ongoing relationships between decision-making community and civil society groups at the local level (Fig 8.2). Formal relationships existed only where existing structures were established by well-known NGOs, such as Doctors without Borders (or Médicins Sans Frontières/MSF). MSF facilitated the relationship between the NGOs and government and was considered to have high levels of mutuality (Del Valle and Healy, 2013; Johnson, 2014a).

Decision makers did not perceive the second issue (of adverse selection) as being problematic. The narratives of the decision makers on their policy - making reveal that the information gathered for their decision was mainly based on their own networks of specialists as well as a council of specialists that were known as the experts in the field. The selection or the convening of the committee was also both informal and formal. Even though the formal process was also at times *ad hoc* based on the issue of the legislation

and policy that needed attention[56] . Based on the responses of informants, there were mutual informal relationships among senior health bureaucrats, senior academics, and politicians, in which politicians, for example would telephone the other for advice or an alternative perspective on an issue[57]. These relationships often began as formal relationships, for example with one parliamentary member being a senior academic before being elected, a relationship that later was sustained by mutuality arising from trust, respect, and exchange of information. Responses of the parliamentary members showed that each of them (and many others also) had their own informal relationships with trusted academics[58].

The moral hazard was a problematic issue due to limited insight of the government in decision making in universities and research councils. This relates to the government's desire that science should contribute to solving these problems[59]. Based on the responses, the distrust of national statistics and in the quality of research created barriers in decision makers and government in utilizing research. Yet this problem is multi-dimensional, as this has to take into account the individual instances, starting with the education of researchers and going all the way to the national level and the overall legislative framework on research policy.

So far, the policy measures taken were to improve accountability. The national scientific council has focused its efforts on the assessment process of proposals in the calls for funding. The government also introduced central planning in the form of research accountability by showing the effectiveness of the research through regular progress reports to government (e.g. to the Ministry of Health and the National Scientific Council). This process also applies to government grant-funded projects meant to increase competitiveness among the researchers. However, the criteria for research effectiveness

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[56] this information was based on observation notes taken during the interview with P2; Sep 16, 2015; Oct 17, 2015

[57] this information was based on observation notes taken during the interview with P2 Oct 17, 2015; Oct 17, 2015

[58] this information was based on observation notes taken during the interview with P2 Oct 17, 2015; Oct 17, 2015

[59] this information was based on observation notes taken during the interview with parliamentarians Oct 17, 2015

and application of the research is not clear, based on the researchers' responses[60]. Rather this approach has created a process of bureaucratization of research that results in checklists of items that researchers must satisfy administratively to be accountable for their research, with limited consideration of the quality of the research or its application[61]. Hence, this creates a vicious cycle of producing research with questionable quality for the intended use (such as knowledge sharing, or as an information source for decision making). Once decision makers question the quality of the research thus refers to other sources (such as international donor-funded research projects or international policy interventions), while researchers are doing research as their own business as usual.

The fourth type of problem (of decision making and priority setting) was the lack of transparency in decision making, not only in the research arena but also in formulation of health policy in general. Based on the responses of parliamentary members, the democratic decision-making process is quite young and yet to mature in the political setting of Uzbekistan. Thus, it is difficult to expect transparency in decision-making processes at the national political level, let alone in the arenas of education, R&D, and health policy. There are, however, efforts underway to improve this; via official legislative reform the government's response was to strengthen the role of stakeholders in the decision-making process of science funding, namely by establishing a "council" for the national science system that controls the funding decisions. Further interventions were made by international agencies such as UNDP to strengthen transparency in decision making and encourage the use of evidence for policy making in general (United Nations Development Programme, 2014b).

Table 8.1 '**Principal Agent issue on health research system governance: Case of Uzbekistan applied from Häkansa 2013 framework of principal agent (Håkansta, 2013)**

Issue type	Issue	Solution
Having researchers do what politicians want (an issue of responsiveness)	Hierarchical command of research priority; research execution by established academies and specialized research institutes	Not perceived as problem

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[60] this observation is based on notes taken during interviews with researchers Aug 20th, 2015

[61] this observation is based on notes taken during interviews with researchers Aug 20th, 2015

Choosing the best scientists (adverse selection)	Scientific elites chosen based on networks of parliamentary members and known affiliation with ministry of health; academic council; ad hoc selection	Not perceived as a problem
Making sure that researchers do the task delegated to them in best way possible (moral hazard)	Mistrust of research information and statistics; reliance on international donor agencies; reference to international practice	Education reform; capacity development of researchers; policy reform on academic degree accreditation
Deciding on priority setting and decision making in research	No transparent public science system; no transparent mechanism in place	UNDP capacity development project on transparency for policy decision making ; establishment of academic council

In sum, current health-research system governance is an accumulation of processes from reforming public policy (Table 8.1). The above schematic suggests that although the researcher and the state should form a mutual exchange dynamic, in reality there are gaps in this relationship. Furthermore, the issues raised from this principal-agent perspective showed that the reform in health research system is a complex political task that involves not only internal political dynamic but also international standards and expectations from diverse stakeholders. The responses from both the state decision makers and researchers show emerging signs towards more emphasis on the usefulness of evidence-based policies that could lead to future investments in research development. The narratives from policy makers demonstrated that there is a movement for a more democratic organization of the public health research system.

Overall assessment

The empirical findings based on the analytical framework stemming from different perspectives of institutionalism suggest that institutional theories were useful in aligning various aspects of health research systems and explain its status. This evidence points towards the argument of path dependency, isomorphism, with fragmented governance mechanisms of principal agent research dynamics. Table 8.2 summarized the overall assessment of the health research system. The outputs indicate that research in Uzbekistan has grown in volume over the past 20 years with an annual growth rate of 3.28%. The high quality of the research publications, in terms of citations, showed that the

corresponding authors affiliated with academies were producing more heavily cited research than other research-producing entities such as specialized research institutes. One of the reasons behind this could be the active international collaborations that academies have been initiating compared to other organizations. The reform attempts at innovation and learning were sporadic. For instance, promoting competitive funding at the individual level for scientists at research institutes to encourage innovation was an attempt to change the norm. However, this attempt resulted in limited changes in research practice and behavior as demonstrated by some of the researcher responses, which seemed to be due to the endurance of old normative institutions (DiMaggio & Powell, 1991; March & Olsen, 1989). The lack of new researchers coming in to research and development coupled with the aging of existing researchers further aggravates this situation (Table 8.2).

The number of research institutes and structures as well as organizational hierarchies showed path dependent traits. Although the research scope was wide, the focus was more on basic science in the health field. Tashkent was the main research producer based on the bibliometric analysis with implications to spatial temporality. Other features of the health research system were aversion to reform and the hierarchical governance structure within the research system (Tab 8.2). Hence, institutional theory was useful in explaining some of the researchers' behavior from specialized health research institutes. While the responses of researchers indicated that existence of collaborative scientific consultations with business industries (e.g. the food industry and the telephone industry), the legislative framework of centralized management has not been active in providing regulatory or normative institutions to support relevant research for the private sector. The delayed policy response relates to the impacts of social and political transitions. The lack of research production coupled with the lack of focus in setting priorities in health implies Uzbekistan has unstable capacity to respond to changes in governance.

Table 8.2 Overall assessment of analytical framework using institutional perspective: Case of Uzbekistan framework applied from (Karaulova et al., 2016b)

Indicator	Component	Uzbekistan health research systems
Outputs	Volume	Publication output: 321 research outputs from 1991 to 2015

		Growth: 3.28% annual growth of research production per year (based on WoS and PubMED data) refer to Chapter 5.1.1
	Quality	Educational entities such as Tashkent Medical Academy and the Uzbekistan Academy of Science produce high quality research and engage in active international collaboration
Re-creation	Rejuvenation	Lack of new researchers. Rapid aging of research personnel.
	Learning and innovation	Reform attempts are sporadic.
	Path dependence	Path dependency observed organizational hierarchies, decision-making processes.
Centrality	Subject centrality	Wide research scope, with focus on basic health sciences.
	Spatial centrality	Tashkent is the main regional research producer.
Competence and autonomy	Collaboration and diffusion	Less diffusion. The most-cited institutes in research publications typically also engage in international collaboration.
	Institutional agency	Isolationism, aversion to reform. Internal agenda setting. Hierarchical governance structure.
	Resources	Centralized agenda-setting and funds allocation by National Academy of Science in Uzbekistan
Principal agent relations	Research to policy	Hierarchical command of research priorities; research execution by established academies and specialized research institutes
		Scientific elites chosen based on networks of parliamentary members and known affiliation with the ministry of health; academic council; ad hoc selection

Other theoretical approaches to the health sector

The limitation of the institutional approach was that it did not help to explain use in policy and research communication dynamics within the health research system. With regards to research about policy, myriad studies have explored the politics and window of opportunity aspect of policy making in policy theories, and can therefore be useful in understanding evidence use from the perspective of describing policy change (Trostle et al., 1999; Lomas, 2000; Hanney, 2004; Shroff et al., 2015). Grundy's argument that health systems act as a passenger being driven by the politics and history of the nation is also applicable to health research systems (Grundy, 2015). Grundy (2015) further points out that traditional models of public health management have focused on technical solutions such as disease intervention and health insurance policy, rather than focusing on political and historical determinants of health. Applying Grundy (2015)'s argument to the health

research systems, similar case can be made as the main discourse in both academic and international reports on building capacity in health research systems. So far these approaches have been focused on educational training and partnerships from individual, organizational, or national scale with marginal concern for the country's political and historical developments in health research. The theoretical lens from political science (including history and sociology) are key analytic tools to examine health research systems, as it opens up new avenues for discussion and analysis (Atkinson, 2002; Grundy et al., 2015; Cullerton et al., 2016).

8.2. Overall conclusion and generalization of results

In conclusion, the Uzbekistan health research system was and in some respects still is an under-explored research topic. This thesis aimed to enrich this line of literature by presenting empirical findings of how the health research system is structured and organized based on both quantitative and qualitative findings on those health research systems. The bibliometric findings displayed a snapshot of science disciplines, journals, organizations (including universities), and of the most frequently cited scientists etc. Juxtaposing bibliometric output indicators over time was helpful to understand the development of research topics and trajectories of each institutes. Uzbekistan has now experienced 20 years of independence. The lowest points in research production during that period were right after independence and the period during the political insurgence. These low points clearly suggest that development phases of any health research system should take into account the political and economic conditions of the nation in question.

From a holistic point of view, this thesis provided insights into tensions facing Uzbekistan academic research practice, more specifically Uzbekistan's process of adopting research standards from the West. Nevertheless, this is also to point out that while Uzbekistan to some extent adopted the neo-liberal doctrine after the Soviet Union (1991), the changes were not radical nor instantaneous, and changes in research practices and performance are taking place at a much slower pace than the political changes. The slow changes in Uzbekistan economic policy towards market orientation has impacted education, R&D, and health, for it was only recently that research knowledge was considered to be a commodity to move the country's course to the international arena

(World Health Organization Regional Office for Europe, 2014). One such realization translates into recent policy changes that Uzbekistan has implemented to improve the quality of scientific research done in Uzbekistan. As mentioned in the previous chapter, Uzbek researchers are now required to pass foreign language tests (such as English) and publish in approved listings of foreign literature to fulfil criteria for obtaining academic degrees[62]. This change in policy inevitably translates into a desire for a knowledge economy or a knowledge-based society in which the country cares about how much scientific knowledge its people create in the form of research papers in international databases, such as the Web of Science. These changes in research policies now requires new sets of fulfilment criteria that encourage scholars' research performance and productivity. However, up until now scholars have been pushed just to get anything published, not matter what or where, that they have tended to take the easier route of approaching less rigorous journals or even quite spurious ones. These same issues have been raised recently in Kazakhstan, India, and Oman (Al-Adawi et al., 2016; Kana, 2016; Groves, 2016; Yessirkepov et al., 2016). Since such instances account for up to of publications, there is not much space left for more complicated and cutting-edge research. Yet there is also valid criticism being made that if the emphasis is placed on international dissemination of scientific knowledge and rewards are given on that basis, this could result in detrimental effects as researchers will be less focused on national development and solving critical problems in their own national contexts (Wight, 2008; Borda-Rodriguez and Johnson, 2013). There should be some balance in promoting and rewarding research that responds to one's own nation's objectives and others, and to publishing in one's own nation's/region's journals in one's own language, and in international journal that typically use English as the mode of communication.

The findings from the case studies of research organizations and the insights from key informants revealed the tensions that surround policy changes. For instance, the respondents were aware of the need for improving research management and human resources, but progress in making these changes is slow. These concerns have been expressed by the national level officials and similar suggestions have been made by the WHO (World Health Organization Regional Office for Europe, 2016). Yet, voices that

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[62] Source: Resolution of the Presidium of the Higher Attestation Commission under the Cabinet of Ministers (the registered MU of 25.03.2013 № 2441www.lex.uz accessed on Nov. 18, 2016

argue for broader engagement of researchers, policy makers, and other interested parties and for open discussion is minimal. Apart from completing required research projects with government funding, most academics and organizations have seemed to neglect other values and norms that improve the performance and organization of research. These values include increased awareness of research integrity as well as increasing incentives and roles for academics and faculties in research management. All this demonstrates that in Uzbekistan the health research system has been formally structured and organized, while the research management aspect demonstrated limited maturity in active engagement and open discussions.

The findings also indicated that the changes in the research system is not linear. The mix of the lingering Soviet legacy with new forms of management is evident, as are complex interfaces among research producers (both at an individual and at an organizational level). This is where the theoretical perspective and the analytical framework of this study proved useful: It identified factors and processes that shape the development of the health research system. Regarding the Uzbekistan health research system, the institutional change in the current state happened when detailed plans (whether the result of international agencies' suggestions or of locals') were dictated from the top down. The results of this study revealed that these top-down institutional changes and shifts did not create completely new values and ethics but rather altered the balance between existing ones due to path dependent practices. This follows Lam (2010)'s argument on the "complex dynamics of organizational change that permit the co-existence of contradictory institutional logics" (Lam, 2010), p309). The findings follow the arguments made by many other scholars who have studied the different sectors of the Uzbekistan context (Jarvik, 2005; Ergashev, 2006; Laruelle, 2010; Hakimov, 2016; Hansjürgens, 2016): namely that addressing the Soviet legacy matters in analyzing the current situation. This is perhaps because the elites from the Soviet times and their practices still influence the elites and managers of the health system today.

Research capacity building in low-to-middle-income countries remains challenging and contested (Ager and Zarowsky, 2015; Bates et al., 2015; Elmusharaf et al., 2016; Franzen et al., 2017). The funding flows for global health research are small, as no countries have met the 2% target for health research determined by the World Health

Organization (WHO) (World Health Organization, 2012). Similar challenges such as bureaucratic hurdles, finding the right partners, and coordinating common objectives present themselves to somewhat similar degrees, but perhaps in Uzbekistan these issues need a more careful approach and consideration before initiating such research capacity strengthening initiatives. Organizations in low-income countries such as ministries of health, universities, and research institutes are chronically underfunded, and funding is too often unpredictable and therefore reserved exclusively for short-term projects. Short-term funding creates conflicts with local human resources funding incentives. This is due to consultancy posts work only for investigating short-term objectives at the expense of building long-term projects as argued by Wight (2008) (Wight, 2008)

When it comes to international donors on Uzbekistan, project results showed barriers and challenges. In Uzbekistan, like in other low-to-middle-income countries, the external projects focused on the institutional level. Therefore, the activities were focused on short-term, disease-specific interventions that were did not really consider long-term aspects such as human resources training or education or research development. COHRED's assessment of research capacity initiatives found that although there are a number of funders and research organizations funding the development of the research sector around the globe, the decisions are taken independently, with overlapping objectives but separate governance arrangements (COHRED, 2002; Ahmedov et al., 2007). These difficulties were due to the funding process, which often limited long-term capacity building due to short-term rigid indicators by monitoring and evaluating policies and practices. In addition, common in Uzbekistan's health care sector were much criticized fragmented activities that lacked coordination and cooperation between global donors (Ulikpan et al., 2014). Highest disease burden is not necessarily the focus of aid to global health research efforts, let alone disease characteristics and findings from each specific region. For instance, cancer morbidity in Uzbekistan is high in both genders in the fifth decade of life, but most of the health aid efforts go into alleviating particular favorite disease conditions, such as TB, malaria, and HIV/AIDS. The full understanding and best treatment practices in Uzbekistan, like other LMICs, is limited due to the absence of local research on the local area of need (Asadov and Aripov, 2009).

There is no one-size-fits-all way of maximizing synergies between various actors to strengthen research capacity and the health research system, because local contexts vary case by case. The lesson learned is that even the external experts trying to involve local actors need time, as the need for a project on a particular topic (meaning one related to a specific theme or disease) may not be what is needed for the given context. The research capacity-building projects need to identify the ways in which societies, organizations, and professionals respond and adapt to these challenges. It is appropriate to provide broad strategic goals and principles that apply across all countries. However, operationally speaking strategic plans for strengthening countrywide health research systems need the bottom up approach and the sensitivity to the particular country's environment (e.g. its socioeconomic status, geographic location, and political situation). In other words, there is no uniform prescription for strengthening a country's health research systems. All countries have some components of a health research system that work to strengthen the health system, and it is necessary to strengthen existing components, in that particular country's context. This means having a good understanding of the health research system in a country. Such understanding leads to international, national, and regional strategies for strengthening tailored to the country's requirements. Future research should focus on gaining better insight into in-depth evaluation of researchers and research organizations.

Perhaps the challenge that Uzbekistan has to face is restoring accountability and trust at the bureaucratic level. The evidence suggests that this hiding and masking of realities, whether in statistics or in official reports, was prevalent during Soviet times, when it was used to hide realities and avoid opposition (Anderson et al., 1994; Tolts, 2001, 2008). This aspect is apparently still somewhat prevalent, as the realities of health care from the national news media vs the external media and international human rights groups depict a different picture (Eurasianet, 2011; Saidazimova, 2014a). The cost of health care, which officially is supposed to be available to all free of charge, is actually not (Antelava, 2013; Saidazimova, 2014b). According to an external media report (Eurasianet, 2011), the reality of health in Uzbekistan is much debated, since, for example, HIV infections are on the increase in the rural countryside (Eurasianet, 2011). The civil societies working on human rights, such as the International Crisis Group of Uzbekistan, reported interviews with government officials on the health sector. The external media presented this type of

underreporting of maternal mortality as an effort by the state to maintain its legitimacy and "not to be seen as failing in their responsibility to the people" (Eurasianet, 2011). Such contested realities will be one of the hardest challenges Uzbekistan has to overcome. While the findings from the empirical chapter on policy making showed that policy makers strive to make better legislative outcomes for the population, the trajectories taken so far indicate inadequate attention to the health and social welfare of the nation.

However, as all institutions are constantly changing (even stasis is a state of change itself) in Uzbekistan, there are glimpses of hope about the development of health research in Uzbekistan. With the death of the president, the new president like the new regime will make changes to the government to ensure better policies that will stabilize the government and the new future (International Crisis Group, 2016a). The current president holds hope and promise to the citizens as most of the leaders have shown that they overturn the policies of the previous leader (International Crisis Group, 2016b). Economic and legislative government policies have an effect on other sectors. The decisions made by the hierarchical governance shapes health research system, as it is part of the public sector of society. Uzbekistan has to play major catch up to drive the nation into a more knowledge-based economy. For instance, other countries took charge of their education sector, such as China, where research policy and the changing role of the state brought reforms in knowledge systems (Meek and Suwanwela, 2007) and investment in their higher education policies, particularly science (Meek et al., 2009). The variations in labor markets, educational system hierarchies, state science and technology policies, and other features of national research systems have been argued to affect the development of technologies and products, for differences in the intensity of reputational competition and the degree of intellectual pluralism and flexibility change such development (Whitley, 2003). As such, transparency and trust of integrity in research and data may be the first step towards a commitment to the health of the population. Without necessary information to find potential solutions for the population there is no progress towards better health of the nation.

While drastic changes may not be needed for Uzbekistan to embrace a more profound change in the health research systems, a new regulatory institution should be put in place in terms of university education and promotion that can not only affect

research productivity but also better publishing practices (Cadez, 2013). Values and norms should be changed gradually to result in better research practice and capacity for researchers and research organization, and this can eventually lead to better research systems. The institutional environments of societies change over time, and the changes in the institutional environment may influence the capacity of a society to make major scientific discoveries. For the institutional environment in which research organizations are embedded has an impact on organizational behavior.

Studies that highlight researcher perceptions and behavior argue that adequate attention to research organization dynamics helps to develop a more complete structure for managing research, thereby creating a more effective system for formalizing research behaviors (Martinson et al., 2006; Nguyen and Meek, 2016). Haynes et al., (2011) argue that because of the complexity of the problems identified, these suggestions are easier said than done (Haynes et al., 2011a). The application of these solutions may require not only organizational efforts but also those of the government, research funding agencies, and the whole research community. The challenge here is not only to create and apply new research management practices but also to gain support from the whole research system. This means that the change should occur at a system-wide level and not at an individual organization basis. The dialog between researchers and government officials as well as politicians should start to help researchers to understand the new challenges that they are facing in light of policy change as well as for officials to understand the specificity of conducting and evaluating research in different fields. To find solutions to these inherent problems will require new communication and coordination between local and global partners, ministries of health, academic institutions, as well as local and global funding partners.

What makes for successful conditions and for better research governance and what roles local organizations and institutions should play in the development of those conditions needs further exploration. Therefore, the same research framework has potential applicability for international comparisons in similar geopolitical settings. This could lead to a deeper understanding of variations in health research capacity. These studies could have a broad approach, similar to this one, or focus more narrowly on one aspect, such as the role of health policy paradigms in the evolution of the field, or the

consequences of policy relevance and proximity to policy making for the development of health policy. Much more effort is crucial to understand existing logics so that local actors can self-organize to maximize health research capacity locally.

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Appendix A. Timeline of key changes in Higher Education, Research, and Development, Health (1991-2015)

Political Economic	Health Sector (health systems and health research)	Timeline	Higher Education	Research and Development Sector
		1924-1990 Soviet Rule		
Transition to market economy	Law on sanitary control (1992) Expansion of immunization and communicable disease programming in the early to mid-1990s	1991-1995 Independent state building		Establishment of State Committee on Science Engineering Decree President of the Republic of Uzbekistan No UP 345 from 18.02.1992 years "Education of the State Committee of Uzbekistan on Science and Technology (SCST Uzbekistan)
Transition from unicameral to bicameral government	World Bank starts initiative projects HIV/AIDS 1995		Law on education adopted 1992	
Gradualist approach to reform implementation			Mixed funding formula involving private funding tuition fee introduced 1995	
Uzbek Parliament announced a set of liberalization measures, including the	Law on protection of population (1996)	1996-2007 Authoritarian regime turning point	Stage 1 of NPPT 1997-2001	

reduction of state intervention, and the strengthening of legal protection for business enterprises (1999)				
Rising cost of living, and of corruption, along with continued lack of civil liberties, the support for the president declines.[78] Foreign relations: close ties with United States, European Union, and NATO [79]	The Law N 415-I on Medications and Pharmaceutical Activities of Uzbekistan dated 25.04.1997 constitutes the regulatory backbone of the pharmaceutical industry		Stage 2 of NPPT 2001-2005	Decree of the President of the Republic of Uzbekistan No UP 3029 of 20.02.2002 "On improving the organization of research activities"
Government policies have pushed international donor out 2000s[80]	Law on protection of population affected with tuberculosis Law on donation of blood		Foreign universities allowed to open branches in Uzbekistan, 2001	Presidential Decree, 8 August 2006, on measures to improve the coordination and management of science and technology
	Law on improving sciences Law on reforming tertiary care delivery framework		Westminster, Russian Economic University, In Ha university branch opens in Tashkent 2002	

[78] https://fas.org/sgp/crs/row/RS21238.pdf
[79] https://fas.org/sgp/crs/row/RS21238.pdf
[80] U.S. relations with Uzbekistan experienced a setback in 2005 after the United States joined others in the international community in criticizing an Uzbek government crackdown in the town of Andijon. This contributed to Uzbekistan's closure of over a dozen U.S.-based or U.S.-supported non-governmental organizations (NGOs) Source: Johnson (2014a).

	Health financing in health care	2007-2015 'ad hoc developments' post elections	Stage 3 of NPPT 2005-2010	Resolution of the President of the Republic of Uzbekistan No PP 436 from 07.08.2006 "On measures to improve the coordination and management of the development of science and technology"
Conducting UN sponsored election	World bank project II 2005-2012		Bologna system implemented	
Civil conflict in Andijan	Women and child health project 2005-2012			President of the Republic of Uzbekistan No UP 4059 from 02.12.2008 "On establishment of free industrial zone in Navoi region.
Decrease in foreign direct investment	Tertiary care centers' organization 2009		New program covering 2011-2016 adoption of physical human resources for higher education institutions	
	Presidential decree 2009 on maternal and child health			
	Cabinet of Ministers Decree No. 319, 18 December 2009, on improving the framework for postgraduate medical education			
	Law on prevention of iodine deficiency, 3 May 2007, No. 97			
Gradual involvement of international development	Cabinet of Ministers Decree No. 145, 21 May 2009, on the organization and functional framework of tertiary care centers			

	German Reconstruction Credit Institute (KfW) on equipping regional multi-specialty centers are one recent example of major external assistance programs. Bilateral development agencies from the United States, EU member states, Kuwait, Korea, and Japan are other major international donors in the health sector. Loans from international agencies World Bank and ADB loans for primary care and maternal and child health, Islamic Development Bank for cancer services		
	Presidential Decree No. 1652, 28 November 2011, on the next steps of health reform		Cabinet of Ministers Decree No. 365, 28 December 2012, on improving postgraduate education and science
Gradual foreign direct investment participation	Welfare Improvement Strategy 2008–2010 and 2013–2015 Law on restrictions on sale and consumption of alcohol and tobacco, 5 October 2011, No. 302		Open policies for pharmaceutical development

Gradual transition to free market economy with strong state oversight. Concerns regarding human rights issues, transparency, corruption, and governance	Law on prevention of micronutrient deficiency, 7 June 2010, No. 251 Ratification of Framework Convention for Tobacco Control, August 2012 Presidential Decree No. 1652, 28 November 2011, on the next steps of health reform Cabinet of Ministers Decree No. 91, 29 March 2012, on capital investment plans in the health sector and reforms of the organizational framework Project on Improvement of Mother and Child Health Services, EU grants, 2009–2012 and 2012–2016 Presidential Decree No. 4456, 24 July 2012, on reforming the framework for the training of scientists and the granting of science degrees Presidential Decree No. 1652, 28 November 2011, on the next steps of health reform Cabinet of Ministers Decree No. 91, 29 March 2012, on capital investment plans in the health sector and reforms of the organizational framework			Uzbekistan adopted the Decree of the President of the Republic of Uzbekistan dated 15.12.2010 No PP 1442 "On the priorities of industrial development of Uzbekistan in 2011 - 2015

	(B) Law Of The Republic Of Uzbekistan On The Sanitary-Epidemiological Welfare Of Population (Collection Of Legislation of the Republic of Uzbekistan, 2015, number 34, p. 451) Achievement of MDG goals 4 & 5 by Uzbekistan (2/3rds reduction in maternal and child mortality from 1990 levels)		

Appendix B.

Search Algorithm

1. PubMed: http://www.ncbi.nlm.nih.gov/pubmed/ Search as of Dec. 31, 2015

Result: 243

User query:

(((("health"[MeSH Major Topic] OR "health care category"[MeSH Major Topic] OR "public health"[MeSH Major Topic] OR "global health"[MeSH Major Topic] OR "sanitation"[MeSH Major Topic] OR "hygiene"[MeSH Major Topic] OR "epidemiology"[MeSH Major Topic] OR "environmental health"[MeSH Major Topic] OR "occupational health"[MeSH Major Topic] OR "food safety"[MeSH Major Topic] OR "pharmacology"[MeSH Major Topic]) AND ("english"[Language] OR "russian"[Language])) AND ("uzbekistan"[MeSH Terms] OR "uzbekistan"[All Fields])) AND ("1991"[PDAT] : "3000"[PDAT]) AND (Journal Article[ptyp] AND "humans"[MeSH Terms])

2. Web of Science : http://apps.webofknowledge.com/

(As of Dec. 31, 2015- result may differ depending on institution log0in journal subscription access) and database update.)

Search Algorithm

c. Search #2 AND #1 approx. 177

7,673 search results with

(CU=(Uzbekistan)) AND DOCUMENT TYPES: (Article)

Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=1991-2015

1,944,144 search results with

(ts=(health* OR health care OR public health OR global health OR sanitation OR hygiene OR epidemiolog* OR environment* health OR occupation* health OR food safety OR pharmaco*)) AND DOCUMENT TYPES: (Article)

Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=1991-2015

Appendix C.

Categorization of research organizations in Uzbekistan[1]

Specialized centers include the Republican Scientific Center of Neurosurgery, the Republican Scientific Center for Emergency Medical Aid, and the National Cancer Research Center.

Research Centers include the Institute of Health and Medical Statistics of the Ministry of Health of the Republic of Uzbekistan, the Research Institute of Virology, the Scientific-Research Institute of Hematology and Blood Transfusion, the Research Institute of Sanitation, Hygiene, and Occupational Diseases, the Research Institute of Traumatology and Orthopedics, and the Research Institute of Epidemiology, Microbiology and Infectious Diseases.

Research institutes include the Republican Children's Rehabilitation Center of diseases of the musculoskeletal system of the Ministry of Health of Uzbekistan, the Republican Pathology Center, the Republican Perinatal Center, the Republican Center for AIDS, the Republican Center of Mother and Child Screening, along with the Republican Clinic of Tashkent Pediatric Medical Institute, the National Children's Psychoneurological Hospital U.K. Kurbanova, and the Republican Clinical Eye Hospital.

The Republican Specialized Scientific and Practical Medical Center includes the Republican Specialized Scientific and Practical Medical Center of Dermatology and Venereology, the Republican Specialized Scientific and Practical Medical Center of Obstetrics and Gynecology, the Republican Specialized Scientific and Practical Medical Center of Pediatrics, the Republican Specialized Scientific and Practical Medical Center of Therapy and Rehabilitation, the Republican Specialized Scientific and Practical Medical Center of Tuberculosis and Pulmonology, the Republican Specialized Scientific and Practical Medical Center of Endocrinology, the Republican Specialized Center of Cardiology, the Republican Specialized Center of Eye Microsurgery, the Republican

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[1] Source: www.minzdrav.uz Ministry of Health in Uzbekistan official webpage accessed on May 28, 2016

Specialized Center of Urology, and the Republican Specialized Surgery Center named after academician V.Vahidova.

Academies include the Andijan State Medical Institute, the Bukhara State Medical Institute, the Nukus branch of the Tashkent Pediatric Medical Institute, the Samarkand State Medical Institute, the Tashkent Medical Academy, the Tashkent Institute of Postgraduate Medical Education, the Tashkent Pediatric Medical Institute, the Tashkent Pharmaceutical Institute, the Urgench Branch of the Tashkent Medical Academy, the Fergana Branch of the Tashkent Medical Academy, and the Academy of Science (although not in the health sector).

Appendix D.

List of academic journals related to health sciences in Uzbekistan [2]

The list of scientific journals where the results of the degree of Doctor of Science dissertation can be published * (December 30, 2013, the Presidium of the HAC 201 / approved by Decree No. 3)

14.00.00 - Medical Sciences				
№	Name of (In appropriate cases or specialized group Specialized)	Publication city	According to the Web site address	The founder or publisher
1.	Medical Journal (medicine journals of Uzbekistan)	Tashkent	www.medjurnal.uz	The Ministry of Health of the Republic of Uzbekistan
2.	Tashkent Medical Academy Bulletin (Bulletin of the Tashkentskoy Medical Academy)	Tashkent	http://vestnik.tma.uz/	Tashkent Medical Academy
3.	Surgery	Tashkent	http://www.vakhidov.uzsci.net/publish.html	Republican Specialized Surgery Center
4.	Medical Association Bulletin	Tashkent	http://www.avuz.uz/bulletene/	Association of Doctors
5.	Emergency Medical Bulletin (Vestnik may preventative medicine)	Tashkent	http://www.med.uz/emergency/association/magazine.php	Association of emergency doctors
6.	Neuroscience	Tashkent		Neurological Association, the Tashkent Institute of Postgraduate Medical
7.	Dentistry	Tashkent	http://stomjurnal.tibbiyot.com/ojurnale.htm	Association of Dentists
8.	Theoretical and Clinical Medical Journal (Journal teoreticheskoy klinicheskoy Medicine)	Tashkent	http://academy.uz/ru/publications/part1.php?ELEMENT_ID=35	The Academy of Sciences of the Republic of Uzbekistan

[2] Source: This list was approved on April 11, 2013, by the Presidium of the HAC 197 / by Decree No. 3, "the doctoral thesis basic research results are to be announced in national and foreign countries to enter the prestigious list of specialized scientific journals HAC requirements" is updated on a periodic basis.

№	Name of	Publication city	According to the Web site address	The founder or publisher
9.	Dermatitis News venerologii reproduktivnogo zdorovya	Tashkent	www.ndrz.uz	Healing Maxliyo & V
10.	Pediatric	Tashkent	http://tashpmi.uz/ru/science/journal_pediatry/	Tashkent Pediatric Medical Institute
11.	Dermatoverealogy and aesthetic medicine (dermatoverealogy medical esteticheskaya)	Tashkent	http://dermatology.uz/index.php?option=com_content&view=article&id=331&Itemid=336	Republican Specialized Dermatology and Venereology scientific-practical medical center
12.	Kardiologiyasi	Tashkent	http://www.cardiocenter.uz/index-4.html	Association of cardiologists
13.	A new day in medicine	Tashkent	http://ndm.uz/info/2.html	A new day in medicine LLC
14.	Therapy newsletter (Terapevticheskiy Vestnik Uzbekistan)	Tashkent	http://www.therapy.uz/publikaciya	Association of therapists
15.	Pharmaceutical Journal (magazine Farmatsevticheskiy)	Tashkent	www.pharmi.uz	Tashkent Pharmaceutical Institute
16.	Reports of the Academy of Sciences of the Republic of Uzbekistan	Tashkent	http://www.academy.uz/ru/publications/part1.php?ELEMENT_ID=99	The Academy of Sciences of the Republic of Uzbekistan
17.	Biology	Tashkent	http://www.academy.uz/ru/publications/part1.php?ELEMENT_ID=34	The Academy of Sciences of the Republic of Uzbekistan
18.	Infection, immune pharmacology	Tashkent	http://www.uzpharm.uz	"UZPHARMSANOAT" Tashkent Institute of vaccines and serums

15.00.00 - pharmaceutical sciences

№	Name of (In appropriate cases or specialized group Specialized)	Publication city	According to the Web site address	The founder or publisher
1.	Chemistry of Natural Compounds	Tashkent	http://academy.uz/ru/publications/part1.php?ELEMENT_ID=30	The Academy of Sciences of the Republic of Uzbekistan
2.	Reports of the Academy of Sciences of the Republic of Uzbekistan	Tashkent	http://academy.uz/ru/publications/part1.php?ELEMENT_ID=99	The Academy of Sciences of the Republic of Uzbekistan

3.	University of messages	Tashkent	http://uzmuxabarlari.nuu.uz	The National University of Uzbekistan
4.	Chemistry and Chemical Technology	Tashkent	http://tkti.uz/journal/	Tashkent Institute of Chemical Technology
5.	Pharmaceutical Journal (magazine Farmatsevticheskiy)	Tashkent	www.pharmi.uz	Tashkent Pharmaceutical Institute
6.	Pharmaceutical Bulletin (Farmatsevticheskiy Vestnik Uzbekistan)	Tashkent	http://pharm-reg.uz/article109.html	Of Health Medical Center for examination and standard state-zatsiyasi
7.	Infection, immune pharmacology	Tashkent	http://www.uzpharm.uz	"UZPHARMSANOAT" Tashkent Institute of vaccines and serums

16.00.00 - Veterinary Science				
№	Name of (In appropriate cases or specialized group Specialized)	Publication city	According to the Web site address	The founder or publisher
1.	Zoo	Tashkent	http://vetjurnal.uz/	Head of the State Veterinary Administration of the Republic of Uzbekistan, the Association of livestock producers, farmers Council, "AGROZOOVETSERVIS" limited liability company
2.	In agriculture	Tashkent	http://qxjurnal.asia/	The Ministry of Agriculture and Water Resources
3 .	Agro Education (Journal of Agricultural Research Application)	Tashkent	http://qxjurnal.asia/	The Ministry of Agriculture and Water Resources
4.	Ecology Bulletin	Tashkent	http://www.econews.uz/index.php/journal.html	The State Committee for Nature Protection

Appendix E.
Themes on Grant competition from Committee on Science and Technology Development (Coordination Committee) 2015-2016

Grant	Themes
Practical research	Spiritual, moral, and cultural development of the society, spiritual values, the idea of national cultural heritage, the history of the Uzbek people and statehood, as well as continuity and continuity of education, the study of the discipline of the young generation
	Further deepening of democratic reforms, civil society, development of scientific bases of modernization and liberalization of the national economy
	Energy, energy reuse, transport, machinery, and tools
	The development of renewable energy sources
Innovative 1research	Further deepening of democratic reforms, civil society, development of scientific bases of modernization, and liberalization of the national economy
	Energy, transport, machinery, and tools
	The development of renewable energy sources
	Public information aimed at increasing the level of high-tech information technology, telecommunications networks, hardware and software intellectual property management, development of teaching methods and systems
	The rational use of natural resources and the environment
	Plants, animals, and microorganisms genetic resources of agricultural crops in the creation of new highly productive varieties of crops and animal breeds
	Modern genomics, proteomics and based on the achievements of bioinformatics the development of biotechnologies
Innovative 2 research	Agriculture, biotechnology, ecology and environmental protection
	Medicine and Pharmacology
	Earth sciences (geology, geophysics, seismology and the processing of mineral raw materials)

Source: http://fan-portal.uz/Contests/Contest/21 Science and Technology Development under the Cabinet of Ministers of the Republic of Uzbekistan

Appendix F.
Basic salaries of scientific and guidance employees of research institutions[3]

N	Name of posts	The size of official salaries, Soum.
1.	Director of the Institute	
	Professor	768825
	Ph.D.	737590
	PhD	706526
2.	Deputy Director for Science, Director of the Institute of the branch and other research institutions	
	Professor	706526
	Ph.D.	681424
	PhD	650938
3.	Scientific Secretary of the Institute, Head of the research laboratory (Department)	
	PhD or Professor	681424
	PhD, who holds the title of senior researcher and Associate Professor	650938
	Ph.D., has no academic title	626005
4.	Deputy Director of the branch and other research institutions for scientific work	
	Ph.D. or Professor	650938
	Ph.D., who holds the title of senior researcher and Associate Professor	626005
	Ph.D., has no academic title	600934
5.	Chief Researcher	
	Ph.D., has the title of professor	650938
	Ph.D., who holds the title of senior researcher and Associate Professor	626005
	Ph.D., has no academic title	600934
6.	Leading Researcher	
	Ph.D., has an academic title	626005

[3] Source : Participating in the implementation of scientific and technical programs of fundamental and applied research and innovative work from the budget (approved by the Cabinet of Ministers on August 18, 2009 N 233) www.lex.uz accessed on Nov. 17, 2016.

	Ph.D., has no academic title	600934
	Ph.D., has an academic title	571276
7.	Senior Researcher	
	Ph.D., has an academic title	571276
	Ph.D., has no academic title	541957
	having no scientific degree	513290
8.	Research Assistant	
	Ph.D.	541957
	Without a scientific degree (with experience of scientific activity over 2 years)	513290
	Without a scientific degree (with experience of scientific work up to 2 years)	484862
9.	Trainee Researcher	427798