Identifying Barriers to the Adoption of Telemedicine in Pakistan:

Through the lens of National System of Innovation

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A thesis submitted in partial fulfillment of the requirements for the degree of MS Innovation and Entrepreneurship (MS I&E)

NUST Business School (NBS)

National University of Sciences and Technology (NUST) Islamabad, Pakistan.

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This is to certify that the research work presented in this thesis, titled "**Identifying Barriers to the Adoption of Telemedicine in Pakistan: Through the Lens of National System of Innovation**" was conducted by **Ms. Aqsa Khalil** under the supervision of **Dr. Ayesha Abrar**. No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the **Department of Management & HR, NUST Business School, National University of Sciences & Technology, Islamabad, Pakistan** in partial fulfillment of the requirements for the degree of **Master of Human Resources & Management , Department of Management & HR, NUST Business School, National University of Sciences & Technology, Islamabad, Pakistan.**

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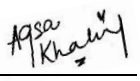
Signature 

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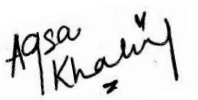

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Contents

List of Symbols, Abbreviations & Acronyms

DHA	Digital Health Association
DHQ	District Health Quarters
ICT	Information and Communication Technology
LMIC	Low and Middle-Income Countries
M/o NHSRC	Ministry of National Health Services Regulations & Coordination
NSI	National System of Innovation
SI	Systems of Innovation
THQ	Tehsil Headquarters
PMC	Pakistan Medical Commission

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Abstract

Existing research shows that the adoption of Information and Communication Technologies (ICTs) in the form of telemedicine and ehealth for healthcare development is a promising approach to improve healthcare access in developing countries with weak healthcare systems. However, despite its potential to address various healthcare barriers, Pakistan has not experienced substantial benefits from telemedicine. This research aims to identify and analyse the barriers within the innovation system that hinder the effective adoption of telemedicine. The research employs a qualitative approach and analyses the data through template analysis. Data is collected from key stakeholders such as doctors, policymakers, telemedicine start-up owners, and analysts through semi-structured interviews to gather insights and recommendations for promoting telemedicine adoption and innovation in Pakistan's healthcare sector. The research findings suggest that technological constraints are not the top barriers to telemedicine adoption in the country. Rather, cultural attitudes towards virtual healthcare, uncoordinated activities among stakeholders, the absence of comprehensive policy development, and the lack of research and telemedicine courses in academia hinder the successful adoption of telemedicine.

Keywords: mhealth, ehealth, telemedicine, telehealth

Chapter 1: Introduction

The following section provides an overview of the significance and concept of telemedicine followed by aims and objectives of the study, research questions and a comprehensive outline of the entire thesis.

Background

Telemedicine offers a diverse range of effective uses that have the potential to revolutionize healthcare delivery and improve patient outcomes. In background studies on the changing landscape of health care by Duchatteau & Vink, (2011), telemedicine is considered to be one of the major trends in health care. Telemedicine offers numerous advantages including facilitation of online specialist consultations such as telecardiology, telemonitoring, teleradiology, telepathology etc. to other centres, to other physicians or directly to the patients, allowing them to benefit from expert medical advice without the need to travel (Tachakra et al., 2003). The telemedicine applications and technologies have proven their potential overtime when it comes to delivering care through cost-saving methods and improvement of the quality of care (Van der Klauw & Flim, 2011). Among the most prevalent and most impactful applications are remote consultations providing timely care to the patients thus, leading to reduced burden on traditional healthcare facilities. Additionally, it promises to reduce access barriers to healthcare where distance is a significant factor (Chen et al., 2022). The main advantages of such solutions are time saving and cost reduction; particularly those related to transportation, and easier access to care (Baudier, 2021). An important feature of virtual healthcare delivery is its ability to provide continuous tracking of vital signs and health parameters, enhancing disease management and early detection of health issues through telemonitoring and remote patient monitoring (El-Rashidy et al., 2021). Moreover, providing mental health support to patients through methods such as teletherapy and counselling services has also been proven highly impactful, offering accessible and confidential assistance to those in need. These diverse applications reveal the transformative potential of telemedicine in expanding access to quality care and promoting new and better ways of patient-centred healthcare delivery. (Haleem et al., 2021). Despite its widely explored potential and proven benefits the field is still relatively obscure and limited in practice in emerging economies due to several barriers (Greenhalgh et al., 2017). There is a need to look into these barriers to telemedicine adoption so that healthcare systems can make best use of its benefits and ensure it complements traditional healthcare, especially in situations

where health conditions are such that paying a physical visit to a doctor is not deemed necessary (George & Hovan George, 2023).

In healthcare, innovation is hard but dissemination is even harder (Berwick, 2014); for an innovation to be widely adopted, there needs to be concrete evidence backing up its efficacy and efficiency (Grimshaw et al., 2012). Research on Health Information Technology and Patient Safety by Sittig et al., (2020) reveals the critical nature of health indicating that health is a sensitive domain thus, new methods or technologies must be thoroughly tested and validated, before they are widely adopted, to ensure patient safety. While technology has the potential to improve care, it does not come without risks (Sittig et al., 2020). In an exploratory research on risks related to the use of telemedicine applications and ehealth technologies, Ossebaard et al., (2012) concluded with evidence that although the field has proved to be a new-age necessity but certain shortcomings still prevail which include technological challenges such as issues of limited resolution and inconsistent colour depth of digital images, security concerns, narrow band width for data transmission, usability problems and inaccurate or faulty devices. Implementation of new technologies in health and social care services is inherently challenging hence, the diffusion of telemedicine services remains limited (Greenhalgh et al., 2017). Developing countries also struggle with the implementation of technology, such as limited internet access and lack of seamless modes of communication. The top barrier is technology, which presents significant challenges to the widespread adoption and effective implementation of telemedicine (Kruse et al., 2018). Technological barriers are often cited as a significant cause of the disappointing telemedicine adoption and utilization rates (Paul et al., 1999). One of the foremost obstacles that has been discussed several times is inadequate infrastructure. Apart from technological barriers, challenges at individual and organizational levels propose barriers to adopt telemedicine in both developed and developing countries one way or the other hindering its widespread adoption and use (Kruse et al., 2018).

The benefits of employing telemedicine are often out of reach, especially in low resource settings, due to the high costs of fully deploying communication infrastructures such as fibre optic links and satellite communications to remote areas (Alenoghena et al., 2023). Issues such as patient satisfaction, safe transmission of data, confidentiality concerns and privacy breaches, computer and eHealth illiteracy have also been explored and reported in several studies (Wade et al., 2019). There is a need to explore the potential barriers in adoption faced by core stakeholders in the field of telemedicine to come up with solutions and strategies that can be fruitful for all. This research study involves data collection from a research sample which is more representative of the telemedicine industry as it attempts to include diverse stakeholders that are linked to the telemedicine healthcare ecosystem. This research aims at exploring and identifying barriers for health-tech organizations.

1.1 Problem Statement

Besides online consultation, telemedicine start-ups are now branching out into creating specialized services provision platforms such as tele-orthopaedic, tele-dermatology, and tele-mental health services etc., including digital therapeutics, body sensors, wearable devices for health monitoring, and AI-based personalized care. Despite growing evidence highlighting the benefits of telemedicine in enhancing healthcare access and delivery, several barriers impede its broad adoption. It is crucial to identify and understand these primary obstacles, as there is no universal framework or best practice solution for all ICT innovations or countries. The barriers and challenges faced when adopting and implementing a specific ICT innovation can vary significantly between different countries or organizations. Different countries are likely to face some common barriers and challenges in adopting a specific ICT innovation (e.g., telemedicine) there still is a significant degree of variation involved. However, each country will have its own unique sets of barriers and challenges related to its context and environment (Alaboudi et al., 2016). Thus, the ultimate success of adopting and implementing telemedicine in a given country or organisation is ensured if these barriers and challenges are adequately identified.

1.2 Research gap

The successful adoption of e-health depends on the engagement of end users, i.e., physicians and patients, and the internal and external stakeholders involved in the ecosystem (Talwar et al., 2023). The existing research on telemedicine largely focuses on technological barriers and patient perspectives as key factors influencing telemedicine adoption. A particular category of factors investigated by the literature is the individual behavior of the user, i.e., the patient (Cannavacciuolo et al., 2023). Studies by Greenhalgh et al. (2017) and Osei et al. (2021) have highlighted the importance of understanding patient attitudes and behaviours towards telemedicine. However, comprehensive research on the barriers and facilitators from the perspectives of healthcare providers, who are crucial in implementing and sustaining telemedicine services, are limited. Similarly, the roles of policymakers in creating supportive regulatory environments and the challenges they face have not been sufficiently explored in low-resource settings (Mishra et al., 2020). regarding other important barriers to telemedicine adoption that extend beyond technology and. While increasing investments in telecom sector and technological advancements in telemedicine are great steps, benefits to patients where disparities prevail will not accrue without taking the entire system into account (Dickey & Wasko, 2023). Recent studies underscore the general barriers to telemedicine adoption, such as technological limitations, infrastructure deficits, and systemic practices (Gates, 2020). However, most studies frequently overlook the nuanced, context-specific issues that are crucial for effective implementation

and scaling in developing economies. For instance, research often fails to address how local healthcare practices, financial constraints, and regulatory environments distinctly impact telemedicine adoption and utilization in these regions (Wang et al., 2023; Li et al., 2023). Need for context-based research in virtual healthcare is crucial for gaining a comprehensive understanding of the broader barriers to telemedicine adoption and developing effective strategies to overcome them.

1.3 Research Questions:

1. What are the primary barriers faced by telemedicine actors (healthcare providers, healthcare academia, telemedicine startup owners, telemedicine startups' analysts and healthcare policy makers) hindering the adoption of telemedicine?
2. What non-technological activities among telemedicine actors contribute to the barriers towards telemedicine adoption?

1.4 Research Objectives:

1. To find out potential barriers faced by the key stakeholders of the telemedicine ecosystem.
2. To identify and analyze the specific activities of stakeholders within the national innovation system that contribute to barriers in the adoption of telemedicine.

1.5 Significance of the study:

The significance of this research lies in its potential to address critical gaps and challenges in the adoption of telemedicine, which is increasingly important in modern healthcare delivery. By exploring barriers beyond technological issues and patient perspectives, this study also highlights the limited capacity of certain actors and institutions to adopt digital solutions. Understanding these broader barriers is essential for developing comprehensive strategies to promote telemedicine adoption and integration into healthcare systems. The lens of National System of Innovation in non-technological activities is important as such innovation involves costs of time and money which are lower than those associated with technological innovation (Fuentes & Soto, 2015). By focusing on non-technological innovations, developing countries can enhance their human capital through training, skill development, and organizational learning. This builds a foundation for future technological advancements (Lundvall et al., 2008).

1.6 Thesis Structure

The thesis is organized as follows. The next sections disclose the literature review and theoretical framework, followed by the research methodology, findings, and discussions. The research concludes with key takeaways and practical implications.

The research will be presented in six chapters.

After stating the introduction, research gap and, objective in chapter 1, the research domain of telemedicine industry and telemedicine entrepreneurship and its barriers are explored in chapter 2. This chapter includes technological, financial, and user barriers and discusses the theoretical framework of National System of Innovation (NSI) adopted for this research.

Chapter 3 presents a thorough discussion of the applied methodology, including the explanation and justification for the choice of the research methodology, the details for data samples and for data collection, data structure, the process of data analysis and the approach to ensure the research quality.

Following the description of the applied research methodology, the findings of the thesis are presented in Chapter 4. The findings are categorized into headings of Actors, Institutions and Activities as suggested by the theoretical lens, and further into sub-headings based on the nature of barriers identified.

Chapter 5 is based on discussions which builds upon the findings of Chapter 4.

Chapter 6 concludes on the barriers of mHealth regarding how telemedicine has failed to become an integral part of the traditional healthcare system in LMICs, and practical implications.

Chapter 2: Literature Review and Theoretical Framework

2.1 Telemedicine Overview:

Digital technologies are playing their part in reshaping almost all organizations and their activities (Cohen et al., 2017; Nambisan, 2017; Yoo et al., 2010). The health-care sector is no exception as it is transitioning from the traditional in-person patient-physician visit to virtual telemedicine healthcare delivery with global outreach (Mishra & Pandey, 2023). The implementation of technology in healthcare domain is not new. Still, with the emergence of COVID-19 as the global health crisis, the importance of telemedicine adoption and its implementation suddenly got more attention and provided a new track for the healthcare industry to explore (Manzoor et al., 2021). Telemedicine is defined as the delivery of online healthcare services to distant patients as a substitute to in-person doctor visits (in situations where physical interactions are not mandatory) with the help of telecommunication and electronic information technologies (Haleem et al., 2021). It is a combination of technology and medicine. It is an easy and effective way to provide affordable but quality healthcare mostly to far-away patients in underserved regions through the use of information and communication technology (ICT) services (Ashfaq et al., 2020). Equal access of affordable and quality healthcare to every citizen is the prime responsibility of any state (Chakraborty et al., 2021). Unfortunately, challenges such as financial, economic, sociocultural differences and large-scale digital disparities in developing nations create unequal divides that produce hurdles for basic rights like education and healthcare to reach masses particularly in low resource settings (Aruleba & Jere, 2022).

In order to overcome local challenges regarding healthcare delivery, many health-tech start-ups and online healthcare providers have come forward with the intention to deliver healthcare services through applicable frameworks mainly in the form of telemedicine (Nittari et al., 2020). Telemedicine is often known by a number of terms that are frequently used interchangeably but when seen carefully; each term has its own meaning. Telehealth is a broad term which caters to all the non-clinical services like those related to healthcare administrative sessions, technical or non-technical trainings, service delivery, use of technology, medical education, provider meetings etc. whereas telemedicine is specifically fixated on clinical services only (Bitar & Alismail, 2021). This shows that telehealth includes a wider scope of healthcare services as compared to telemedicine since it can also refer to non-clinical services. As per the definition of WHO, Telehealth includes “Surveillance, health promotion and public health functions.”

Telemedicine, on the other hand, deals with providing virtual clinical services (synchronous and asynchronous) to patients via mode of electronic communication. Asynchronous means that the events are not happening in real time i.e. the exchange of information between patient and the consultant are not occurring simultaneously. The time or location of sending information that might involve diagnostic images, email exchanges, surveys completion etc. is different to the time or location of their response or interpretation (Waller & Stotler, 2018). Synchronous means that the information exchange or service provision among the healthcare provider and the patient is occurring at the same time. It involves instantaneous two-way interaction which might be in the form of audio/ videoconferencing; live interaction etc. (Batsis et al., 2019). Teleconsultation, disease diagnosis, telemonitoring and mentoring all fall under the domain of telemedicine. m-Health is another commonly used term in telemedicine. It involves delivering medical care to patients by the use of mobile applications or applications on other sources of electronic communication gadgets (Kruse et al., 2022). Healthcare practices mostly in the form of text messages or portals etc. for both patients and the doctors or healthcare providers fall under the category of ehealth practices. In some cases, the service delivery is facilitated i.e. in the presence of an additional person who is experienced so that the procedure is monitored and standard of care is met while in other cases, it can be non-facilitated as well which is DTC i.e. direct to customer with no additional person is required to assist or monitor (Waller & Stotler, 2018). Literature suggests that telemedicine has already done wonders in developed countries who are now shifting to wearable healthcare technology such as smart gadgets and body sensors that keep health and any symptoms quantified & under check. Smartphones can track a patient's performance by keeping check on a series of self-completed tasks (e.g., finger tapping) or can detect tremors (Dorsey et al., 2020). Body-worn sensors can provide quantified results by measuring walk or detect falls; some have been cleared by regulatory authorities for use in clinical practice (Dorsey et al., 2020). But in lower middle-income countries, the concept is relatively new and ambiguous. Thus, the landscape from an entrepreneurial perspective is ripe here (Mahdi et al., 2022). The number of healthcare start-ups increased multi-fold during Covid-19. The virus also proved to be an enabler for the plethora of wellness business. Online yoga, online counselling, diet and nutrition sessions received communities' attention at large during the era (Rodrigues & Noronha, 2021).

Overcoming health disparity is still one of the biggest challenges for developing countries (Donnel, 2007). Generally, there are insufficient healthcare resources in the low and middle-income countries and the ones available are unevenly distributed due to the rural-urban divide

(Babatunde et al., 2021). Provision of quality healthcare to the masses is a huge challenge in Pakistan due to a number of reasons including limited infrastructure and inefficient resource allocation. Almost 61% of Pakistan's population resides in rural areas with most of them deprived of basic health facilities (Mahdi et al., 2022). Thus, the industry of telemedicine has great potential in developing countries like Pakistan as it holds the promise of being able to connect patients in the remotest of regions to qualified doctors in urban areas (Mahdi et al., 2022). According to World Health Organization, a sustainable investment in healthcare not just contributes to health benefits but also plays a key role in providing long term solution to reducing poverty and boosting economic growth (Sahar *et al*., 2022). Despite massive investments to expand the health services delivery network, there has been no significant improvement in the health status of the people (Syed, 2021). Certain emerging start-ups are seen making their way to disrupt the traditional market and healthcare practices with innovative ideas and solutions in order to reach the underserved market (Velayati et al., 2022). To make these solutions applicable on a larger context, the institutional context and national system plays a vital role. According to WHO survey in 2016, Pakistan has no laws and regulations regarding telemedicine practices (Mahdi et al., 2022). Healthy evolution of institutions is necessary for entrepreneurship to occur (Steier, 2009). The transformative healthcare concepts here are still in their initial phase, confined to promotion stages with very less sustainable practical implementation. The telemedicine projects are born and developed from the bottom up which typically means that these initiatives originate and evolve primarily through grassroots efforts, or individual innovators rather than being driven by large-scale institutional or governmental mandates. Such initiatives face challenges in achieving large-scale diffusion as there is a lack of resources, infrastructure, and logistics etc., at the territorial level to spread and coordinate the diffusion.

2.2 Entrepreneurship in Telemedicine

The healthcare sector presents opportunities for entrepreneurial innovation, promising improvements in efficiency and patient outcomes and overall system resilience (Garbuio and Lin, 2019). The COVID-19 pandemic has emphasized this point, revealing the healthcare system's vulnerabilities and the essential role of entrepreneurial initiatives in addressing these challenges and driving healthcare delivery forward (Lim et al., 2024). These startups typically initiate businesses to fulfil gaps. The healthcare start-up ecosystem also contributes significantly to economic growth by creating jobs and providing cost-cutting solutions to health care delivery (Hoa et al., 2023). Entrepreneurial ventures can help healthcare organizations create or transfer technology or

innovation outside the institution. The evolution and transformation of healthcare would not have reached its present state without entrepreneurship, which is widely regarded as a catalytic agent for innovation (Maritz et al., 2020). Brown and Patel (2018) explore the impact of entrepreneurship on telemedicine adoption. Their research highlights the critical role of entrepreneurial ventures in fostering a culture of innovation within healthcare organizations. Healthcare start-ups frequently concentrate on attempts for enhancing patient experiences by increasing accessibility, convenience, and personalization of care (Kaur, 2023). Telehealth startups face user acceptance and adoption challenges most often focusing on patient engagement, provider resistance, and technological usability issues (Gracia et al., 2018).

2.3 Barriers to telemedicine startups

In recent times, telemedicine has proven its potential to provide high quality, affordable, and predominantly adapted healthcare services. However, for several reasons, telehealth startups operate in a more uncertain and vulnerable space compared to large IT companies (Chakraborty et al., 2023). They often attempt to sustain themselves through external funding, such as crowdfunding, venture capital, and angel investment (Chakraborty et al., 2023). Securing adequate funding is a persistent challenge for healthcare start-ups. Moreover, establishing a robust distribution network and gaining market access can be challenging for healthcare start-ups due to financial resource constraint and lack of skilled professionals (Hills, 2021). The scarcity of specialized talent and finances, coupled with large number of diverse market competitors, makes it difficult for start-ups to build and retain a customer base (Lallit, 2024).

2.3.1. Technological Barriers:

Technological barriers are often mentioned as a prominent cause of the disappointing telemedicine adoption and utilization rates. Technological barriers are instances where the use of the technology is perceived as not being efficient enough to perform the tasks or accomplish the objectives for which the technology was initially utilized. They include uncertainty about the adequacy of a system to support clinical activities, system reliability, ease of use, and concerns about infrastructure (Paul et al., 2021). Literature highlights the mismatch between technological capabilities of the telemedicine equipment and end-user needs as a barrier (Paul et al., 1999). From a user perspective, studies showed that the monitoring devices are often not fulfilling the needs of end-users. Internet bandwidth is both scarce and expensive in developing countries (Habler & Jackson, 2010). Authors suggest that generally when it comes to adopting new

technology, the potential barriers include deficiency of skilled workforce, financial constraints (Kiel et al., 2017; Geissbauer et al., 2014), data privacy and confidentiality (Kiel et al., 2017; Breunig et al., 2016), data quality, insufficient understanding of integration and systems architecture (Geissbauer et al., 2014) etc.

2.3.2. Financial Barriers:

Apart from the technological barriers encountered, there are certain financial barriers as well that need to be emphasized and worked on (Syed et al., 2021). Addressing technological barriers alone is unlikely to significantly boost telemedicine adoption and utilization rates, as numerous other obstacles—such as professional, operational, and financial barriers would remain. Legal and financial barriers are likely to be primarily administrative in nature (Ly et al., 2017). Some commonly reported barriers for implementing such programs were; lack of funding for development, lack of investor support, lack of infrastructure (e.g. equipment and/or connectivity). Telemedicine systems need financial investment from outside sources, both at the onset of the venture as well as their regular operations and expansion (Sundin et al., 2016).

2.3.3. Privacy Concerns and Patient Satisfaction:

Digital communication is always susceptible to privacy breaches, security issues and cyber risks and the healthcare sector is no exception (Hathaliya & Tanwar, 2020). Telemedicine faces various implementation risks, including data breaches, limited access within the medical community, and potential for incorrect diagnoses (Abugabah et al., 2020). In the cyber world there is an increased risk of data breach which may put sensitive patient information at the risk of exposure to scammers. Ensuring patient privacy and addressing patient concerns to maintain a high level of patient satisfaction continues to be challenging. Based on the published work, it is clear that majority of studies have attempted to reveal patients' attitudes toward the acceptance and use of e-Health. Due to a lack of patient satisfaction, the importance of focusing on end-user needs and requirements was a clear recurrent theme within many researches (Campling et al., 2017). Challenges faced by patients are chiefly due to low health literacy; they may find prescriptions challenging to comprehend, leaving them dissatisfied with the experience (Kruse et al., 2018). Language barrier, patient's lack of understanding regarding the efficacy and security of the process can lead to resistance.

Although the internet and smartphones are becoming more prevalent among the general public, there remains a lack of awareness about their potential benefits, particularly in healthcare. Likewise, many doctors hesitate to embrace telemedicine due to the perceived challenges of not being able to physically examine patients compared to traditional methods. Lack of vision is also a recognized barrier (Saatçioglu et al. 2019). Conflicting priorities contribute to creating hurdles in the adoption of telemedicine (Kane et al., 2015). While mHealth initiatives are expanding in developing countries and each project individually appears impressive, they do not significantly enhance the overall adoption of mHealth (Latif et al., 2017). According to Everett Rogers (1995), the dissemination of innovation relies on three basic clusters of influence: (1) the perception of the innovation; (2) the characteristics of the adopters or non-adopters; and (3) contextual factors including communication, incentives, leadership, and management. Despite this, the literature lacks a comprehensive understanding of the perspectives of essential actors within telemedicine organizations. Dickey & Wasko (2023) argue that while increased investments in ICT and technological advancements in telemedicine are positive steps, benefits to patients, particularly in areas with disparities, will not materialize without considering the entire system. This research aims to explore the barriers and identify obstacles in the interconnectedness of actors and institutions within the telemedicine landscape.

2.4. Innovation diffusion and Telemedicine:

Research on institutional barriers against innovation diffusion on health-tech start-ups reveals that the participant CEOs of telemedicine start-ups in that particular research described hospitals as being “notoriously allergic to change and innovation” and described their rate of adoption as “nauseating” given that providers are still stuck on evaluating the value of basic application of mobile health, even though other industries have already embraced multiple versions of applications in their industries (Lim et al., 2016). Earlier studies have shown that telemedicine can be as effective for primary health as in-person care (Greenhalgh et al., 2016). Participants that had prior mistrust in their health care provider were more reluctant to use tele-medical tools and to join tele-medical programs.

2.5. Theoretical grounding of the study:

Different theories regarding telemedicine have been used earlier. These include TAM, UTAUT, Actor-Network Theory etc.

This research uses the theory of **National Innovation System (NSI)** which says that a nation’s competitiveness depends on the capacity of its industry to innovate and upgrade (Porter, 1990).

‘National innovation systems’ (NIS) — was mainly developed by three scholars; Christopher Freeman (1987), Bengt-Åke Lundvall (1992) and Richard Nelson (1993). The central focus of this approach is on interactive learning, as a driving force of long-run economic development.

A System of Innovation includes all the important factors that influence the development, diffusion and use of innovations (Edquist, 1997). This includes relations amon elements in the system. These factors can be studied in a national, regional or sectoral context. It is widely used in academic contexts and also as a framework for innovation policy-making. Innovation results not only from individual actors’ performance, but also from how they interact with one another as parts of a system, that is, systems of innovation (Solleiro & Gaona, 2012).

2.5.1. Actors:

The systems of innovation place emphasis on interaction between various actors involved in the innovation process (Todtling and Trippl, 2005). In order to promote innovation, the different innovative actors must have strong links with each other based on a strong level of trust and governments should promote and activate trust among the different actors. An interactive system of existing actors, includes private and public firms (both large and small), universities, government agencies and others, that aim to produce, diffuse and utilise knowledge within national border (Lundvall, 1992; Edquist, 2004). According to the National Innovation System (NIS), innovation arises from the interaction among actors who generate, disseminate, and apply diverse forms of knowledge. Therefore, a country’s innovative success largely depends on how effectively these actors connect and collaborate as part of collective knowledge creation systems (Pan et al. 2010).

2.5.2 Institutions:

A national system of innovation includes set of institutions whose interaction determines the innovative performance of firms. It remains understood in the literature that both the category of ‘legal rules, laws and official policies’ and that of ‘informal norms- traditions, customs and shared understanding’ are referred to as ‘institutions’ (Edquist, 2004). System of Innovation is a system of interconnected actors and institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies or innovation.

2.5.3. Activities:

It is important to study the activities (factors, causes, determinants) in SIs. The following activities can be expected to be important in most SIs:

Focus on research and development activities (R&D), formation of new products, markets and tailored solutions, capacity building, creating and changing institutions, articulating requirements originating from demand side etc. (Edquist, 2004)

Systems of Innovation can be quite different from each other, e.g., with regard to specialization of production, resources spent on R&D, etc. Actors perform the activities and institutions provide incentive frameworks for these activities. Hence, we need to focus both on activities and components in order to understand and explain innovation processes.

Examining barriers among actors, institutions, and activities in a system of innovation can have several important implications for various stakeholders and areas of practice. The research findings cross-disciplinary collaboration among various actors to work towards building a supportive ecosystem that fosters innovation, reduces barriers to adoption, and encourages healthcare entrepreneurship. The research can help policymakers and governance bodies identify gaps within the ecosystem as well as help educational actors and institutions integrate findings into curriculum development. Also, the research study highlights priority areas where further in-depth investigation can be done.

Chapter Summary:

This chapter highlights the role of digital technologies on healthcare delivery, particularly through the lens of telemedicine and its role in addressing healthcare disparities and challenges. It mainly highlights the significant barriers faced by telemedicine actors, including technological limitations, financial constraints, regulatory challenges, and user acceptance issues. To fully leverage telemedicine's benefits, it is crucial to understand and address challenges that extend beyond technological and infrastructure limitations, which play a significant role in shaping its effectiveness and integration into healthcare systems in these regions (Bashshur et al., 2014). Identifying these activities is crucial for developing targeted strategies to overcome obstacles and promote the successful adoption of telemedicine initiatives.

Considering the potential benefits telemedicine can bring into the landscape of developing countries, there is need to dig deeper into the barriers to its adoption. In order to investigate this, theoretical frameworks such as the National Innovation System (NIS) provide a foundational lens for understanding innovation dynamics and interactions among diverse actors and institutions within healthcare ecosystems. In summary, there seems to be general agreement that the main components in System of Innovations are actors, and institutions. However, the specification of these components certainly varies between systems.

Chapter 3: Research Methodology

3.1 Philosophical Background of the Research:

The philosophical background of a research study refers to the underlying principles and assumptions that guide the research approach and methodology.

3.1.1 Ontological Positioning:

Ontology is the philosophical study of being. In the most basic sense, ontology describes what can be known (Berryman, 2019). The research is based on constructivist ontology As the study is using template analysis for the data analysis, "social constructivist" position is used which is based on the assumption that there happen to be multiple interpretations for any phenomenon, which depends on the researcher and the research context (Madill et al., 2000).

3.1.2. Epistemological Choice:

This research follows interpretivist epistemology based on the concrete research objectives. The interpretivist research philosophy sees the world differently and looks for multiple truths believing that truth is revealed through meanings constructed socially in business and management disciplines. (Berryman et al., 2019). As the study is using template analysis for the data analysis, it follows the principle that the research is responsible for examining the social world. Thus, it mainly depends on the interest of the researcher.

3.2. Choice of Qualitative Research:

Qualitative analysis is being widely accepted in medical research, but this has long been followed by many scientists, researchers and anthropologists to discover attitude and behavior of people belonging to different cultures practicing different customs (Aoki et al., 2003). The rationale behind using qualitative methods applies here owing to the type of questions probed. Qualitative research is particularly well-suited for studying the barriers to telemedicine adoption as it involves a diverse range of stakeholders, including healthcare practitioners, providers, policymakers, etc., each with unique perspectives and experiences. Qualitative methods such as interviews, focus groups etc. allow researchers to delve deeply into these stakeholders' perceptions, attitudes, and contextual factors (Alsaawi, 2014).

3.3 Research Approach:

Inductive research approach is adopted in the study which involves the data-driven strategy. It starts with the respondents' experiences and data obtained and as a result theory is developed. The research moves along according to the observed themes and patterns in data, inducing explanations to generalize the developed theories (Creswell, 2014). This research study adopts exploratory research approach. It is an efficient method to discover data, relationships, patterns, ideas and themes (Hair et al., 2020).

3.4 Sampling Framework:

The sampling technique used in this research was purposive sampling and snowball sampling.

Purposive sampling was useful since limited number of people were required as per the objectives of the study. It is a non-random sampling technique; typically used in qualitative research. It involves selecting the most desirable information-rich cases to ensure the best utilization of available resources i.e. a deliberate selection of well-informed and proficient participants based on the qualities the participant possesses (Etikan et al., 2016). Simply put, the technique helps in finding out people who can and are willing to provide the information by virtue of knowledge or experience. In qualitative research, sampling techniques can be used alone or in combination with other techniques (Patton, 1990). The two most common sampling techniques used in this research are purposive sampling and snowball sampling. The participants that align with the focus of this research were approached. This included roles (e.g., CEOs, analysts, practitioners, academia, policymakers) and expertise in the telemedicine industry. By targeting individuals directly involved in telemedicine startups (CEOs, analysts) and those influencing policy and academia related to healthcare, diverse and informed perspectives were collected on telemedicine adoption and barriers. This way, purposive sampling helped in choosing participants that can provide valuable insights and firsthand experiences relevant to the research questions about barriers to telemedicine adoption.

Snowball sampling is one of the most popular sampling techniques in qualitative research. It involves getting in-touch with the suitable sample through referrals. It starts with a very small number of initial links who are deliberately selected and approached because they fulfil the research criteria. These contacts further help in referring other potential participants who would

otherwise be hard-to-reach. After recruiting initial participants through purposive sampling, snowball sampling was used to expand participant pool. The initial participants were asked to recommend other individuals who they believe would be knowledgeable and relevant to the study. This approach helped in leveraging the participants' networks to identify additional qualified participants who were not directly accessible through purposive sampling alone.

3.5. Research Context:

In Pakistan, telemedicine is practiced through various online platforms that enable patients to book video consultations with specialist doctors. Prominent platforms such as SehatKahani, Oladoc, Marham, and DoctHERS.com have been operational for the past 5 to 6 years, offering a range of services and expanding healthcare access across the country. Doctors from Pakistan can book discussions with specialist doctors from the USA (Appna.org); psychotherapists offer sessions via Skype additionally to face-to-face consultations in their surgeries; there are individual (local and temporary) projects running time to time (Lotta et al., 2018). During the COVID-19 pandemic, the telemedicine industry in Pakistan experienced a significant boost as there was a rush to implement telemedicine solutions in District Headquarters Hospitals (DHQs) and Tehsil Headquarters Hospitals (THQs). However, the sustainability of these initiatives has become a major concern. Many telemedicine services implemented during the pandemic have struggled to maintain their operations, highlighting the need to investigate the underlying issues that have impeded their long-term success. Additionally, most telemedicine start-ups in Pakistan still rely heavily on external funding, which is not a sustainable model for long-term growth and stability.

Pakistan’s healthcare system is marked by disparities in access to quality care, especially in rural regions where healthcare infrastructure is often limited (Amjad, 2020). Additionally, cultural attitudes towards digital health solutions, financial constraints, and the need for robust regulatory policies create a complex environment that is ideal for studying the multifaceted challenges of telemedicine implementation

3.6 Research Participants:

According to the *Economic Survey of Pakistan*, the PSDP allocation for the health sector during FY2023 was 2.8 percent of the total development budget and 0.05 percent of GDP. Health service delivery, including primary health care, is unregulated in Pakistan. While this has

reportedly given rise to extensive quackery, the health providers also do not need to register with health ministries for opening up a telemedicine practice.

The participants' recruitment process started with identifying the potential actors in telemedicine ecosystem and approaching them via emails and LinkedIn. Participants included CEOs of telemedicine organizations and ehealth analysts, healthcare practitioners, academia and government officials of healthcare. Most telemedicine services in the country do not restrict themselves to specific regions but instead provide nationwide coverage. They offer their services across the entire country, aiming to reach as many patients as possible regardless of geographical location. Consequently, the participants in this study are representative of a broad national demographic, reflecting the widespread accessibility and utilization of telemedicine services across Pakistan.

To maintain the confidentiality of the respondents and keep them anonymous, all interviewees were given pseudonyms from the alphabet A-Z. For example, Respondent 21 was given the pseudonym of "Respondent U". Qualitative research has long been followed by many scientists, researchers and anthropologists to discover attitude and behavior of people belonging to different cultures practicing different customs (Aoki et al., 2003). The rationale behind using qualitative methods quite appropriately applies here owing to the type of questions probed. This study adopts an exploratory research approach. Total of 26 interviews were conducted. Details of the participants are in table below.

3.5.1. Participants of Research

Participants	Position	Based in
1. Respondent A	Telemedicine Startup CEO	Pakistan
2. Respondent B	Telemedicine Startup CEO	Pakistan
3. Respondent C	Telemedicine Startup Analyst	Pakistan
4. Respondent D	Healthcare Practitioner (Physician)	Pakistan
5. Respondent E	Telemedicine Startup CEO	Pakistan
6. Respondent F	Telemedicine Startup CEO	Pakistan
7. Respondent G	Telemedicine Startup CEO	Pakistan

8. Respondent H	Telemedicine Startup Analyst	Pakistan
9. Respondent I	Healthcare Practitioner (Nutritionist)	Pakistan
10. Respondent J	Pathology Professor/Researcher	Pakistan
11. Respondent K	Telemedicine Startups Analyst	Pakistan
12. Respondent L	Telemedicine Startup Analyst	Pakistan
13. Respondent M	Telemedicine Startup CEO	Pakistan
14. Respondent N	General Medicine Professor	Pakistan
15. Respondent O	Healthcare Practitioner (Physician)	Pakistan
16. Respondent P	Anatomy Professor/ Researcher	Pakistan
17. Respondent Q	Telemedicine Startup Analyst	Pakistan
18. Respondent R	Telemedicine Startup Analyst/Researcher	Pakistan
19. Respondent S	Telemedicine Startup Co-Founder	Pakistan
20. Respondent T	President Digital Health Association	Pakistan
21. Respondent U	Telemedicine Startup Analyst	Pakistan
22. Respondent V	Telemedicine Startup Co-Founder	Pakistan
23. Respondent W	Assistant Director (PMC)	Pakistan
24. Respondent X	Healthcare Practitioner (Physician)	Pakistan
25. Respondent Y	Telemedicine Startup CEO	Pakistan
26. Respondent Z	Deputy Director (ICT)	Pakistan

Figure 1: Table of Respondents

3.6 Data Collection Process:

3.6.1 Data Collection Instrument:

Data collection involved primary data collection through semi-structured interviews. Interviews were conducted in-person and online via Zoom, Skype and Google Meet. Interviews were recorded and transcribed. The participants were approached via in-person references, through emails, and social media handles. Along with in-depth interviews, Documentary analysis was also done to see

the current state of telemedicine ecosystem within the country. Document analysis is a commonly used powerful methods often employed in health policy research (Dalgish et al., 2020).

3.6.2 Pilot Testing:

Before diving into the main data collection phase of this research, pilot testing was conducted. The aim of this pilot testing was to fine-tune our research methods and materials. We engaged with five individuals who were CEOs of telemedicine organizations, analysts, and doctors. The insights gained from the pilot interviews were instrumental in enhancing the quality and effectiveness of our data collection process. During the pilot interviews, it became evident that some of the technical language and terminologies used in the initial questionnaire were too complex for individuals. The pilot interviews allowed us to identify and rectify this issue by simplifying the language. This adjustment ensures that the questions are more understandable and accessible to the target participants, facilitating a more fruitful data collection process.

Pilot interviews also revealed that additional probing questions were necessary to encourage participants to provide more detailed and insightful responses. These probing questions were designed to dig deeper into the participants' experiences and perspectives, allowing for a richer understanding of the subject matter.

3.7 Data Analysis:

Template analysis, one of the widely used methods of thematic analysis in qualitative research, is used to evaluate the data. It offers a clear, systematic approach to data analysis. The flexibility of the coding structure helps the researcher to grasp the richest aspects of data in depth easily.

Template analysis is positioned in the middle ground between bottom up and top-down analysis styles. The researcher defines some themes in advances mostly called as “a priori themes” in the development of the template. But they can be redefined and discarded according to the requirement of the recurring themes and codes in the analyses, which develops appropriate new themes. (Brooks et al., 2015; King, 2017).

3.7.1. Initial Template

Barriers

1. **Actors:**
    - **1.1** Academia
        - 1.1.1 Lack of telemedicine awareness
        - 1.1.2 Lack of research in medical institutes
        - 1.1.3 Lack of Digital Health Literacy
        - 1.1.4 Illiteracy
    - **1.2** Service Provider Platforms
        - 1.2.1 Lack of Internet Connectivity
        - 1.2.2 Lack of Equipment
        - 1.2.3 Lack of Infrastructure
    - **1.3** Government
        - 1.3.1 Lack of Policy Implementation
        - 1.3.2 Incompetency of the government actors

2. **Institutions:**
    - **2.1** Culture
        - 2.1.1 Physical consultations
        - 2.1.2 Monopoly of conventional health practices
    - **2.2** Mis (Trust)
        - 2.2.1 Fear of Privacy Breach
        - 2.2.2 Possibility of scams
    - **2.3** Weak Regulatory Framework
        - 2.3.1 Lack of Licensing
        - 2.3.2 Outdated PMC Code of Ethics

3. **Activities:**
    - **3.1** Research & Innovation
        - 3.1.1 Lack of funding
        - 3.1.2 Lack of commercialization
    - **3.2** Networking & Collaboration
        - 3.2.1 Payment collection issue
        - 3.2.2 Resistance from Govt hospitals
        - 3.2.3 Lack of Collaboration of health & business acumen
    - **3.3** Monitoring and Evaluation
        - 3.3.1 Lack of monitoring bodies
        - 3.3.2 Lack of Standardization

The initial template was made from the theoretical lens that helped in creating a structured template that captures the key themes, concepts, or patterns identified in the data. Template analysis suggests that the template can be organized in a hierarchical manner if it helps to clarify relationships between different themes or sub-themes. However, in the National System of Innovation (NSI), actors, activities, and institutions are not typically ranked in a strict hierarchical manner. Instead, they interact and collaborate within a dynamic and interconnected system to drive innovation and economic development. According to Brooks, King and Symon (2015; 2012), following are the steps followed in template analysis:

1. As a researcher, familiarization was developed with the dataset by reading the transcripts for better understanding.

2. Preliminary coding of the data was done by highlighting the recurring concepts in the texts which contributed towards better understanding. This step is similar to the thematic analysis but in Template Analysis, a priori themes were generated to start analysis with guidance of the theoretical lens. These tentative themes helped in structuring the data and classified it for a detailed analysis. However, these categories were kept tentative and open-minded approach was kept for the emerging themes which did not fit in the preliminary template.

3. The next step was to organize the data and categorize them into meaningful clusters. Three major clusters were created to arrange the data such as actors, institutions and activities. Narrower themes were constructed in these broader ones according to the data.

4. At this point, the initial template was clearly taken out of the literature and pilot interviews. The hierarchical arrangement of the data structure was also prominent. All the data was further sub-categorized into barriers of telemedicine.

5. The initial template was adjusted, applied to the rest of the data and modified where necessary. A bottom-up approach was adopted to construct the themes of recurring concepts.

6. The final template was applied to the full data set. But it was refined for better analysis.

3.7.2. Final Template:

Barriers

1. Actors:

- **1.1** Academia
  - 1.1.1 Absence of Telemedicine courses in curriculum of degree programs
  - 1.1.2 Lack of local research in medical institutes
  - 1.1.3 Illiteracy of general population
  - 1.1.4 Lack of vision
- **1.2** Industry
  - 1.2.1 Non-cooperative attitude of doctors
  - 1.2.2 Health Associations acting as influential group
  - 1.2.3 Unregulated Telemedicine Platforms
  - 1.2.4 Insurance companies limited to hospital admissions
  - 1.2.5 Work being done in-silos
  - 1.2.6 More quacks than doctors
- **1.3** Government
  - 1.3.1 Govt acting as a participant & not a regulator
  - 1.3.2 Lack of Standardization
  - 1.3.3 Lack of inter-ministerial coordination

2. Institutions:

- **2.1** Culture
  - 2.1.1 Patriarchal Society
  - 2.1.2 Resistance to Change
  - 2.1.3 Monopoly of conventional service providers
- **2.2** Mis (Trust)
  - 2.2.1 More trust on medical imposters than telemedicine doctors
  - 2.2.2 Fear of Privacy Breach
  - 2.2.3 Fear of imposters and online scams
  - 2.2.4 Doubts on online doctor's expertise and credibility.
  - 2.2.5 Patients hide details
- **2.3** Weak Regulatory Framework
  - 2.3.1 Lack of Ownership
  - 2.3.2 Lack of Licensing
  - 2.3.3 Policy available as a draft only
  - 2.3.4 Outdated Pakistan Medical Commission Code of Ethics

3. Activities:

- **3.1** Research & Innovation
  - 3.1.1 Lack of funding
  - 3.1.2 Lack of Focus on Local Research
  - 3.1.3 Lack of commercialization
- **3.2** Networking & Collaboration
  - 3.2.1 Govt hospitals resistant to collaborate
  - 3.2.2 Fear of Revenues being taken away
  - 3.2.3 Lack of International Collaboration & Investments
- **3.3** Policy Development
  - 3.3.1 Lack of intricate policy guidelines
  - 3.3.2 Lack of monitoring system
  - 3.3.3 Need for a separate telemedicine regulatory body

3.7.3 Data Structure:

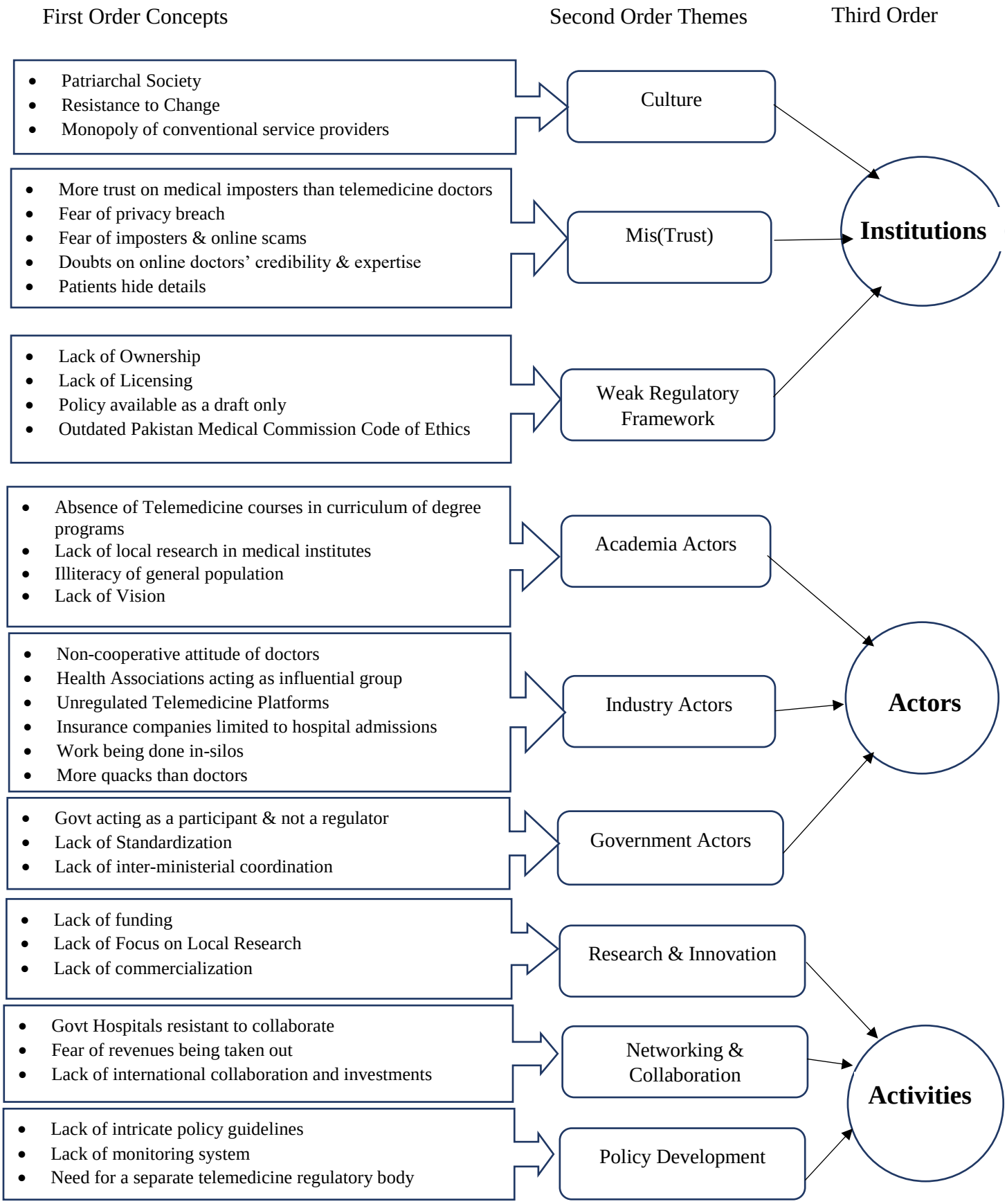

Figure 2: Data Structure

3.8 Ensuring research quality:

Ensuring research quality is significant to produce substantial and trustworthy findings. In the context of this investigation into the telemedicine industry, several measures have been undertaken to uphold the credibility and validity of the research.

3.8.1 Credibility

Credibility pertains to the extent to which the research findings are believable and can be trusted. The following steps have been employed to enhance the credibility of this study:

- In line with Lincoln and Guba's (Guba, 1981) recommendation, participants were offered the opportunity to review and confirm the accuracy of the transcriptions and interpretations of their interviews.
- Engaging with the research context over an extended period allowed the researcher to develop a deeper understanding of the subject matter andbuild rapport with participants. This extended involvement is in accordance with Lincoln and Guba's concept of prolonged engagement, which enhances the researcher's insight into the research context.

3.8.2 Transferability

Transferability concerns the extent to which the research findings can be applied to similar contexts or populations. To enhance the transferability of this study:

- The research includes rich, thick descriptions of the research context, participants, and data analysis. These detailed descriptions, as suggested by Younas and colleagues (2023), will enable readers to evaluate the applicability of the findings to other situations.

3.8.3 Dependability

Dependability is concerned with the stability and consistency of the research findings over time. The following strategies have been implemented to enhance dependability.

- An audit trail, as advocated by Guba and Lincoln (1989), has been maintained, documenting the research process, data collection, and data analysis.

3.8.4 Confirmability

Confirmability refers to the degree to which the research findings are shaped by the participants' perspectives rather than the researcher's biases. To ensure confirmability:

- The researcher has maintained a reflexive journal, as recommended by Finlay (2008), to record personal thoughts, biases, and reflections throughout the research process. It allowed the researcher to engage and relate with the respondents to gather important information in depth with more sophisticated jargons. This improved the quality of data and its veracity. However, the biasness was kept in checkwith help of the journal and cross-checking the transcriptions after each interview for researcher's biased comments. This process also helped in restructuring the questionsin a more natural tone for achieving the raw and unbiased outcomes.

These measures collectively contribute to the credibility, transferability, dependability, and confirmability of the research findings, bolstering the overall quality and trustworthiness of this study.

3.9 Ethical Considerations:

An essential part of this research was the strict adherence to ethical principles, which was crucial for protecting the rights and well-being of participants and ensuring the integrity of the study. The participants were treated as a unique human being within the context of his or her community system and freedom of choice were safeguarded. The ethical considerations in this research included the following elements:

Informed Consent: All the participants involved in the research were asked for their consent prior to the interviews and discussions in order to ensure voluntary participation. Written and verbal consent were obtained from participants to confirm their willingness to participate. The participants were clearly addressed about the context of research and the benefits and risks (if any) involved in it so that they were able to make an informed decision. This communication explicitly articulated the research's purpose, objectives, and procedures, ensuring that participants fully understood the nature of their involvement.

Anonymity: All individuals participating in this research were kept anonymous unless they explicitly granted permission to reveal their identities. This approach protected the interests ofthe participating firms while facilitating open and honest participation in the study.

Transparency: Throughout the research process, the intentions of the study and the expectations of participants were communicated clearly and transparently. The interviews were conducted keeping in mind that if a participant does not feel comfortable disclosing certain information, he/she will not be forced to answer at any point and there will be absolutely no negative consequences if a participant refuses to participate. Participants were allowed to withdraw from the research anytime without having to face any negative repercussions. This commitment to openness prevented any form of deception or misunderstanding at any stage of the research.

Confidentiality and Privacy: This study did not include patients' data and interviews. The confidentiality and privacy of all participating firms was kept in check, ensuring the protection of sensitive business data and preventing the disclosure of any current or future business strategies. They were made aware of the fact that all the information and data provided by them would be used solely for research purposes.

By adhering to these ethical considerations, this research maintained the highest standards of research ethics, fostering trust and cooperation among all participants, while protecting their rights and ensuring the validity of the research outcomes.

Chapter 4: Findings

The analysis of the semi-structured interviews identified the main barriers in the network of telemedicine actors, institutions and activities involved in the system of innovation. The interactive system of actors included CEOs of telemedicine startups, healthcare practitioners, health regulatory bodies and others, that are essentially playing a role in the production, diffusion and utilization of knowledge within national border.

4.1 Actors:

Telemedicine can be seen as a network of different actors. The categories of these actors come across different challenges and barriers that were identified with the help of respondents and further listed below as findings of this research. The findings mostly revolved around the actors of industry, academia and government as key components of system of innovation hence, the template analysis followed the categorization of actors in the same manner.

4.1.1. Academia Actors:

Academia plays an extremely essential role when it comes to the production and diffusion of knowledge. Health care providers specially doctors and medical students are important stakeholders of telemedicine. Respondents specially mentioned lack of understanding, misconceptions and ignorance regarding telemedicine among medical students. They highlighted that one of the main reasons for the telemedicine industry not doing well is because it is still not taught as a core subject to medical students. Despite the advancements in telemedicine and digital health technologies, medical universities maintain a curriculum that predominantly focuses on traditional methods of delivering healthcare. This reluctance to integrate telemedicine and digital health into medical education limits the capacity of future doctors to adapt to the evolving healthcare landscape. It deprives them of adequate knowledge and skills required in utilizing telemedicine tools, interpreting digital health data, or understanding the ethical and legal implications of practicing in a digital healthcare environment.

"We have one of the most overlooked, but I think fundamental stakeholders of the healthcare system which are medical students or doctors or future doctors. This is a huge pain point in Pakistan that digital health is not being taught as one of the mainstream subjects in medical education." (Respondent C)

Despite its great potential, the telemedicine industry is not growing the way it should and is being practiced at a very limited scope. Another reason pointed out by most participants was lack of focus on local research in academic institutes. Respondents mentioned that there is an overall lack of understanding the importance of finding local solutions for local problems of healthcare delivery. Telemedicine providers mentioned that R & D requires knowledge, infrastructure and qualified researchers but the country lacks enough research centers however, incorporating local health research trend into academic institutions would be a good idea to begin with, but the academic institutes and academic heads possess limited research capacity in terms of both, researchers as well as infrastructure. As Respondent E added:

"I have talked to professors. I have talked to Vice chancellors. They are not serious regarding the research. They do not have a vision. They do not have a picture of what the future is going to look like. In the next 10 to 15 years, the education system is going to flip upside down. And these people are not ready for it."

Also, some respondents mentioned the lack of required resources for research. Thus, lack of focus and resource facilitation in research leads to just imitating one another's models and, in most cases, copy pasting bits and pieces of what developed nations are doing which is hardly feasible for developing nations due to completely different contextual challenges.

> *"Research is the driving force for new knowledge production. You cannot always copy paste what others are doing. I want to highlight that there is a shortage of funding and investment in telemedicine research initiatives. Limited financial resources and competing priorities make it difficult to support large-scale research projects and longitudinal studies that could provide valuable insights into the long-term benefits and challenges of telemedicine implementation".* (Respondent P)

According to Respondent H:

"…academics need to come together and think of a plan for Pakistan's telemedicine."

The respondents highlighted a prevalent issue of illiteracy present among masses. The population is divided into different sets of people. There are people who are completely illiterate and so the concept of prioritizing health or using technology as simple as video/audio consultations in healthcare, is a concept non-familiar to them. These are the people who are very hard to shift to telemedicine. This is where the Ministry of Education needs to intervene. According to majority of the respondents, increasing literacy rate is the first step towards prioritizing health and spreading awareness. Government can play an exceptional role in educating masses.

"Health literacy is definitely there which means that there are very less people who have proper awareness regarding their health but then what you & I are talking about is 'digital health literacy' which is a huge barrier because they probably know how to operate a TikTok better, than they would know how to book an appointment." (Respondent X)

"The government's role in educating masses is paramount. They must jump in actively in spreading awareness about eHealth or mHealth through community outreach, workshops, and educational campaigns." (Respondent O)

By providing resources, training, and incentives, the government can empower individuals in backward areas to embrace telemedicine as a valuable tool for accessing healthcare services and improving their overall well-being." (Respondent H)

4.1.2. Government Actors:

Telemedicine is a network of many stakeholders. The industry shall perform in its full potential when all these actors come together. Interview respondents believed that bringing all the actors together- single-handedly by any private body is a task harder than anyone would think. They highlighted that is where the role of government is needed. Government bodies can play their part very strongly in gathering all the players of industry at one platform. It is need of the hour for government to take this industry seriously; gather all the

stakeholders, listen to their reservations, collectively work towards formulation of a detailed framework and come up with policy guidelines accordingly.

"All the stakeholders will have to unite on one platform and only government can do that. Stakeholders involve providers, patients, insurance companies and, fin-tech and right people are needed for that. Someone in the government officials who have the right business acumen and health acumen needs to take the lead". (Respondent G)

Some telemedicine startups claim to have won the trust of the government but that is not enough as the problem still exists because there are no official national policy guidelines or telemedicine frameworks/ protocols established in the country. The authorities need to play the role of a regulator and facilitator here rather than just a participant.

"Government is not the driving force behind telemedicine associations. They just come, attend meetings and leave so their role is just like a participant and not a regulator. This is not solving the issue by any means." (Respondent D)

Many participants doubted the skillset of government officials. They believed there is a lack of representations from the industry experts. Government actors being extremely important stakeholders need to understand the pain points of all the actors. For that matter, there must be an inclusion of academia, business, health and IT experts at government level positions in healthcare. The policies are not going to be effective if there is lack of representation from multiple stakeholders.

"The problem of healthcare won't be solved until and unless you come up with the right person for the right job who can make right policies, who understands the pain points of the stakeholders and identifies the solution for it." (Respondent R)

"Government Institutions need to realize that health is one topic, digitization is another topic and the implementation of these is then also another topic. If they will not move to this side of the counter, they will never be able to understand the problems and challenges of the provider." (Respondent T)

Due to the absence of a monitoring body and policy guidelines in case of telemedicine service providers, respondents mentioned a serious lack of standardization in

the industry. The presence of inefficient players and unfair pricing stems from the lack of standard setting. It is a threat to data security and privacy as well.

". Lack of standardization results in a fragmented and confusing patient experience, particularly for individuals who receive care from multiple providers or use different telemedicine platforms. Without standardized encryption protocols, data storage practices, and authentication mechanisms, there are high chances of patient information being exposed to unauthorized access or breaches"

"Anyone who wants to start a telemedicine platform, irrespective of the patients' privacy, irrespective of the technology use, irrespective of the quality of the doctor, can start at any medicine platform. So at least, if the government cannot become a purchaser of those telemedicine services, it must act as a regulator of those services."

4.1.3 Industry Actors:

Majority of respondents pointed out problems regarding the non-cooperative attitude of doctors. Participants revealed that majority of doctors are accustomed to traditional methods of physical consultations and believe that they are not tech-savvy. They fear change. According to them, shifting from physical consultations to online is going to slow down the process and learning the technicalities of telemedicine platforms is quite a lot of burden for which they do not have enough time. Moreover, once they come on board, a lot of argument goes around settling their consultation charges. Hence, an issue of work ethics rises from most doctors which damages the repute of telemedicine platforms. They demand quite high even for a short consultation and most doctors do not even show up during the working hours that they agreed upon. *Respondent M* added:

"There is no reason for anybody to charge 5000 rupees for a 15-minute consultation. No way. Doctors have a serious attitude problem. I mean, if God forbid, they were not told there's God, 90% of them would assume that they are God. So, there is this attitude problem."

Regarding the attitude problem among doctors, many respondents mentioned their lack of knowledge in applicability and benefits of telemedicine and hence, the resistance to change and upgrade.

Respondent H mentioned:

"We have a doctor population that does not understand the value of data and the value of quality of care. They are so immersed in their own conventional methods that it is a challenge to make them learn about the efficiency that they can bring into their work through telemedicine or digital health. So, I would say the doctor stakeholder population is not on board, they need to come on board with telemedicine."

Some of the respondents mentioned that since there is no national policy or contract of hiring or partnering with doctors, it gets very difficult to verify their expertise and skill level because they do not cooperate much when it comes to providing required documents or experience letters except for providing PMC practitioner licenses which is not enough.

"Honestly, we can just verify their PMC licenses or the degrees that they get from their medical colleges. That's it. And trust me, that is not enough to know the expertise of any doctor in providing online healthcare." (Respondent M)

"Here in Pakistan, we consider doctors to be something a bit above the law or may be more human than the other humans living in here. So, we're not really in a position to question them and when we do, there's a lot of reluctance involved from their side." (Respondent Y)

One concerning issue mentioned by most respondents was the presence of inefficient telemedicine service provision platforms in the market. These industry actors lack robust and efficient models but are offering services free of cost or as low as two rupees.

"One of the extremely problematic things that I would want to highlight is that some of the players in the market don't have strong platforms but they want to have traction. As a result of this, they are providing free of cost services to the clients and I think this is something which is killing the industry." (Respondent F)

"Since there is no proper mechanism for price setting, there are certain incompetent platforms, driving down prices to unsustainable levels."

Provision of healthcare is a very sensitive domain. There is no margin to make mistakes or play casual but still virtual healthcare platforms are unregulated and unmonitored in Pakistan which depicts the level of seriousness of state actors regarding healthcare system.

As mentioned earlier, due to an absence of telemedicine framework in Pakistan, almost all the service providers are working without any strong support from government. Every provider has their own set of guidelines and models upon which they are operating. This also means that a lot of this work is being done in-silos, which means slow growth for the industry. Respondents suggested formation of a telemedicine ecosystem which requires big collaborative steps to be taken with all the important stakeholders united at one platform. For that matter, Digital Health Association (DHA) Pakistan, came forward as an influential group in 2021. The aim of this association was to advise government in formulating digital health friendly policies, promote mutual collaboration amongst all stakeholders; digital health startups, healthcare service providers & health insurance aggregators so as to nurture & promote health digitization in Pakistan. It played a huge role in bringing all the essential stakeholders at one page regarding policy formulation and proceeded several documents and meetings with the government bodies but the association has been unable to do much since the people in power at government healthcare authorities have failed to materialize any of the suggestions despite agreeing. After several meetings and discussions with government, the DHA has still failed to get any policy framework.

"There is an association called Digital Health Association, created by few of the startups like ours. We started this association to ensure that people start recognizing what digital health is. The association tried to get government on board and come up with policies that can benefit the provider as well as the patient but there is no sandbox as yet." (Respondent L)

Many participants mentioned that health insurance companies can prove to be one of the most potential stakeholders in strengthening of telemedicine ecosystem. Health insurance companies can integrate telemedicine services into their existing healthcare delivery systems

and this way people can have access to online OPDs. In Pakistan, insurance companies are mostly limited to hospital admissions.

"Insurance companies don't want to touch telemedicine." (Respondent U)

"The main barriers hindering collaboration between telemedicine and health insurance companies include regulatory hurdles and uncertain reimbursement policies. Without clear guidelines and incentives for insurers to cover telemedicine services, it's difficult for telemedicine providers to secure reimbursement for their virtual consultations."

4.2 Institutions:

The concept further extends beyond these actors to include 'institutions' (Edquist and Hommen, 2008): Institutions are known as common habits, norms, established practices, regulations or laws that regulate the relations and interactions between individuals, groups and organizations. They are the rules of the game.

4.2.1 Culture:

The interview participants mentioned majority of cultural and contextual challenges in the process of spreading awareness and successful adoption, that fall into informal institutions. Respondents shared that there is a major untapped patient population which is extremely resistant towards adopting telemedicine solutions or accepting the concept of online consultations. The commonly mentioned reasons included gender inequality or patriarchal culture which leads to dependency of most rural women on male members of their family. Patriarchal ideology and gender discrimination have deprived women from equal educational, and employment opportunities and health care services (Skalli, 2001).

"Dealing with underprivileged population of Pakistan has always been a significant challenge; specially men. They are quite orthodox regarding their matters that involve women. We've seen some terrible incidents occur as a result. Men being the decision-makers of most families often dictate whether or not their women can access healthcare services, let alone online consultations. This power dynamic presents a major obstacle to ensuring healthcare access for marginalized populations and please note that majority of population

in Pakistan resides in rural or under-developed areas so you can imagine the health of masses there, specially, women and children." (Respondent B)

Lack of access to facilities as basic as health and education to women is something to be worried about.

"I was surprised to see that there are barriers to female populations in Pakistan not being able to go out to doctors due to conservative male members, and other financial or geographic barriers." (Respondent S)

Due to such orthodox mindsets, there are certain healthcare lobbies that are deeply rooted in the healthcare system. Lack of awareness and lack of trust in technology has facilitated these lobbies of fake practitioners and healthcare imposters in making easy money by exploiting people.

"We faced challenges when offering telemedicine in rural areas. Our presence threatened local quacks who were accustomed to being the primary healthcare providers. Pharmacies were affected because we provided high-quality, affordable generic medicines. Ultrasound and pathology setups in the vicinity suffered as we offered investigative facilities at lower prices. The local mullahs were also displeased, although we didn't discourage seeking spiritual healing alongside medical treatment. However, these established forces had influence over their local residents and health inspectors who obstructed our operations." (Respondent B)

Participants talked about resistance to change at different levels. They highlighted that conventionally, there is a huge majority of people who strongly believes in only consulting a doctor face-to-face. They believe in physically seeing the doctor as this is a set common practice and so they believe in the 'need-for-touch' even if they have a minor cough or flu that can be seen online by a medical doctor. They do not get satisfied until the doctor examines them physically.

"People want to be seen physically and not through a Tele medicine platform." (Respondent F)

"I will say that think about the Pakistani population. A majority of them wants face to face interaction with a clinician. They want to be seen by a doctor. They want to be prescribed medicine by a doctor, and they want to ideally get 'Takat ki drip' as well. So, this is majority of the population set that we're dealing with." (Respondent G)

4..2.2 Mis (Trust):

Regarding the discussion related to patriarchy, many respondents highlighted that such concerns mostly arise due to unawareness, illiteracy and conformist mindsets. Many people are found to trust unqualified practitioners with their lives rather than the online qualified doctors available.

"It's not just the accessibility problem, it's a reliability problem as well. You will be surprised that Pakistan has a total of almost 220,000 registered doctors in Pakistan and a total of almost 650,000 quacks. So, there are more quacks than doctors in Pakistan because people go to them." (Respondent G)

"Patients need to realize that the quack who's sitting at the end of the street is not the option to treat you. It is much safer doing the telemedicine option." (Respondent H)

More often than not, providing telemedicine solutions looks like a matter of privacy breach to such populations.

"When dealing with such populations, they consider it a threat to their privacy because they fear they're being recorded and it is hard for them to trust. They're hesitant to allow women use video consultations because they worry that their conversations with doctors might be recorded or misused. It can be seen that this fear stems from a deep-seated mistrust of technology and a belief that women's private matters should remain within the confines of the family. As a result, many women are deprived of the opportunity to seek medical advice online, which further exacerbates their already limited access to healthcare." (Respondent I)

In order to overcome this issue, most telemedicine platforms are hiring local representatives from the targeted area, who can help locals understand the importance of consulting a doctor online and also educate them regarding patient privacy and the treatment efficacy. It does

help to a limited extent since people are more willing to listen to someone who belongs to the same locality, speaks the same language and can understand their concerns but there are challenges in its way too.

"When we went to rural settings, we wanted to hire girls to work for us so that they can reach maximum female patients in the rural settings but then again, in a rural setting, girls are very much domesticated. They are not supposed to work out or intermingle with the general public. So, collecting that workforce too was a challenge for us." (Respondent A)

Many service providers mentioned their strategies and methods in trying their own ways to raise as much awareness among people as possible. These includes sessions with the local communities, voicemails, interactive voice response services and follow-up messages on cell phones etc.

"In our rural outreach program, we conducted tailored sessions for different demographics to educate them. We emphasized staying away from unqualified practitioners and explained how our telemedicine technology works. Additionally, we utilized an IVR solution for mass outreach, delivering audio messages about our services. However, there is only limited effort that we can do on our part. There are resource constraints for small businesses and so ultimately, we had to shut it down. However, with government support, we believe awareness about telemedicine can grow faster, improving healthcare access in rural areas." (Respondent T)

The participants also mentioned that even for the educated population within the country, there are concerns when it comes to trusting online doctors and rightly so. People have their doubts regarding the credibility and expertise of online doctors. They sometimes fear that the person sitting behind the screen might not be a qualified doctor or he/she might be out of practice.

> *"the patients do not take the doctor seriously. I think one factor that contributes to it is these portals usually do not have a very hard check and balance, so anyone with 0 experience or 0 expertise can register themselves, they just need their medical license." (Respondent I)*

Respondent U added,

"The patients don't take online doctors seriously enough to actually believe them, because usually the telemedicine portals in Pakistan don't charge as much as in person consultation."

Respondents mentioned that due to no national guidelines or privacy protocols present regarding the telemedicine framework, people do not consider their medical data is safe online which is true in some cases since all the telemedicine platforms are not HIPAA Compliant and privacy can be an issue.

"Without naming names, there will be digital health platforms where I personally have seen people who are not doctors registered as doctors. So, it's just another channel for quackery then. So, you're not really solving the problem." (Respondent H)

"I think data protection is a huge issue in Pakistan and when it's medical data, it's much more sensitive. A lot of the times when I've asked startups about their data protection mechanism, they go like; nothing will happen, we have kept it secure and we have it in the google drives, and everybody, in the company that's not even a doctor has access to those Google drives. So, I think data breach is the biggest issue. All of this can be dealt with formulating proper guardrails and regulation."

"In Pakistan, unfortunately, data is easily available and I mean this is going a bit off topic, but then there's a lot of international research grants that are given to South Asian countries like Pakistan, India, Bangladesh because it is very easy to get patient data from there. There's no regulations around patient data." (Respondent C)

All these reasons listed above such as privacy concerns, need-for-touch and non-familiarity of patients with the online doctor lead to a weak patient-doctor relationship. Due to this, sometimes the patients may intentionally hide medical details or sometimes the doctor forgets to ask certain questions regarding the patient's medical history. This can be seen as an associated risk.

"You completely rely on the patient to give you all the information when it is an online consultation. The doctor himself cannot verify that information. For instance, a person could be lying about their age or weight or anything because there is a certain stigma attached to health issues in Pakistan. So, people do get defensive if they have not built a nice

relationship with the doctor without realizing that the consultant is doing his job and won't be judging them." (Respondent I)

4.2.3 Weak Regulatory Framework:

As per respondents, the major failure in healthcare system of Pakistan is primarily due to lack of regulatory framework, monitoring bodies and policy guidelines. Health including eHealth is not a priority for government institutions and it shows. According to data from the World Bank, Pakistan's total healthcare expenditure as a percentage of GDP has been relatively low compared to other countries.

"We have seen how much of the GDP is being spent on health. It's less very low as compared to the growing population size. So, it shows how serious is government about the healthcare and spending on people's health."

Telemedicine is not a very recent discovery, it has been there for years but when Covid-19 happened, it created a death scare and people started preferring online consultations over physical ones in order to stay safe through the pandemic. Considering this as a great entrepreneurial opportunity, several telemedicine startups came forward with the idea of providing online consultations with doctors. In such chaotic times, the absence of proper guidelines by the healthcare regulatory authorities made it hard to differentiate authentic telemedicine providers from the fake ones. The providers faced issues regarding their credibility. In the light of above-mentioned scenario, Ministry of National Health Services Regulations & Coordination (M/o NHSRC) came up with a telemedicine policy draft in the year 2021.

"Even for the conventional healthcare, government came up with healthcare regulations very late and so for telemedicine they just came up with a draft policy during the times of Covid-19, which never got passed."

The draft suggested getting an initial temporary telemedicine license from Pakistan Medical Commission (PMC) which would be converted into a permanent license post 06 months of training. Furthermore, the document suggested that the Telemedicine Certification Training shall be provided by entities authorized and accredited by the M/o NHSR&C. It further

proposed that the application being used by the doctors to provide consultations shall be required to register with the Ministry. However, the policy draft called for comments and reviews on the document by all the relevant stakeholder but as soon as the chaotic death scare of pandemic ended, the draft did not materialize into any concrete framework or policy.

So back in 2021, there was a move, when Telemedicine and digital health were the buzzword all around the world and Pakistan as well. So, there was a push to create a digital health framework. And they got all the different stakeholders together to draft a document but then, that movement fizzled out as well. So, I don't know what the status of that particular document is. There was a draft by the regulatory authorities because they created a draft, asked for feedback from the Digital Health Association and other stakeholders. But I don't know where that all went to be honest."

Digital Health Association Pakistan came forward of the collective voice that adding Telehealth facility to all the users of Sehat Card would be greatly beneficial not only to fulfil the void of OPD facility under Sehat Card but also act as a gatekeeping & preventive medicine mechanism.

> *"In this regard we recommended that a nominal amount of premium may be added in the existing per family premium of Sehat Card and subsequently that amount be allocated to Digital Health Companies that qualify the due process. This initiative has already been successfully initiated in neighboring country by the name of e-sanjeevani which has already served more than 1.2 Crore consultations serving more than 90,000 patients daily from the platform of Digital Health Association. It was requested to the Provincial Minister that a meeting time be accorded with relevant federal & provincial authorities in this regard so as to move forward towards implementation of Teleconsultation with Sehat Sahulat Program, and several meetings occurred and mutual understanding was made to work on this suggestion but nothing worked out."*

Respondents mentioned a lack of ownership regarding the industry.

"PMC that is the Pakistan Medical Association; it said that Telemedicine does not fall under our responsibility. Federal Ministry of Healthcare said it falls under PTA because the service is being delivered through phone. PTA said it is a health service so it falls under

the Ministry of Health. To sum it up I think nobody knows exactly who is going to be responsible. There is no regulator". (Respondent L)

This lack of ownership shows a very worrisome aspect regarding lack of inter-ministerial coordination.

"I don't know of any institution or any licensing body for platforms like ours. I remember I approached NHSR&C, PMC and Islamabad Health Regulatory Authority to give us license for telemedicine, but they were surprised as to why we have come to them. Then we went to Punjab Health Commission and asked them for a license since we are going to be operating there too but it has been a year and they still do not know which category to put that into." (Respondent F)

There is no particular licensing of these portals to see if the people that they are claiming to be doctors are actually qualified doctors or not. They do not have to get any sort of permissions from any health regulatory authorities.

"The telemedicine startups or organizations just register their company with SECP, then they prepare their websites or mobile apps." (Respondent G)

4.3 Activities:

The central focus lies on interactive learning as a driving force of long run economic development. The interactive learning is based on activities between actors and institutions. These include Research, Innovation & Commercialization, Networking & Collaboration, Education & Skills Development and Monitoring & Evaluation.

4.3.1 Research & Innovation:

Respondents discussed that there is very limited understanding of telemedicine in Pakistan. There is a need to look at the bigger picture which shows that telemedicine is not just a one-time teleconsultation, but is a great way to reach underserved areas and ensure cost-cutting care delivery, patient empowerment, disease management, early patient engagement & education, as well as preventive care.

> *"usually telemedicine is confined to an online consultation or it's a concept among everyone that the telemedicine is actually a video consultation between the healthcare professional and the patients. But actually, telemedicine is coming under umbrella of three parameters i.e. teleconsultation, tele-education and tele-monitoring."* (Respondent N)

There is a need to look to investigate and explore health trends, patient demographics, market dynamics and for that matter, research and analysis are supposed to be essential ongoing processes in the development of telemedicine services and business models. Continuous iteration and improvement are essential to ensuring the relevance, effectiveness, and success of telemedicine initiatives over time.

Telemedicine is a quite context-specific practice and requires tailor-made solutions for different areas depending upon the type of population and its dynamics. Research can help here diving into the local problems.

> *"Research plays a crucial role in understanding the diverse needs and preferences of patients in telemedicine. By conducting studies and surveys, researchers can gather insights into factors such as cultural backgrounds, technological literacy, socioeconomic status, and medical conditions that influence patient experiences and outcomes in telemedicine."*

Respondents mentioned a dearth of funding by the government to upscale the infrastructure for telemedicine so that it can reach the underprivileged audiences too. Ministry of Health must look into providing grants for research projects that focus on providing entrepreneurial solutions for delivering primary care to patients in underserved areas through digital means instead of conventional healthcare delivery that requires a lot of human resource and is not cost-friendly.

> *The intersection of business and health presents numerous opportunities for market innovation and growth. Research can help identify emerging trends, unmet needs, and market gaps that present opportunities for businesses to develop and commercialize products, services, and technologies that address healthcare challenges and capitalize on market demand.*

Respondents mentioned the need of carrying out relevant research that can help in developing platforms that can provide specialized care.

> *"no one is providing specialized care services like we have so many epidemic diseases like thyroid and like those diseases which can be managed by talking and consultations."*

Respondents mentioned that when Covid-19 happened several government hospitals tried building the telemedicine care centers but failed to sustain. There are matters like these that need to be investigated and research in order to benefit masses. A successful research starts with looking into local problems and then finding the solutions to it (Spithoven, 2021).

> *"There needs to be a strong focus on capacity building, thorough evaluation and research. There is a telepsychiatry department, there is a telemedicine department, but you can't even imagine how it is running. There are ten to eleven separate numbers for each department. There is a room for telemedicine for all the doctors. They sit on the computers. There is a software, but they don't understand what sort of interventions they need to do and how they have to plan it."*

This shows that there is need of spreading awareness as well as a need to explore more within the industry.

4.3.2 Networking and Collaboration:

Respondents mentioned the importance of collaboration and partnership among academia, industry, and government for fostering a thriving innovation ecosystem and driving economic growth and societal progress. Participants mentioned that among many challenges that start-up ecosystem has to face in Pakistan, one big issue is that younger or smaller companies including telemedicine startups often find it difficult to have collaborations with big industry players. While working with the government, big corporations, and banking sectors etc. there is a very visible divide between the startup sector of the country and the industrial or corporate sector of the country. The big industries are often resistant to collaborate with start-ups thinking that collaborations with such companies might take away major chunks of their revenue which is not true.

"Health is such a big pie that if government collaborates with every business, every one of them will make their profits even you will easily get more people who can be trained and deliver health with making more revenue effectively. New ethical businesses can be created, jobs can be created and actual quality services can be provided to people but it is being wasted mindlessly."

Doctors as well as hospitals who are set in their own conventional ways and running system are resistant to partner or collaborate with telemedicine organizations due to the fear of revenues being shared through such partnerships.

> *"Health service providers and hospitals actually don't want to collaborate with a solution which has already developed its technology platform, which is much better in every possible way. So, these hospitals will go for whatsapp calls and everything but they are very resistant towards adopting a technological solution with the customers, so the problem that we mainly face is the resistance from institutional health service providers because somehow, they feel that by collaborating with technology platform like ours, we are going to take away their revenues while I think it's the other way around. We are going to connect their patients in a secure telemedicine platform and bring them more patients because they can consult the doctors from the ease and comfort of their homes."*

Along with local challenges, respondents also discussed barriers in international collaborations and reduced international investments due to a lack of Digital Healthcare Framework in Pakistan. International collaborators and investors feel hesitant to engage with non-accredited telemedicine platforms due to concerns about reliability, accountability, and compliance with regulatory requirements.

> *"The absence of policy guidelines for telemedicine platforms affect international collaborations and undermine the attractiveness of the Pakistani telemedicine market. International investors view regulatory uncertainty as a barrier to entry and prefer to allocate their resources to markets with more predictable regulatory environments."*

4.3.3 Policy Development:

As mentioned earlier, respondents focused the most on the policy development aspect. Participants believed that policy development is going to be the first step towards establishing a concrete telemedicine ecosystem within the country. It would create trust among stakeholders. Participants mentioned that policy must be formulated after a thorough investigation of the current scenario of telemedicine in the country and through joint collaboration of stakeholders. The respondents also mentioned the need for establishing a monitoring system in order to ensure the long-term continuity of the industry.

> *"The policy must be a very detailed formulated one. It must contain clear guidelines regarding scope of telemedicine, technology standards, reimbursement policies, licensing of telemedicine practitioners and platforms, encryption protocols and privacy, parameters of accreditation, standardization, training and much more."*

Several participants also mentioned that telemedicine policy formulation must not be the responsibility of Federal ministry of health as it has already failed to revolutionize conventional health system till date. A separate body working on digitization, licensing, monitoring must be formed.

> *"Well, Federal and Provincial Ministries have failed the healthcare system many times. Telemedicine if left upon them, shall never reach its due potential. Instead, there should be a separate entity actively dedicated to digitization, licensing, and monitoring within the telemedicine sector."*

Chapter 5: Discussion

Telemedicine focuses on providing medical care to patients in remote locations using telecommunication technologies. It has been shown to be cost-effective solution to improve health outcomes, and enhance patient satisfaction. Tele-monitoring of patients with chronic diseases can potentially facilitate early detection warning signs of health deterioration and thereby prevent hospitalization (Herold et al., 2018). Several studies have examined the efficacy of telemedicine interventions as well as challenges associated with the adoption of eHealth innovations (Sundin et al., 2016). Technological barriers are often cited as a significant cause of the disappointing telemedicine adoption and utilization rates. The adoption rate of industry is slow. Each telemedicine system faces unique challenges in each geographic location based on country dynamics, regions and towns they choose to operate their business. Despite numerous studies on eHealth and its potential benefits, the industry still has a long way to go to prove its true worth.

While the hype surrounding telemedicine is high in the private organizations, multiple stakeholders of public health sector remain cautious and doubtful towards its incorporation into existing systems. This research study pointed out the barriers at national level system of innovation comprising of actors, institutions and the interactive activities that need to be overcome in order to increase the adoption of telemedicine among end-user i.e. patients.

As reported by Zhang & Zaman, (2020) and several others, considering the conventional health infrastructure and existing health disparities in Pakistan, the country is an ideal setting for increasing use of telemedicine, and would demonstrate substantial benefits to rural population living at significant distance from an already limited specialized healthcare force. Visiting a public sector hospital has been considered as a nightmare due to poor quality of services, behavioral attitudes, infrastructure and hospital management (Deogankar, 2004).

This research study supports the findings of Kazmi et al., 2022 and O'Shea et al., (2015) that reported lack of adequate knowledge and training for telemedicine in medical institutes that consequently result in resistance from doctors to incorporate the ehealth practices thus, posing barriers to adoption of telemedicine and suggested to integrate elements of existing applications to mainstream telemedicine within medical education. At the very least, medical

schools could adopt a telemedicine core course to better equip young physicians with the knowledge and skills to incorporate telemedicine into their future practices. This research study reports lack of inclusion of telemedicine in the curriculum and very limited research within the local problems of healthcare as the weakness of academia. To increase respective knowledge and awareness among healthcare professionals, eHealth and telemedicine should be an integral part of the medical curriculum as well as of advanced training for medical staff (Wernhart et al., 2019). A mix method research study by Sapci & Sapci, (2019) found out that when students are actively involved in the learning process, learning is most efficient. The study demonstrated a strong and consistent association between specific skills sets training and students' adoption and confidence towards overall technology and using remote patient monitoring strategies, and provided valuable feedback about technical challenges. Knowledge transfer between academia and industry is considered an important driver of innovation and economic growth as it eases the commercialization of new scientific knowledge within firms (Ye & Wang, 2019). The findings suggest looking into health trends, patient demographics, market dynamics and carrying out research and analysis accordingly to provide local solutions as health dynamics vary geographically. Hence, a lack of tailor-made solutions for telemedicine were reported.

Prior research suggests that culture-specific beliefs play a huge role in health behavior. Owen O' Donnel, (2021) presented low demand and resistance to adopt modern health interventions often derive from deep-rooted attitudes that reflect culture and social norms. Pakistan has a collectivistic culture which means that the interest of the group prevails over the interest of the individual (Ittefaq et al., 2022). Many collectivist societies are highly patriarchal, so it is often women who are deprived of basic facilities as well as opportunities and expected to sacrifice (Kim, 2009). This research study aligns with the above researches and reports that social norms and peer pressure play significant roles in collectivistic cultures.

On the other hand, this research explores the major barrier of non-existent policy frameworks for telemedicine within the country. The findings are consistent with work of Ali et al., (2021) that shows the major failure in the healthcare system of Pakistan is lack of

governance and monitoring Policy, the scenario was found to be no different in case of telemedicine industry.

Ample amount of evidence is present in literature which proves the significance of telemedicine in clinical care, chronic disease management and disease prevention along with its benefits in time-saving and cost-cutting (Bashshur et al., 2014). But, it continues to fail though in translating its potential in the form of widespread adoption and poor understanding of knowledge management is a contributor according to Standing et al., (2018). In his study regarding knowledge management in telehealth, it was reported that a holistic systems perspective is required rather than the focus being on solely on software if knowledge is to be effectively managed. The findings of this thesis align with Standing et al. (2019) on knowledge management in telemedicine. The industry's multifaceted nature necessitates several requirements for effective knowledge sharing and continuous learning among actors, including top management support, a clear vision for knowledge sharing, and reliable support systems. Research findings on Regional System of Innovations in South Africa by Van Dyk et al., (2010) report that telemedicine is inherently multidisciplinary, requiring significant knowledge sharing and interaction across various disciplines and organizations to foster innovation. The findings from this thesis indicate that there are many requirements that need to be in place for knowledge to be effectively shared and for actors to continually learn. Several barriers hinder effective knowledge sharing and continuous learning in telemedicine. These include a lack of trust and interconnectedness among actors, insufficient top management support, inadequate collaborative efforts, and unreliable support systems.

The research findings reported that most of the barriers are not such that cannot be overcome but despite interactions of telemedicine stakeholders with health regulatory authorities, many a times the policy regarding telemedicine never materialized which contributes to a lot of blockades for the industry to grow at its full potential. Apart from factors such as political instability, this shows a serious lack of required skillset and acumen of state actors, lack of inter-ministerial coordination among the external stakeholders and lack of ownership.

This research findings showed that technological constraints are not the most impeding factors in the country; isolated and uncoordinated activities among actors and institutions

are the prime barriers here. Policy making for telemedicine requires the collaboration of several stakeholders. There is poor collaboration within and between different departments in the health sector regarding Moreover, there is a poor collaboration between various sectors as well. Literature suggests that telecommunication sector is growing daily. *Economic Survey of Pakistan* described the technological changes in stating that Pakistan's IT sector had gone through an historic move in the past few years and the country had taken the lead in adopting new technology. Telecom sector and IT has a huge role to play in telemedicine. An appropriate skills mix is a key policy instrument to provide a workable policy in telemedicine industry.

Thesis findings align with the fact that trust plays a critical role in facilitating health care delivery as investigated by Taylor et al., (2023). It also shows that the absence of clear policy guidelines, lack of licensing and monitoring system creates lack of standardization and uncertainty for international collaborators and investors regarding the regulatory framework governing telemedicine practices. This uncertainty increases perceived risks associated with investing in or partnering with telemedicine platforms, potentially leading to reluctance to engage in collaborative ventures.

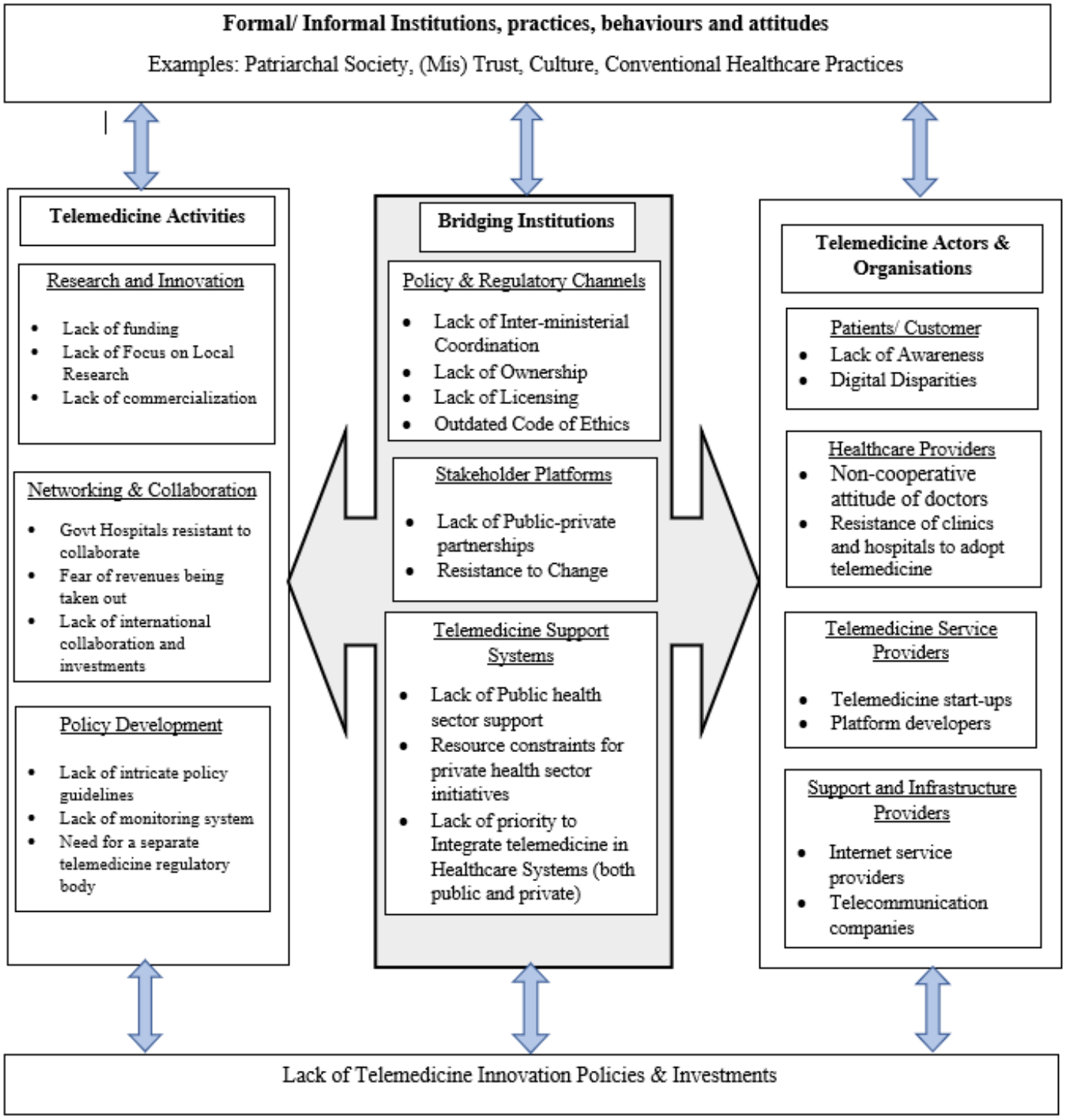

Figure 3: Proposed Framework

5.1 Proposed Framework:

The proposed framework provides a comprehensive understanding of institutions that hinder the and restrict knowledge sharing and interconnectedness among key actors and activities in the telemedicine ecosystem. By outlining various components, the framework highlights critical issues like the absence of telemedicine education, lack of public-private partnerships, and non-cooperative attitudes among healthcare providers. Additionally, it emphasizes the influence of informal institutions, practices, and attitudes, such as resistance to change and mistrust. This holistic approach facilitates the identification of systemic challenges. It also sheds light on significant policy-making barriers that impede the progress of telemedicine. The framework underscores the limited collaboration with international organizations, which hinders knowledge sharing and the adoption of best practices. These barriers contribute to a fragmented telemedicine ecosystem, limiting its potential to improve healthcare accessibility and outcomes. Such restrictions in knowledge sharing impedes the feedback loop among telemedicine actors, leading to delays in refining and improving telemedicine practices.

Chapter 6: Conclusion, Implications and Future Direction

6.1 Conclusion:

Prior researches show that Pakistan, in its 75-year history, has experienced one approved National Health Policy passed through Parliament (1990), two National Health Policies announced and approved by the ministerial Cabinet (1997, 2001) and one draft policy of 2010. None of the policies were translated into operational planning as the targets were overambitious and direction tended to be vague. The medical practice in the country is alarmingly unregulated.

The study rests on the premise that despite being widely acknowledged for supporting efficient and effective delivery of medical services, telemedicine adoption has not become an integral part of the healthcare system in Pakistan. Such disengagement deprives the healthcare system of delivering cost-effective and inclusive medical care. Given the criticality of the issue, the factors contributing to limited adoption of the industry cannot be ignored. Taking this in notice, this study explores the barriers contributing to the low adoption of telemedicine. This research contributes to the literature by investigating the barriers that are faced by actors in the innovation system. The research findings indicate that while technological limitations exist within the country, they are not the primary obstacles to progress. Instead, the main barriers stem from disconnected and uncoordinated efforts among various actors and institutions involved. It contributes to the existing literature by investigating the obstacles faced by actors within the National System of Innovation, including doctors, policymakers, academia, startup owners, and telemedicine analysts. By focusing on these stakeholders, the research aims to uncover the underlying issues hindering the widespread implementation of telemedicine. Main barriers stem from disconnected and uncoordinated efforts among the various actors and institutions involved. This fragmentation leads to inefficiencies and hampers the cohesive development of telemedicine initiatives. Moreover, the lack of a robust regulatory framework exacerbates these issues, as it fails to provide clear guidelines and standards for telemedicine practices. Without proper regulation, the trust and acceptance of telemedicine by both healthcare providers and patients remain low. Additionally, the absence of strategic operational planning further

complicates the adoption process, as initiatives often lack clear objectives and measurable outcomes as they are not backed by local research on prevailing issues. Addressing these challenges requires a multi-faceted approach that involves the active collaboration of all stakeholders within the innovation system. Policymakers need to create and enforce comprehensive regulations that support telemedicine adoption. Healthcare providers and institutions must work together to develop and implement strategic plans that align with national health policies. Furthermore, investment in infrastructure and training is essential to ensure that technological advancements can be effectively utilized.

In conclusion, while Pakistan faces significant barriers to the adoption of telemedicine, these challenges are not insurmountable. By fostering coordination and collaboration among all actors involved, and by establishing a clear and supportive regulatory framework, Pakistan can overcome these obstacles and integrate telemedicine into its healthcare system. This integration is crucial for delivering cost-effective, inclusive, and high-quality medical care to its population, ultimately improving the overall healthcare outcomes in the country.

6.2 Implications:

6.2.1. Theoretical Implications:

This study contributes to the theoretical knowledge of telemedicine barriers in literature by conducting comprehensive research involving various stakeholders, such as doctors, start-up owners, analysts, and policymakers. It underscores the importance of interactive activities that need to be focused on to address these barriers effectively. By engaging with these diverse actors, the study provides a multi-faceted perspective on the challenges in telemedicine adoption. This approach not only enriches the existing body of knowledge but also highlights the critical role of collaboration and active engagement among stakeholders in overcoming the obstacles to telemedicine implementation.

6.2.2. Practical Implications

This study offers three key contributions to practice: First, it reveals that Resistance to the adoption of telemedicine extends beyond just patients and doctors; it involves multiple external stakeholders who play crucial roles in supporting these practices. Moreover, even

within the realm of innovation, there are reservations regarding the potential of telemedicine. By uncovering such dimensions, this research brings out the intricacy of the issue and points out top barriers hindering the formulation of effective strategies and interventions to overcome such resistance.

Second, it highlights the fact that despite the strength of these innovations to deliver healthcare with better cost-saving models, there exist several institutional obstacles that may produce frictions in the adoption of e-health innovations. By doing so, it sows that the adoption of these innovations is not just an operational or technical decision, rather it is a broader decision.

Third, telemedicine start-up' owners and analysts shared an interesting viewpoint on incorporating business acumen from the industry experts into the national level policy making for telemedicine. This collaboration would not only aid the creators of telemedicine solutions but also attract international knowledge sharing from those interested in contributing to the health sector. Their involvement could amplify the impact of telemedicine initiatives, increase public awareness, and drive adoption, ultimately enhancing the effectiveness and reach of telemedicine services across Pakistan.

6.2.3. Limitations:

The findings of this research may not be universally applicable to all healthcare systems or contexts. The barriers to telemedicine adoption could vary significantly depending on regional differences in healthcare infrastructure, cultural norms, and regulatory frameworks. Additionally, the research may have limitations related to the size and representativeness of the sample population studied.

6.3 Future Directions:

Building on the findings of this study, it is crucial to explore innovation systems at regional and sectoral levels to gain a detailed understanding of the implementation problems of telemedicine at each level. This need is further underscored by the implications of the 18th Amendment, which has led to the devolution of power to the provinces. Conducting a comparative analysis when studying innovation systems at regional and sectoral levels facilitates the identification

of best practices and successful models of telemedicine adoption. These insights can be replicated in other regions or sectors to enhance their telemedicine implementation. comparative analysis. By comparing different regions and sectors, it is possible to identify best practices and successful models of telemedicine adoption. These insights can be leveraged to replicate success in other areas.

References:

Abugabah, A., Nizamuddin, N., & Alzubi, A. A. (2020). Decentralized telemedicine framework for a smart healthcare ecosystem. *IEEE Access*, *8*, 166575–166588. https://doi.org/10.1109/ACCESS.2020.3021823

Alaboudi, A., Atkins, A., Sharp, B., Balkhair, A., Alzahrani, M., & Sunbul, T. (2016). Barriers and challenges in adopting Saudi telemedicine network: The perceptions of decision makers of healthcare facilities in Saudi Arabia. *Journal of Infection and Public Health*, *9*(6), 725–733. https://doi.org/10.1016/j.jiph.2016.09.001

Alenoghena, C. O., Ohize, H. O., Adejo, A. O., Onumanyi, A. J., Ohihoin, E. E., Balarabe, A. I., Okoh, S. A., Kolo, E., & Alenoghena, B. (2023). Telemedicine: A Survey of Telecommunication Technologies, Developments, and Challenges. *Journal of Sensor and Actuator Networks*, *12*(2). https://doi.org/10.3390/jsan12020020

Alsaawi, A. (2014). A CRITICAL REVIEW OF QUALITATIVE INTERVIEWS. In *European Journal of Business and Social Sciences* (Vol. 3, Issue 4). http://ssrn.com/abstract=2819536URL:http://www.ejbss.com/recent.aspxhttps://ssrn.com/abstract=2819536Electroniccopyavailableat:http://ssrn.com/abstract=2819536URL:http://www.ejbss.com/recent.aspx

Amjad, M. (2020). Telemedicine: Implementation, Challenges and Opportunities in the Global World. *Qlantic Journal of Social Sciences and Humanities*, *1*(2), 40–53. https://doi.org/10.55737/qjssh.738748741

Aruleba, K., & Jere, N. (2022). Exploring digital transforming challenges in rural areas of South Africa through a systematic review of empirical studies. In *Scientific African* (Vol. 16). Elsevier B.V. https://doi.org/10.1016/j.sciaf.2022.e01190

Ashfaq, A., Memon, S. F., Zehra, A., Barry, S., Jawed, H., Akhtar, M., Kirmani, W., Malik, F., Khawaja, A. W., Barry, H., Saiyid, H., Farooqui, N., Khalid, S., Abbasi, K., & Siddiqi, R. (2020). Knowledge and Attitude Regarding Telemedicine Among Doctors in Karachi. *Cureus*. https://doi.org/10.7759/cureus.6927

Babatunde, A. O., Abdulazeez, A. O., Adeyemo, E. A., Uche-Orji, C. I., & Saliyu, A. A. (2021). Telemedicine in Low and Middle Income Countries: Closing or Widening the Health Inequalities Gap? *European Journal of Environment and Public Health*, *5*(2), em0075 https://doi.org/10.21601/ejeph/10777

Bashshur, R. L., Shannon, G. W., Smith, B. R., Alverson, D. C., Antoniotti, N., Barsan, W. G., Bashshur, N., Brown, E. M., Coye, M. J., Doarn, C. R., Ferguson, S., Grigsby, J., Krupinski, E. A., Kvedar, J. C., Linkous, J., Merrell, R. C., Nesbitt, T., Poropatich, R., Rheuban, K. S., … Yellowlees, P. (2014). The empirical foundations of telemedicine interventions for chronic disease management. *Telemedicine and E-Health*, *20*(9), 769–800. https://doi.org/10.1089/tmj.2014.9981

Batsis, J. A., DiMilia, P. R., Seo, L. M., Fortuna, K. L., Kennedy, M. A., Blunt, H. B., Bagley, P. J., Brooks, J., Brooks, E., Kim, S. Y., Masutani, R. K., Bruce, M. L., & Bartels, S. J. (2019). Effectiveness of Ambulatory Telemedicine Care in Older Adults: A Systematic Review. In *Journal of the American Geriatrics Society* (Vol. 67, Issue 8, pp. 1737–1749). Blackwell Publishing Inc. https://doi.org/10.1111/jgs.15959

Berwick, D. M. (n.d.). *Disseminating Innovations in Health Care*. https://jamanetwork.com/

Bitar, H., & Alismail, S. (2021). The role of eHealth, telehealth, and telemedicine for chronic disease patients during COVID-19 pandemic: A rapid systematic review. In *Digital Health* (Vol. 7). SAGE Publications Inc. https://doi.org/10.1177/20552076211009396

Campling, N. C., Pitts, D. G., Knight, P. V., & Aspinall, R. (2017). A qualitative analysis of the effectiveness of telehealthcare devices (i) are they meeting the needs of end-users? *BMC Health Services Research*, *17*(1). https://doi.org/10.1186/s12913-017-2408-8

Cannavacciuolo, L., Capaldo, G., & Ponsiglione, C. (2023). Digital innovation and organizational changes in the healthcare sector: Multiple case studies of telemedicine project implementation. *Technovation*, *120*. https://doi.org/10.1016/j.technovation.2022.102550

Dickey, A. M., & Wasko, M. M. L. (2023). Digital Disparities in Patient Adoption of Telemedicine: A Qualitative Analysis of the Patient Experience. *International Journal of Healthcare Information Systems and Informatics*, *18*(1). https://doi.org/10.4018/IJHISI.318043

Chakraborty, I., Ilavarasan, P. V., & Edirippulige, S. (2021). Health-tech startups in healthcare service delivery: A scoping review. In *Social Science and Medicine* (Vol. 278). Elsevier Ltd. https://doi.org/10.1016/j.socscimed.2021.113949

Edquist, C. (2004). Science and Public Policy Final remarks Reflections on the systems of innovation approach. In *Science and Public Policy* (Vol. 31, Issue 6). Beech Tree Publishing. www.circle.lu.se.

El-Rashidy, N., El-Sappagh, S., Riazul Islam, S. M., El-Bakry, H. M., & Abdelrazek, S. (2021). Mobile health in remote patient monitoring for chronic diseases: Principles, trends, and challenges. In *Diagnostics* (Vol. 11, Issue 4). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/diagnostics11040607

Fuentes, R. A., & Soto, A. R. (2015). Non-technological innovations in Chilean agricultural firms: What motivates the decision to innovate and the propensity of innovation? *Ciencia e Investigacion Agraria*, *42*(2), 171–179. https://doi.org/10.4067/S0718-16202015000200004

Gates, B. (2020). Responding to Covid-19 — A Once-in-a-Century Pandemic? *New England Journal of Medicine*, *382*(18), 1677–1679. https://doi.org/10.1056/nejmp2003762

George, A. S., & Hovan George, A. S. (2023). *Partners Universal International Innovation Journal (PUIIJ) Telemedicine: A New Way to Provide Healthcare*. https://doi.org/10.5281/zenodo.8075850

Grimshaw, J. M., Eccles, M. P., Lavis, J. N., Hill, S. J., & Squires, J. E. (2012). Knowledge translation of research findings. *Implementation Science*, *7*(1). https://doi.org/10.1186/1748-5908-7-50

Hair, J. F., Page, M., & Brunsveld, N. (n.d.). *Essentials of Business Research Methods; Fourth Edition*.

Haleem, A., Javaid, M., Singh, R. P., & Suman, R. (2021). Telemedicine for healthcare: Capabilities, features, barriers, and applications. In *Sensors International* (Vol. 2). KeAi Communications Co. https://doi.org/10.1016/j.sintl.2021.100117

Hathaliya, J. J., & Tanwar, S. (2020). An exhaustive survey on security and privacy issues in Healthcare 4.0. In *Computer Communications* (Vol. 153, pp. 311–335). Elsevier B.V. https://doi.org/10.1016/j.comcom.2020.02.018

Herold, R., van den Berg, N., Dörr, M., & Hoffmann, W. (2018). Telemedical Care and Monitoring for Patients with Chronic Heart Failure Has a Positive Effect on Survival. *Health Services Research*, *53*(1), 532–555. https://doi.org/10.1111/1475-6773.12661

Hills, A. (n.d.). *Operational Challenges Faced by Healthcare Start-ups in Pharma Sector in India*.

Ittefaq, M., Seo, H., Abwao, M., & Baines, A. (2022). Social media use for health, cultural characteristics, and demographics: A survey of Pakistani millennials. *Digital Health*, *8*. https://doi.org/10.1177/20552076221089454

Kamal, S. A., Shafiq, M., & Kakria, P. (2020). Investigating acceptance of telemedicine services through an extended technology acceptance model (TAM). *Technology in Society*, *60*. https://doi.org/10.1016/j.techsoc.2019.101212

Kim, S. S. (2009). Individualism and collectivism: Implications for women. *Pastoral Psychology*, *58*(5–6), 563–578. https://doi.org/10.1007/s11089-009-0236-4

Kruse, C. S., Pacheco, G. J., Vargas, B., Lozano, N., Castro, S., & Gattu, M. (2022). Leveraging Telehealth for the Management of Breast Cancer: A Systematic Review. In *Healthcare (Switzerland)* (Vol. 10, Issue 10). MDPI. https://doi.org/10.3390/healthcare10102015

Latif, S., Rana, R., Qadir, J., Ali, A., Imran, M. A., & Younis, M. S. (2017). Mobile Health in the Developing World: Review of Literature and Lessons from a Case Study. In *IEEE Access* (Vol. 5, pp. 11540–11556). Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/ACCESS.2017.2710800

Lotta, A., Klippel, E., Kira, S. D., Stiedenroth, S., Prof, S., & Brosius, C. (n.d.). On and under the Surface. *SOUTH ASIA INSTITUTE Health and Society in South Asia Series*.

Lundvall, B.-Å., Rasmussen, P., & Lorenz, E. (2008). Education in the Learning Economy: A European Perspective. *Policy Futures in Education*, *6*(6), 681–700. https://doi.org/10.2304/pfie.2008.6.6.681

Martins, C., Oliveira, T., & Popovič, A. (2014). Understanding the internet banking adoption: A unified theory of acceptance and use of technology and perceived risk application. *International Journal of Information Management*, *34*(1), 1–13. https://doi.org/10.1016/j.ijinfomgt.2013.06.002

Mahdi, S. S., Allana, R., Battineni, G., Khalid, T., Agha, D., Khawaja, M., & Amenta, F. (2022). The promise of telemedicine in Pakistan: A systematic review. In *Health Science Reports* (Vol. 5, Issue 1). John Wiley and Sons Inc. https://doi.org/10.1002/hsr2.438

Mishra, A., & Pandey, N. (2023). Global entrepreneurship in healthcare: A systematic literature review and bibliometric analysis. In *Global Business and Organizational Excellence* (Vol. 42, Issue 5, pp. 9–21). John Wiley and Sons Inc. https://doi.org/10.1002/joe.22193

Myers, M. D., Chughtai, H., Davidson, E., Tsibolane, P., & Young, A. G. (2020). Studying the other or becoming the other: Engaging with indigenous peoples in is research. *Communications of the Association for Information Systems*, *47*, 382–396. https://doi.org/10.17705/1CAIS.04718

Nittari, G., Khuman, R., Baldoni, S., Pallotta, G., Battineni, G., Sirignano, A., Amenta, F., & Ricci, G. (2020). Telemedicine Practice: Review of the Current Ethical and Legal Challenges. In *Telemedicine and e-Health* (Vol. 26, Issue 12, pp. 1427–1437). Mary Ann Liebert Inc. https://doi.org/10.1089/tmj.2019.0158

Paul, D. L., Pearlson, K. E., Mcdaniel, R. R., Pearlson, K. E., & Mcdaniel, R. R. (1999). Assessing Technological Barriers to Telemedicine: Technology-Management Implications. In *IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT* (Vol. 46, Issue 3).

Sapci, A. H., & Sapci, H. A. (2019). Digital continuous healthcare and disruptive medical technologies: m-Health and telemedicine skills training for data-driven healthcare. *Journal of Telemedicine and Telecare*, *25*(10), 623–635. https://doi.org/10.1177/1357633X18793293

Sundin, P., Callan, J., & Mehta, K. (2016). Why do entrepreneurial mHealth ventures in the developing world fail to scale? *Journal of Medical Engineering and Technology*, *40*(7–8), 444–457. https://doi.org/10.1080/03091902.2016.1213901

Waller, M., & Stotler, C. (2018). Telemedicine: a Primer. In *Current Allergy and Asthma Reports* (Vol. 18, Issue 10). Current Medicine Group LLC 1. https://doi.org/10.1007/s11882-018-0808-4

Wernhart, A., Gahbauer, S., & Haluza, D. (2019). eHealth and telemedicine: Practices and beliefs among healthcare professionals and medical students at a medical university. *PLoS ONE*, *14*(2). https://doi.org/10.1371/journal.pone.0213067

Choi, H., & Zo, H. (2019). Assessing the efficiency of national innovation systems in developing countries. *Science and Public Policy*, *46*(4), 530-540.

Pan, T. -W., Hung, S. -W., and Lu, W. -M. (2010) 'DEA Performance Measurement of the National Innovation System in Asia and Europe', Asia-Pacific Journal of Operational Research, 27/03: 369–92.

To¨dtling, F., and Trippl, M. (2005) 'One Size Fits All?: Towards a Differentiated Regional Innovation Policy Approach', Research Policy, 34/8: 1203–19.

Aoki, N., Dunn, K. I. M., Johnson-Throop, K. A., & Turley, J. P. (2003). Outcomes and methods in telemedicine evaluation. *Telemedicine Journal and e-Health*, *9*(4), 393-401.

Berryman, D. R. (2019). Ontology, epistemology, methodology, and methods: Information for librarian researchers. *Medical reference services quarterly*, *38*(3), 271-279.

Bilal, W., Qamar, K., Siddiqui, A., Kumar, P., & Essar, M. Y. (2022). Digital health and telemedicine in Pakistan: Improving maternal healthcare. *Annals of Medicine and Surgery*, *81*, 104425.

Byus, K. (2018). Observe, orient, decide, act: A subjectivist model of entrepreneurial decision making. *Journal of Managerial Issues*, 349-362.

Chen, S., Cheng, A., & Mehta, K. (2013). A review of telemedicine business models. *Telemedicine and e-Health*, *19*(4), 287-297.

Chen, Q., Xu, D., Fu, H., & Yip, W. (2022). Distance effects and home bias in patient choice on the Internet: Evidence from an online healthcare platform in China. *China Economic Review*, *72*, 101757.

Cho, K. (2018). Critical Review on the Conventional Concept of Entrepreneurship and the Components of Its Definition. *The Korea Entrepreneurship Society*, *13*(6), 98-125.

Chu, C., Cram, P., Pang, A., Stamenova, V., Tadrous, M., & Bhatia, R. S. (2021). Rural telemedicine use before and during the COVID-19 pandemic: repeated cross-sectional study. *Journal of medical Internet research*, *23*(4), e26960.

Dalglish, S. L., Khalid, H., & McMahon, S. A. (2020). Document analysis in health policy research: the READ approach. *Health policy and planning*, *35*(10), 1424-1431.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics*, *5*(1), 1-4.

Farooqi, M., Ullah, I., Irfan, M., Taseer, A. R., Almas, T., Hasan, M. M., ... & Nagarajan, V. R. (2021). The revival of telemedicine in the age of COVID-19: benefits and impediments for Pakistan. *Annals of Medicine and Surgery*, *69*.

Greenhalgh, T., Vijayaraghavan, S., Wherton, J., Shaw, S., Byrne, E., Campbell-Richards, D.,. & Morris, J. (2016). Virtual online consultations: advantages and limitations (VOCAL) study. *BMJ open*, *6*(1), e009388.

Hathcoat, J. D., Meixner, C., & Nicholas, M. C. (2019). Ontology and epistemology.

Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., & Buckley, N. (2015). Strategy, not technology, drives digital transformation. *MIT Sloan Management Review and Deloitte University Press*, *14*(1-25).

Khawar, M. (2021). Benefits and challenges of Big Data in healthcare: A Systematic Review of the Pakistan Initiatives.

Kimjeon, J., & Davidsson, P. (2022). External enablers of entrepreneurship: A review and agenda for accumulation of strategically actionable knowledge. *Entrepreneurship Theory and Practice*, *46*(3), 643-687.

Kruse, C. S., Pacheco, G. J., Vargas, B., Lozano, N., Castro, S., & Gattu, M. (2022, October). Leveraging Telehealth for the Management of Breast Cancer: A Systematic Review. In *Healthcare* (Vol. 10, No. 10, p. 2015). Multidisciplinary Digital Publishing Institute.

Lanivich, S. E., Smith, A., Levasseur, L., Pidduck, R. J., Busenitz, L., & Tang, J. (2022). Advancing entrepreneurial alertness: Review, synthesis, and future research directions. *Journal of Business Research, 139*, 1165-1176.

Ly, B. A., Labonté, R., Bourgeault, I. L., & Niang, M. N. (2017). The individual and contextual determinants of the use of telemedicine: A descriptive study of the perceptions of Senegal's physicians and telemedicine projects managers. *PloS one*, *12*(7), e0181070.

MacFarlane, A., Harrison, R., & Wallace, P. (2002). The benefits of a qualitative approach to telemedicine research. *Journal of Telemedicine and Telecare*, *8*(2_suppl), 56-57.

O'Donnell, O. (2007). Access to health care in developing countries: breaking down demand side barriers. *Cadernos de saude publica*, *23*, 2820-2834.

Paul, D. L., Pearlson, K. E., & McDaniel, R. R. (2021). Assessing technological barriers to telemedicine: technology-management implications. *IEEE Transactions on engineering management*, *46*(3), 279-288.

Raj, A., Dwivedi, G., Sharma, A., de Sousa Jabbour, A. B. L., & Rajak, S. (2020). Barriers to the adoption of industry 4.0 technologies in the manufacturing sector: An inter-country comparative perspective. *International Journal of Production Economics*, *224*, 107546.

Scott Kruse, C., Karem, P., Shifflett, K., Vegi, L., Ravi, K., & Brooks, M. (2018). Evaluating barriers to adopting telemedicine worldwide: a systematic review. *Journal of telemedicine and telecare*, *24*(1), 4-12.

Sittig, D. F., Wright, A., Coiera, E., Magrabi, F., Ratwani, R., Bates, D. W., & Singh, H. (2020). Current challenges in health information technology–related patient safety. *Health Informatics Journal*, *26*(1), 181–189. https://doi.org/10.1177/1460458218814893

Standing, C., Standing, S., Gururajan, R., Fulford, R., & Gengatharen, D. (2018). Coming to Terms with Knowledge Management in Telehealth. *Systems Research and Behavioral Science*, *35*(1), 102–113. https://doi.org/10.1002/sres.2443

Sundin, P., Callan, J., & Mehta, K. (2016). Why do entrepreneurial mHealth ventures in the developing world fail to scale? *Journal of Medical Engineering and Technology*, *40*(7–8), 444–457. https://doi.org/10.1080/03091902.2016.1213901

Tachakra, S., Wang, X. H., Istepanian, R. S. H., & Song, Y. H. (2003). Mobile e-Health: The Unwired Evolution of Telemedicine. In *TELEMEDICINE JOURNAL AND e-HEALTH* (Vol. 9, Issue 3). www.liebertpub.com

Talwar, S., Dhir, A., Islam, N., Kaur, P., & Almusharraf, A. (2023). Resistance of multiple stakeholders to e-health innovations: Integration of fundamental insights and guiding research paths. *Journal of Business Research*, *166*. https://doi.org/10.1016/j.jbusres.2023.114135

Taylor, L. A., Nong, P., & Platt, J. (2023). Fifty Years of Trust Research in Health Care: A Synthetic Review. *Milbank Quarterly*, *101*(1), 126–178. https://doi.org/10.1111/1468-0009.12598

Van Dyk, L., Groenewald, M., & Abrahams, J. F. (2010). Towards a regional innovation system for telemedicine in South Africa. *2nd International Conference on EHealth, Telemedicine, and Social Medicine, ETELEMED 2010, Includes MLMB 2010; BUSMMed 2010*, 1–4. https://doi.org/10.1109/eTELEMED.2010.8

Zhang, X., & Zaman, B. uz. (2020). Adoption mechanism of telemedicine in underdeveloped country. *Health Informatics Journal*, *26*(2), 1088–1103. https://doi.org/10.1177/1460458219868353

Appendices

Appendix 1 Interview Guide

Research Purpose: The objective of the research is to identify the key institutions, actors and activities involved in Online Healthcare Delivery and explore the barriers in its adoption.

1. What is your name?
2. Which organization do you work in?
3. What is your position at work?
4. How many years of work experience do you have in the health sector?
5. What is your understanding of telemedicine?
6. What is the product or service your organization offers in terms of healthcare/telemedicine? (specify the type of services being offered)
7. What associated risks do you see with Telemedicine or digital health?
8. Which regulatory bodies & government institutions that you know of, are actively monitoring telemedicine practices in Pakistan?
9. Can you please discuss existing regulations or policy framework regarding online health delivery in Pakistan as per your knowledge?
10. How do you see the impact of 18th amendment on healthcare sector of Pakistan? (Power being devolved to provinces)
11. Any kind of barriers/hindrances your organization had to face by the Ministry of Health and other government bodies?
12. Apart from the institutional and regulatory bodies, can you point out other key players involved in telemedicine ecosystem?
13. What kind of barriers you had to face from these players you mentioned?

14. What barriers do you see in collaborating with telemedicine startups or digital health stakeholders?

15. How do you see the role of universities and academia in the context of telemedicine?

16. What kind of barriers/hindrances your organization had to face from the consumers' side?

17. Any other barriers?

18. What kind of support or cooperative activities do you expect from the government institutions?

19. What support or cooperative activities do you expect from other stakeholders of telemedicine ecosystem?