A study of identification and management of key factors of customer engagement in eHealth in India

A thesis submitted to the

UPES

For the award of

Doctor of Philosophy

in

Management

By

Dikhita Das

MAY 2024

Supervisor

Dr. Anita Sengar

Department of General Management

School of Business, UPES

Dehradun- 248007: Uttarakhand

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With the blessings of the Almighty,

I dedicate this thesis to my parents and my son "KRISHIV" for their endless love, immense support, and encouragement.

MAY, 2024

DECLARATION

I declare that the thesis entitled "**A study of identification and management of key factors of customer engagement in eHealth in India**" has been prepared by me under the guidance of **Dr. Anita Sengar**, Associate Professor, School of Business, UPES.

The content of this thesis has not been utilized as the foundation for the conferment of any prior degree or fellowship.

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3rd May, 2024

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CERTIFICATE

We certify that **Ms Dikhita Das** has prepared her thesis entitled "***A study of identification and management of key factors of customer engagement in eHealth in India***" for the award of Ph.D. degree of the University of Petroleum and Energy Studies, Dehradun under our guidance.

She has carried out the work at the Department of Management, School of Business, University of Petroleum and Energy Studies, Dehradun.

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ABSTRACT

The term **"eHealth"** encompasses a wide array of healthcare activities facilitated by electronic processes. This encompasses electronic health records, patient administration systems, laboratory systems, and other documentation types that might not align with mobile health applications. This study primarily focuses on eHealth, with some consideration of mHealth. eHealth, sometimes spelled e-health, represents a relatively modern form of healthcare that emerged around 1999 (Della, 2001). Initially conceived as "Internet medicine," eHealth has evolved to encompass "almost everything linked to computers and medicine" (Eysenbach, 2001).

"E-health is an emerging field at the crossroads of medical informatics, public health, and commerce, referring to health services and information supplied or enhanced through the Internet and related technologies," I would define the term and concept. In a broader sense, the phrase refers to "a state of mind, a way of thinking, an attitude, and a dedication to networked, global thinking in order to improve health care locally, regionally, and globally through the use of information and communication technology" [Eysenbach et al. 2001].

In the realm of eHealth, customers are typically referred to as patients or users. These individuals utilize eHealth services such as telemedicine, online consultations, health monitoring apps, and digital health platforms to access healthcare remotely or manage their health more efficiently. The term "customer" might be used in a broader business context when discussing the consumers of eHealth products or services, but within the healthcare domain, the term "patient" is more commonly employed. Understanding consumer engagement in healthcare is multifaceted, with emphasis on meeting individual, organizational, and policy-level needs and preferences. Health applications play a vital role in providing patients with information and involvement to stay informed about their health. However, user expectations for simplicity and intuitiveness are not always met by all apps. An evaluation of a basic mHealth app using the Nielsen model identified concerns regarding learnability, satisfaction, and efficiency. As technology continues to shape healthcare, it is crucial to address challenges faced by demographic groups unfamiliar with new technologies or encountering difficulties with eHealth apps. Researching these challenges and demographics is essential for developing

effective strategies to improve customer engagement and ensure inclusivity in healthcare technology adoption (Dameff et al., 2019).

This study investigates the effects and constraints to the adoption of consumer interaction in the national health service in India, providing a fresh perspective on eHealth. This study highlights what obstacles healthcare organisations should consider while dealing with eHealth and what could stymie the healthcare sector's growth. One of the most significant features of today's society is the treatment of old persons and residents who require professional assistance. Expectations for how eHealth adoption can help companies in general, as well as expectations for eHealth adoption in healthcare. According to studies, higher eHealth usage in India can improve productivity, decision-making information, quality, and so on [Meskó et al. 2017]. At the same time, research reveal that eHealth adoption in India has challenges [Kaur et al. 2019]. As a result, it's worth looking into what the real impacts of the eHealth implementation have been so far, as well as what challenges have developed. The goal is to look into the consequences and roadblocks from the standpoint of customer engagement.

eHealth apps have attracted considerable interest from a range of stakeholders, including patients, healthcare providers, insurance firms, and researchers. These apps empower patients to manage their health independently and encourage active participation, ultimately resulting in better health results. They provide numerous advantages such as assisting in making informed decisions, effectively managing chronic conditions, and improving communication between patients and healthcare providers. However, despite these advantages, eHealth applications face numerous challenges, with customer engagement being a crucial concern. There is a noticeable lack of research investigating the reasons behind the relatively low uptake of eHealth solutions in India, despite the launch of initiatives like the NDHM. Thus, it is essential to identify, classify, and rank the primary obstacles hindering the adoption of eHealth technologies in the nation. This study aims to bridge this gap in the current body of knowledge by analyzing the various challenges that hinder the widespread adoption of eHealth technologies in India.

Recognizing the substantial research gap, following research questions have been framed to address this pertinent issue:

RQ 1: What are the various factors that affects the adoption of eHealth in India?

RQ 2: What are the various factors of customer engagement that effects the adoption of eHealth in India?

RQ 3: What is the relationship between the factors of customer engagement affecting adoption of eHealth in India?

RQ 4: What will be the propose solution towards the improvement in customer engagement for the adoption of eHealth in India?

The explicit objectives of this research were:

RO1: To identify and evaluate the factors that affects the adoption of eHealth in India.

RO2: To identify and evaluate the factors of customer engagement that effects the adoption of eHealth in India.

RO3: To understand the relationship between the factors of customer engagement affecting adoption of eHealth in India.

RO4: To propose solution towards the improvement in customer engagement for the adoption of e-Health in India.

Within the dissertation, the literature review delved into three primary subjects, bolstered by studies on the Normalization Process Theory and the Technology Acceptance Model, both pertinent to the research area. This thorough review revealed significant findings and identified areas where existing literature falls short, offering valuable guidance for the ongoing research. Subsequently, the amassed literature was organized and classified according to these principal themes. **Our research advances knowledge in two separate ways:**

a) In contrast to past analyses of the literature, it elicits the cognitive, psychological, and social network patterns of the eHealth research domain.

b) Rather than relying on qualitative analysis, it based its findings on quantitative data.

Major gaps derived from literature review:

- Numerous obstacles to eHealth adoption have been recognized on a global scale. However, there is a pressing need for comprehensive research to pinpoint the specific barriers impeding eHealth adoption in India.
- Studies in India have considered either digital health or m-Health as a whole, but there is not much research considering a depth study in eHealth adoption in India.
- Framework or models have concentrated more on infrastructure, technology in general, and not on engagement of customers in particular. Customer engagement barriers and its sub-barriers need to be investigated in regard to eHealth implementation in India.
- The majority of studies in the eHealth research domain are conceptual or review studies, with limited empirical research available.
- There is a lack of research specifically focusing on the hurdles encountered during the integration of eHealth solutions in India, as well as strategies to surmount these obstacles.

Identified gap from literature review on the theoretical premise

- Normalisation process theory has been used in digital health but extended study need to be done considering eHealth.
- The TAM can be very well used to understand the barriers affecting customer engagement so that efforts can be put to overcome the barriers of new technology and increase adoption of eHealth in India.
- Limited research exists regarding the utilization of Normalization Process Theory (NPT) and the TAM in examining eHealth within the Indian healthcare sector.

A crucial area of inquiry pertains to evaluating e-health services in India, including barriers to adoption and implementation. This study has the potential to offer valuable insights to bolster ongoing e-health endeavors and improve the effectiveness of forthcoming initiatives. However, despite its importance, the assessment of e-health services has received insufficient attention, both in theory and practice, as noted by Brender (2006) and Friedman and Wyatt (2005). This research contributes to a wider scholarly effort aimed at crafting and appraising a thorough evaluation framework for e-health services.

In a **pragmatic research paradigm**, both quantitative and qualitative methods are utilized based on the research questions and context. This often involves a mixed-method approach,

combining different data types and analysis methods. We've chosen pragmatism as our research paradigm because we aim to understand solutions for the non-adoption of eHealth in India. Our research utilizes a mixed-methods approach, which encompasses quantitative data collection and analysis alongside face-to-face interviews to capture qualitative perspectives on individuals' attitudes and inclinations toward eHealth adoption. This inclusive methodology facilitates a thorough comprehension of the efficacy and real-world implications of the approach, blending insights from both data types. These findings hold significance for problem-solving and offer pragmatic avenues to tackle various research goals.

According to my research I identified that eHealth is a booming topic in this era and is well known concept globally even India is adopting it but there exist a lot of adoption barriers in eHealth. The issue has been identified through literature review as many barriers exists which is qualitative in nature. But then sample conduction and further detail through both qualitative and quantitative in each objective. This approach enables researchers to validate their findings by cross-referencing results obtained from both quantitative and qualitative methods. It allows for the verification of whether the outcomes observed using each method complement each other, and helps to explain any unexpected results from one method through insights gained from the other method. The more significance has been got regarding customer engagement as the top-most barrier and also its sub barriers have been identified.

In this study objective 1 methodology adopted was FAHP which is the integration method of qualitative and quantitative methods. Then, objective 2 FAHP and DEMATEL is used which is again the qualitative attributes are converted into the quantitative attributes. Next, objective 3 we used ISM which is a quantitative decision-making technique used to analyze complex issues and relationships between different components or factors. It involves a pair-wise comparative analysis to describe and prioritize these relationships based on their importance and influence. So, **mixed method research** is needed to move to the further step.
According to my research I identified that eHealth is a booming topic in this era and is well known concept globally even India is adopting it but there exist a lot of adoption barriers in eHealth. The issue has been identified through literature review as many barriers exists. But sample conduction and further detail through qualitative manner more significance have been got regarding customer engagement as the topmost barrier and also its sub barriers have been identified. Both qualitative and quantitative research is needed to move to the further step. So, accordingly this research needs to be an exploratory in nature.

The primary objective of the study was to investigate whether barriers to customer engagement exist in the eHealth adoption process and, if so, to develop strategies and solutions to overcome them. Further qualitative discussion on these themes is provided within the results section to offer a comprehensive understanding of the findings. There were ten main themes identified which were 1.eHealth, 2. New technology, 3. Barriers 4. Patient barriers 5. Practitioners barriers 6. Researchers barriers 7. Customer Engagement 8. Government initiatives 9. Potential solutions 10. Adoption strategies. There are total **173 codes** divided in each themes but some codes are used in two or more themes. Moreover, there are **327 quotations** each making this study unique and presenting the best strategies and solution for better customer engagement in eHealth adoption in India.

Utilizing methods such as **FAHP, DEMATEL, and ISM,** we prioritized, weighted, and delineated the relationships among these barriers. The identification of barriers to customer engagement was initially derived from a literature review and subsequently validated by experts. Additionally, a qualitative study using **ATLAS.ti** was conducted, exploring the perspectives of three key stakeholders: patients, doctors, and practitioners. These findings have the potential to streamline implementation processes and enhance the uptake of electronic health products and services, thereby positively impacting the well-being of citizens and shaping the future operation of health systems in India. Customer engagement was identified in the study as one of the obstacles to the adoption of eHealth, and as a result, six strategies and solutions for improving eHealth facilities were developed through a qualitative investigation.

Future research endeavours could expand both the scope and methodology utilized in this study. Additional MCDM techniques like PROMETHEE, NWHF-CRITIC ,AHP and NWHF-MAUT could be utilized to either confirm or question the findings acquired. Moreover, more qualitative inquiry could be undertaken to explore further the sub-barriers that have been identified. Additionally, conducting further quantitative investigations could assist in discerning causal relationships among the identified sub-barriers within similar or disparate industries. Replicating the study in other nations with varying political, social, institutional, technical, and economic landscapes compared to India could offer valuable insights.

Keywords: eHealth, Customer Engagement, mHealth, FAHP, ISM, DEMATEL Qualitative research, Strategies, India

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DIKHITA DAS

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LIST OF ABBREVIATIONS

CE- Customer Engagement

DEMATEL- Decision Making Trail and Evaluation Laboratory

DISHA- Digital Information Security in Healthcare Act

eHealth- Electronic Health

EHR- Electronic Health Record

EMR- Electronic Medical Record

FAHP- Fuzzy Analytic Hierarchy Process

GoI- Government of India

HIAAS- Health Informatics as a service

HIPAA- Health Insurance Portability and Accountability Act

ICMR- Indian Council of Medical Research

ICT- Information and Communication Technology

ISM- Interpretive Structure Model

mHealth- Mobile Health

MoHFW- Ministry of Health and Family Welfare

NDHM- National Digital Health Mission

NHA- National Health Authority

NHSRC- National Health Systems Resource Centre

NIC- National Informatics Centre

NIHFW- National Institute of Health and Family Welfare

NPM- Normalization Process Model

NPT- Normalization Process Theory

PM-JAY- Ayushman Bharat Pradhan Mantri Jan Arogya Yojana

TAM- Technology Acceptance Model

WoS- Web of Science

CHAPTER 1

INTRODUCTION

OVERVIEW

This study introduces the concept of eHealth, tracing its development on a global scale as well as within India. It explores the diverse elements influencing the uptake of eHealth, particularly within the Indian context, and offers an outline of consumer engagement aspects relevant to eHealth adoption in India. Moreover, the chapter assesses the importance of customer engagement factors and provides recommendations for improving customer engagement to facilitate the adoption of eHealth in India. Moreover, this chapter aims to elucidate key concepts crucial for comprehending the essence of the entire study. It discusses the evolution of eHealth and highlights the challenges hindering its adoption in India, particularly focusing on customer engagement. Furthermore, the chapter addresses the business problem and articulates the research problem at hand.

BUSINESS PROBLEM STATEMENT

This study explores the effects and constraints of eHealth adoption in India's healthcare sector, emphasizing obstacles and growth hindrances while examining real impacts and challenges, particularly focusing on customer engagement as a key barrier.

BACKGROUND OF THE STUDY

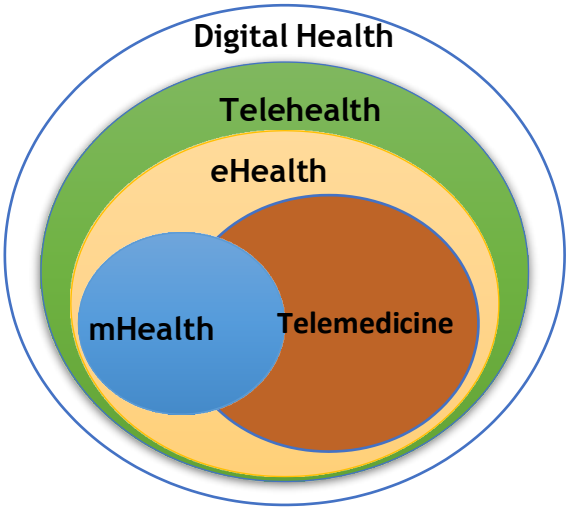


Figure 1.1: Venn diagram for digital health

The digital health industry has expanded in the last year. **Digital health** is a discipline that brings together digital care programmes, to improve health systems efficiency by making medicine more personalised and precise through technology, health, healthcare, life, and society. [Fadahunsi and colleagues 2021]. It makes health concerns and hurdles more understandable and precise for persons receiving medical care and social prescription through information and communication technology [Bhavnani et al. 2016]. eHealth, mHealth, Telehealth, and telemedicine are phrases used to describe how patients are managed using mobile and desktop technology.. Although these terms are often used interchangeably, each denotes a specific facet of technology and healthcare. Figure 1.1 illustrates the Venn diagram of digital health, delineating their distinctions.

These terms are commonly misunderstood and interchanged as well. Let's look at the first one, **Telehealth**, and see how it differs from the rest. Clinical and non-clinical services, as well as practitioner training and continuing medical education, are all included in telehealth. Telehealth, as defined by Shaw (2009), pertains to the utilization of electronic information and communication technology for the dissemination of health services and information. It enables patients and doctors to communicate over vast distances, as well as care, advice, warnings, training, treatment, surveillance, and distant enrolment [Masson 2014].

Now, let's explore the broader aspect of eHealth. The term **"eHealth"** encompasses a wide array of healthcare activities facilitated by electronic processes. This encompasses patient administration systems, electronic health records, , laboratory systems, and other documentation types that might not align with mobile health applications. Furthermore, eHealth encompasses mHealth applications and connectivity, often referred to as mHealth or m-Health. **mHealth** entails utilizing mobile devices like cell phones or tablets to bolster healthcare activities. With mHealth, patients can utilize their personal mobile devices to securely store, access, and oversee their medical records. Such applications enhance the efficiency of healthcare data delivery. Notably, mHealth apps serve a variety of stakeholders, including researchers, practitioners, patients, and healthcare providers. Moreover, there's a rising trend in the utilization of health tracking apps for mobile devices in daily life. **Telemedicine** is a term that relates to clinical services that are provided from a distance. The concept of telemedicine was born out of the need to treat patients who lived in faraway locations. Knowledge how the terminologies interact to produce the broad picture of virtual healthcare is critical to our understanding of our healthcare options. These services strive to optimize the effectiveness, caliber, and cost-efficiency of care, benefiting both healthcare providers and patients alike. Each service has its unique role in shaping a comprehensive digital healthcare strategy tailored to patient needs.

This study primarily focuses on eHealth, with some consideration of mHealth. eHealth, sometimes spelled e-health, represents a relatively modern form of healthcare that emerged around 1999 (Della, 2001). Initially conceived as "Internet medicine," eHealth has evolved to encompass "almost everything linked to computers and medicine" (Eysenbach, 2001). This broad definition encompasses various electronic processes and communication methods used in healthcare. eHealth plays a crucial role in overcoming barriers to accessing healthcare, such as rural settings, transportation limitations, mobility issues, outbreaks, epidemics, pandemics, funding constraints, and staffing shortages (Shaw et al., 2017). It facilitates virtual meetings, distance learning, presentations, and supervision among healthcare practitioners, as well as online information dissemination and health data management (Griskewicz, 2002). Moreover, eHealth contributes to the integration of healthcare systems. Especially notable is the increased reliance on eHealth services in recent times, mainly during the pandemic. Amid the transition of numerous services to virtual platforms, eHealth has emerged as a crucial facilitator in granting individuals access to healthcare while mitigating the risk of disease transmission, notably during the COVID-19 pandemic. Expectations about access to care, ease of care and

waiting periods are shifting as more individuals obtain to these services. We live in a world where everything is convenient. Information is always at the tip of a user's finger thanks to technology on conveniently available smartphones. By improving communication procedures, mHealth and eHealth can deliver appointment reminders, medication reminders, and much more. Instead of relying on paper documents, healthcare providers now have easier digital access to information and records. It is clear that e-health is much more than a technological achievement.

"E-health is an emerging field at the crossroads of medical informatics, public health, and commerce, referring to health services and information supplied or enhanced through the Internet and related technologies," I would define the term and concept. In a broader sense, the phrase refers to "a state of mind, a way of thinking, an attitude, and a dedication to networked, global thinking in order to improve health care locally, regionally, and globally through the use of information and communication technology" [Eysenbach et al. 2001].

The definition of eHealth should be broad enough to encompass the dynamic environment of the Internet while acknowledging that it encompasses more than just electronic health records. Over time, various definitions have been used to designate ICT applications in the service of health. Initially, around 1970, "medical informatics" was coined to describe the computer processing of medical data, reflecting the cutting-edge technology of the time. However, with the development of digitalization, the focus shifted from "information processing" to "information communication." Terms such as "health telematics" and "telemedicine" were used, eventually evolving into "e-health" or "eHealth."

The advancement of network transfer rates, facilitated by interconnected computers, has eliminated barriers to the exchange of medical data, physiological signals, and medical imaging. Standardization of computer exchange protocols, such as the Internet Protocol, along with improved medical data organization and data security legislation, enables health professionals from diverse locations to connect and collaborate more easily. The value of eHealth lies not only in technology or data exchange but also in its potential to develop networks of expertise and experience in the health sector. eHealth has now become essential, posing a considerable challenge for the future that demands collaboration, coordination, networking, and strategic planning at all levels. Achieving coordination in eHealth remains a daunting task, necessitating cooperation among various stakeholders from administration, insurance, business, science, and other sectors to realize optimal development in the healthcare

landscape leveraging existing communication networks. Despite being a formidable task, the benefits of successful coordination will be realized by all, as citizens gain access to high-quality, affordable healthcare anytime and anywhere.

As of my last update in January 2022, there isn't a single focal organization for eHealth Initiative in India. However, several governmental and non-governmental organizations play significant roles in promoting eHealth initiatives in the country. Some of these include:

1. **Ministry of Health and Family Welfare (MoHFW):** The MoHFW plays a central role in formulating health policies and implementing eHealth initiatives in India.

2. **National Health Authority (NHA):** The NHA oversees the implementation of various health schemes, including the Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (PM-JAY), and works towards the digital transformation of healthcare delivery systems.

3. **National Health Systems Resource Centre (NHSRC):** This autonomous organization under the MoHFW provides technical assistance and capacity-building support for the implementation of eHealth initiatives.

4. **National Institute of Health and Family Welfare (NIHFW):** NIHFW conducts research, training, and advocacy in the field of public health, including eHealth.

5. **National Digital Health Mission (NDHM):** Initiated by the Government of India, the National Digital Health Mission (NDHM) strives to establish a digital health ecosystem that harmonizes multiple stakeholders and encourages the uptake of digital health records and services.

6. **Indian Council of Medical Research (ICMR):** As the premier authority in India, it spearheads the coordination, development, and advancement of biomedical research, encompassing studies pertinent to eHealth technologies.

7. **National Informatics Centre (NIC):** NIC is the premier science and technology organization of the Government of India in the field of informatics, providing infrastructure and support for various eHealth projects.

8. **Public and Private Healthcare Providers:** Hospitals, clinics, and healthcare providers across the public and private sectors also play crucial roles in implementing eHealth initiatives and adopting digital health technologies.

These organizations collaborate and synergize efforts to propel the adoption of eHealth initiatives in India, with the overarching goal of enhancing healthcare delivery, accessibility, and quality through the integration of technology. For most of the current information, it's advisable to check recent sources or official government announcements.

INTRODUCTION TO eHEALTH

Over time, there has been a notable increase in the healthcare industry's focus on eHealth, leading to a gradual transition from conventional healthcare delivery methods to digital technologies. The implementation approaches differ considerably, both within India and globally, ranging from small-scale initiatives integrating various IT systems to extensive national programs (Dasgupta & Deb, 2008; Juciute, 2009). eHealth serves various purposes, including bridging gaps in healthcare delivery and providing online learning platforms, discussions, observations, and demonstrations among practitioners (Shaw et al., 2017). It also facilitates online data and health information management, as well as integration within healthcare systems (Griskewicz, 2002). During the COVID-19 pandemic, reliance on virtual resources increased, serving a broader purpose of providing access to treatment while minimizing the risk of infection (Monaghesh & Hajizadeh, 2020).

The term "eHealth" refers to healthcare activities supported by electronic processes, encompassing various aspects related to computers and medicine (Della Mea, 2001; Eysenbach, 2001). It includes electronic health records, patient management systems, laboratory systems, and other technologies aimed at improving healthcare practices. Additionally, "mobile health" or "mHealth" involves using mobile devices like cell phones or tablets to support healthcare procedures, allowing patients to record, store, and analyze their healthcare data (Kallander et al., 2013; Ventola, 2014). The use of mHealth apps benefits both research and healthcare practitioners, with health tracking apps becoming increasingly popular. Overall, eHealth, encompassing the use of information and communication technologies (ICT)

for health, plays a significant role in modern health delivery systems by enhancing efficiency, accessibility, and effectiveness.

Enhanced Access to Healthcare:

eHealth technologies such as telemedicine and mobile health (mHealth) apps enable patients to access healthcare services remotely, overcoming geographical barriers and improving access for underserved populations (Bashshur, Shannon, & Bashshur, 2015).

Improved Efficiency:

Electronic health records (EHRs) and electronic medical records (EMRs) streamline administrative tasks, reduce paperwork, and enable quick retrieval of patient information, leading to more efficient healthcare delivery (Adler-Milstein & Jha, 2017).

Better Communication and Coordination:

eHealth tools facilitate communication and collaboration among healthcare providers, allowing for seamless sharing of patient data, consultations, and referrals. This leads to more coordinated and integrated care delivery (Greenhalgh et al., 2009).

Remote Monitoring and Management:

Remote patient monitoring (RPM) technologies enable healthcare providers to monitor patients' health remotely, allowing for early detection of health issues and timely interventions, particularly for chronic disease management (Inglis et al., 2015).

Health Education and Promotion:

eHealth platforms provide opportunities for health education and promotion through online resources, mobile apps, and social media, empowering individuals to take control of their health and make informed decisions (Laranjo et al., 2015).

Support for Clinical Decision-Making:

Decision support systems integrated into EHRs assist healthcare providers in making evidence-based decisions by providing alerts, reminders, and access to clinical guidelines and research literature (Kawamoto et al., 2005).

Public Health Surveillance and Disease Monitoring:

eHealth systems facilitate the collection, analysis, and dissemination of health data, supporting public health surveillance efforts and enabling early detection and response to disease outbreaks and other health threats (Friede, Blum, & Kollmann, 2015).

Cost Savings:

By reducing the need for physical infrastructure, minimizing unnecessary procedures, and improving operational efficiency, eHealth solutions can lead to cost savings for healthcare systems and patients alike (Gold et al., 1996).

Personalized Medicine:

eHealth technologies, coupled with advances in genomics and big data analytics, support the development of personalized medicine approaches by tailoring treatment plans and interventions to individual patients' characteristics and needs (Hamburg & Collins, 2010).

Research and Innovation:

eHealth platforms provide valuable data for health research and innovation, facilitating clinical trials, epidemiological studies, and the development of new medical devices, drugs, and treatment protocols (Kim & Travers, 2018).

Overall, eHealth plays a crucial role in transforming healthcare delivery systems by improving access, efficiency, quality, and patient outcomes while also supporting public health initiatives and driving innovation in healthcare. Digital solutions aim to improve patient-centered healthcare by enhancing care quality and facilitating communication between healthcare providers and patients (Birnbaum et al., 2015). Despite these intentions, there are instances where the efficacy of eHealth technology is doubted, as there appears to be a disparity between the purported benefits and the realized outcomes (Resnicow et al., 2010; Chaudhry et al., 2006). This inconsistency has resulted in a lack of research on the precise effects of eHealth technology on healthcare delivery. Healthcare personnel often exhibit hesitancy and minimal support for eHealth technologies, as they may not perceive them to be effective for themselves or their patients (Chaudhry et al., 2006). Consequently, eHealth technologies frequently encounter acceptance issues. Despite the Indian government's initiation of the National Digital Health Mission (NDHM) in 2020 to revolutionize the country's healthcare system, there remains a lack of literature addressing eHealth hurdles in India.

There is a notable absence of empirical research exploring why there has been limited adoption of eHealth in India, despite the initiation of NDHM. Therefore, it is crucial to identify, categorize, and prioritize the key factors serving as barriers to eHealth adoption in the country. This study seeks to fill this gap in the existing literature by examining the challenges that impede the adoption of eHealth technologies in India.

INTRODUCTION TO CUSTOMER ENGAGEMENT

In the realm of marketing, the concepts of customer engagement and engagement at large have garnered significant attention in recent years, with a focus on gaining a competitive edge by fostering stronger and more enduring relationships with customers (Pansari & Kumar, 2017). Recent studies underscore the importance of engagement in service ecosystems, considering a broader range of stakeholders and the significance of systemic shifts (Brodie et al., 2011; Hollebeek et al., 2018; Kamoonpuri & Sengar, 2003; Storbacka et al., 2001). Engagement has been investigated across various contexts, including social media, online platforms, and brand communities (Azer & Alexander, 2020; Azer et al., 2021; Bowden et al., 2017), as well as the functioning of interaction platforms (Blasco-Arcas et al., 2016; Breidbach & Brodie, 2017).

ENGAGEMENT

The notion of engagement was initially introduced in the context of labor by Kahn (1990), who posited that individuals exhibit varying degrees of themselves in work settings, with engaged employees being more likely to express their true selves when they perceive the environment as conducive to authenticity. Engagement, as described by scholars, includes qualities like energy, commitment, and absorption in various aspects of psychology. It involves being interested and immersed in activities, along with a sense of dedication and resilience. Additionally, engagement can encompass feelings of exhaustion. Studies from the 1990s identified job and role involvement as mental states affecting behavior. Now, we'll examine the existing literature on marketing engagement research.

CUSTOMER ENGAGEMENT

Customer engagement (CE) involves actions that cultivate repeated interactions, enriching the emotional, psychological, or physical investment a consumer makes in a brand, as viewed by practitioners (Pansari and Kumar, 2017). Conversely, CE, as defined by information systems scholars, refers to the degree of consumer involvement in a collaborative exchange of knowledge with both firm representatives and other customers (Brodie et al., 2011; Hollebeek et al., 2018; Kamoonpuri and Sengar, 2003; Storbacka et al., 2001). In a contemporary CE marketing model, consumers are segmented based on their transactional engagement with a brand. Bowden (2009) proposed a CE conceptual framework that, while focusing exclusively on current customers, illustrates how interactions between customers and brands, as well as engagement strategies, may differ depending on whether customers are first-time or repeat purchasers.

CE encompasses the process through which a business establishes a rapport with its customer base to nurture brand awareness and loyalty. Marketing endeavors, online content, and outreach via social media, mobile platforms, and wearable technology all contribute to achieving this objective. Customer engagement is a critical component of a thriving business, as research indicates that highly engaged customers are likely to generate 23% more revenue compared to less engaged ones (Pansari and Kumar, 2017).

A marketing approach known as customer engagement marketing delivers consumers personalized, timely, and relevant messages. Its emphasis on personalization distinguishes it

from other marketing tactics. The relevance of the content encourages customers to feel like active participants in the brand community. Customer engagement marketing is effective as it distributes the responsibility of delivering an exceptional customer experience across various teams within an organization, encompassing every stage of the customer journey.

CUSTOMER ENGAGEMENT IN eHEALTH

After exploring the concept of customer engagement, it's crucial to delve into the literature to understand its relevance in the context of eHealth. Healthcare systems globally are under pressure to reduce risks and improve patient health outcomes, all while facing financial constraints and resource competition (Gruman et al., 2010; Graffigna et al., 2013). Engaging patients in actively managing their health is seen as a solution to these challenges. It's increasingly recognized that patient engagement plays a vital role in treatment adherence and the overall quality of patient care (Schwappach, 2010). At the core of this discussion is the notion of "patient engagement," also known as "treatment efficacy" (Gruman et al., 2010; Graffigna et al., 2013). This concept originates from a consumer health perspective, which considers patients as individuals influenced by their unique socio-economic contexts (Hardyman et al., 2015).

In the realm of eHealth, customers are typically referred to as patients or users. These individuals utilize eHealth services such as telemedicine, online consultations, health monitoring apps, and digital health platforms to access healthcare remotely or manage their health more efficiently. The term "customer" might be used in a broader business context when discussing the consumers of eHealth products or services, but within the healthcare domain, the term "patient" is more commonly employed.

Carman et al. (2013) describe patient engagement as a set of behaviors demonstrated by patients, family members, healthcare professionals, and organizational policies that encourage the active involvement of patients and their families in healthcare decision-making. This collaboration aims to establish partnerships between patients and healthcare providers, ultimately improving the quality and safety of healthcare services. In their definition, engagement is viewed as a systemic concept influenced by patient behaviors at various levels, including individual, relational, organizational, and health policy levels. Similarly, Hibbard et

al. (2004) define patient participation in terms of "activation," referring to patients who actively manage their own health. Gruman's patient engagement behavioral framework (2010) acknowledges the diverse components of patient engagement and characterizes it as the actions individuals can take to actively participate in their healthcare to maximize benefits. Graffigna et al. (2013; 2015) offer a multidimensional perspective, defining patient engagement as a psychosocial process with cognitive, emotional, and behavioral dimensions. They emphasize the importance of emotional involvement alongside cognitive and behavioral activation for patients to be fully engaged in their healthcare, highlighting the need for emotional elaboration in addition to cognitive and behavioral aspects for comprehensive patient engagement (Graffigna et al., 2013).

CUSTOMER ENGAGEMENT AS A BARRIER IN eHEALTH

eHealth applications have become increasingly popular among various stakeholders, offering patients greater control over their health and facilitating active engagement for improved outcomes. Despite their benefits in decision-making, chronic disease management, and patient-provider communication, these applications face challenges in customer engagement. One major concern is acquiring and targeting specific populations to enhance engagement. While eHealth apps present opportunities for managing diverse medical needs through smart devices, effectively engaging consumers within a short timeframe remains a challenge (Varshney et al., 2014). Studies reveal that many users spend less than 30 seconds familiarizing themselves with new apps before abandoning them, underscoring the need for effective engagement strategies to retain users.

Understanding consumer engagement in healthcare is multifaceted, with emphasis on meeting individual, organizational, and policy-level needs and preferences. Health applications play a vital role in providing patients with information and involvement to stay informed about their health. However, user expectations for simplicity and intuitiveness are not always met by all apps. An evaluation of a basic mHealth app using the Nielsen model identified concerns regarding learnability, satisfaction, and efficiency. As technology continues to shape healthcare, it is crucial to address challenges faced by demographic groups unfamiliar with new technologies or encountering difficulties with eHealth apps. Researching these challenges and demographics is essential for developing effective strategies to improve customer engagement and ensure inclusivity in healthcare technology adoption (Dameff et al., 2019).

MOTIVATION/NEED FOR THE RESEARCH

India's healthcare landscape reflects its vast socioeconomic diversity, presenting challenges such as a shortage of primary care doctors in rural and semi-urban areas and the need for continuous medical education among rural practitioners (Rao et al., 2020; Syed-Abdul et al., 2011). Additionally, many medical practitioners lack formal qualifications, leading to variations in care practices (Das and Barnwal, 2017). A significant portion of the population relies on non-allopathic medicine, with limited access to modern healthcare services (Gogtay et al., 2002; Festa et al., 2022). High out-of-pocket expenditures, exacerbated by travel costs, further hinder healthcare access, particularly in rural areas (Archana et al., 2014; Vasudevan et al., 2019). Consequently, untreated diseases are often managed through alternative methods, such as faith healing or over-the-counter medications (Banerjee, 2004), exacerbating healthcare disparities, particularly for the rural population. Moreover, incomplete epidemiological data hampers the development of effective preventive health programs (Fairchild et al., 2018).

Amid these challenges, the concept of e-health has gained prominence, albeit with varying definitions. Coined around 1999, e-health encompasses a broad spectrum of computer technology and medical applications, including online pharmacies (Kaur et al., 2019). Originating from business and marketing spheres, the term emerged alongside other "e-words" such as e-commerce and e-business. Companies like Intel define e-health as a collaborative effort between healthcare and technology sectors to leverage the internet's potential in healthcare delivery.

BUSINESS PROBLEM

Since the advent of computers in the 1960s, the healthcare sector has exhibited a degree of hesitancy towards embracing new information technology innovations compared to industries like finance and telecommunications (Phichitchaisopa and Naenna, 2013). Nevertheless, the healthcare industry's interest in eHealth has steadily increased over time, with implementation efforts ranging from small-scale IT projects to large-scale national programs (Juciute, 2009).

Despite this growing interest, the effectiveness of eHealth technology has been subject to scrutiny due to a perceived gap between promised benefits and actual outcomes (Atienza et al., 2010). There remains a notable dearth of research exploring the specific impacts of eHealth technology on health outcomes and healthcare delivery. Healthcare professionals often exhibit

hesitancy and limited support for eHealth initiatives, citing concerns about the technology's efficacy for themselves and their patients (Chaudhry et al., 2006). As a result, eHealth solutions usually encounter opposition. Integrating eHealth solutions into the healthcare system necessitates close collaboration and communication between health-care providers, patients, informal caregivers, target consumers, and other stakeholders. This appears to be rather tough to achieve in practise.

The users' position on the peripheral is another factor contributing to the perceived limited influence of eHealth technology. In most cases, end user has only a little role in the creation of eHealth solutions. Lack of human centeredness causes usability concerns [Kelders et al. 2020] and high attrition rates [Eysenbach 2005]. People just stop using technology that interferes with their daily routines, habits, or rituals. Finally, it appears that implementing new technology takes time and is disappoint for all parties concerned. In this way, knowledge-intensive result in "high tech but low effect" eHealth devices [Kelders et al. 2020, Nijland et al. 2011]. It's time to reassess how technology is used to improve health care. The methodologies being utilised to develop eHealth technologies are ineffective in terms of producing meaningful, manageable, and sustainable technology.

This study investigates the effects and constraints to the adoption of consumer interaction in the national health service in India, providing a fresh perspective on eHealth. This study highlights what obstacles healthcare organisations should consider while dealing with eHealth and what could stymie the healthcare sector's growth. One of the most significant features of today's society is the treatment of old persons and residents who require professional assistance. Expectations for how eHealth adoption can help companies in general, as well as expectations for eHealth adoption in healthcare. According to studies, higher eHealth usage in India can improve productivity, decision-making information, quality, and so on [Meskó et al. 2017]. At the same time, research reveal that eHealth adoption in India has challenges [Kaur et al. 2019]. As a result, it's worth looking into what the real impacts of the eHealth implementation have been so far, as well as what challenges have developed. The goal is to look into the consequences and roadblocks from the standpoint of customer engagement.

RESEARCH PROBLEM

eHealth apps have attracted considerable interest from a range of stakeholders, including patients, healthcare providers, insurance firms, and researchers. These apps empower patients

to manage their health independently and encourage active participation, ultimately resulting in better health results. They provide numerous advantages such as assisting in making informed decisions, effectively managing chronic conditions, and improving communication between patients and healthcare providers. However, despite these advantages, eHealth applications face numerous challenges, with customer engagement being a crucial concern.

The novelty of technology presents a common challenge as users may not allocate sufficient time to learn and utilize health applications effectively, resulting in frustration and negative perceptions. Providers play a vital role in encouraging patient engagement by motivating them to use these applications and integrating tools that align with both provider workflows and patient needs, thereby enhancing consumer engagement and retention (Liaw et al., 2017).

Effective digital health communication should be tailored to match users' literacy levels, language preferences, cultural backgrounds, and social contexts, ensuring accessibility, clarity, interactivity, and motivation (Kreps et al., 2019). While implementing customer engagement strategies can be challenging, it is feasible with continuous technological advancements. The key is to identify and address existing and potential barriers to engagement and patient outcomes (Verhoef et al., 2010). Moreover, understanding and addressing consumer motivations are essential to mitigate barriers associated with using health applications (Borges do Nascimento et al., 2023). By recognizing these motivations and implementing tailored solutions, stakeholders can enhance customer engagement and promote positive health outcomes in the context of eHealth applications.

RESEARCH QUESTION (RQ)

The following research questions were addressed in this study:

RQ 1: What are the various factors that affects the adoption of eHealth in India?

RQ 2: What are the various factors of customer engagement that effects the adoption of eHealth in India?

RQ 3: What is the relationship between the factors of customer engagement affecting adoption of eHealth in India?

RQ 4: What will be the propose solution towards the improvement in customer engagement for the adoption of eHealth in India?

RESEARCH OBJECTIVES (RO)

The explicit objectives of this research were:

RO1: To identify and evaluate the factors that affects the adoption of eHealth in India.

RO2: To identify and evaluate the factors of customer engagement that effects the adoption of eHealth in India.

RO3: To understand the relationship between the factors of customer engagement affecting adoption of eHealth in India.

RO4: To propose solution towards the improvement in customer engagement for the adoption of e-Health in India.

CHAPTER SUMMARY

In this chapter, we delve into the fundamentals of eHealth in India, examining its implementation in recent years and reviewing the prevailing adoption challenges across the nation. We address both the business problem and the research problem, elucidating the exploration questions and research objectives. Furthermore, we explore the bibliometric analysis and theme-wise literature on customer engagement, identifying it as one of the primary barriers to eHealth adoption in India.

CHAPTER 2

REVIEW OF LITERATURE

OVERVIEW

This section provides an overview of the literature review process employed in this research, including the methodology used and a summary of the themes identified from the literature. The thematic analysis of both academic and industrial literature is also presented. Literature review serves as a foundation for formulating specific research questions by systematically collecting and synthesizing previous research findings (Snyder, 2019). Through the exploration of past literature, research gaps can be identified. Chapter two presents a comprehensive literature review focusing on eHealth, barriers to its adoption in India, customer engagement challenges, and initiatives undertaken by the Indian government to enhance eHealth adoption. The relevant literature is categorized and presented under three main themes for simplification and organization. Additionally, the Normalization Process Theory and Technology Acceptance Model (TAM) are considered to provide a comprehensive understanding of the research topic.

INTRODUCTION

A literature review is an academic piece of writing that showcases one's grasp of the scholarly literature related to a particular topic within its broader context. It involves not only summarizing existing research, theories, and evidence but also critically evaluating and discussing this material. This process entails analyzing and interpreting the identified content in relation to the topic at hand, offering insights, and potentially identifying gaps or areas for further investigation. The primary goals of a literature review are to present the existing knowledge and research on a topic and to provide one's own critical assessment and discussion of this information.

LITERATURE REVIEW METHODOLOGY

We conducted a bibliometric analysis from 2007 through the mid of 2022 to better understand the various eHealth programs being offered in India today, as well as their nature, funding, and

operational issues. Various reports about eHealth in India have been identified. Even though, the majority of the articles (i) were created by individuals who worked on such programs (Agrawal et al., 2013; Ganapathy & Ravindra, 2009; Mishra et al., 2009); (ii) reported studies on eHealth user attitudes (Chattopadhyay, 2010; George et al., 2007; Meher et al., 2009)or (iii) were literature reviews (Kapoor et al., 2020; Sankaranarayanan and Ganesan, 2016; L. K. Sharma & Rajput, 2009). To evaluate and forecast the research status and development trend, bibliometrics looked at the distribution network, quantifiable linkages, changing the law, and numerical management of literary information. They were able to realize the geographical and chronological analysis of extensive literary works as a result. In calculating the amount of knowledge produced and the principles governing scientific progress, bibliometrics plays a special role (Yu et al., 2020).

However, the central emphasis of the bibliometric research on eHealth is on the application of appropriate knowledge structures. There are no relevant papers on eHealth that emphasize the hot spots and potential future advancements from the viewpoint of Indian research facilities and their collaborating networks of worldwide research. To explain the changing trends of eHealth research from 2007 to 2022 until this point and provide references, this work analyzes the period pattern, regional or national collaboration and impact, co - operation interactions among research organizations and scholars, connections and explorations of Indian eHealth publications based on the fundamental collection of the WoS (SCIE/SSCI) database.

Statistical methods are employed in bibliometric studies to "track the rise of multi-disciplinary sectors " and to "measure the 'output' of individuals/research teams, organizations, and countries."(Ellegaard & Wallin, 2015). Bibliometrics is becoming more and more popular as a method for spotting emerging trends in the field of study, spotting patterns in the collection of scientific publications, and assessing the structural aspects of a study as well as its development and dynamical characteristics. Bibliometrics is often used to evaluate the academic success of a certain person, a department, or an overall country based on the number of citations (Cobo et al., 2011a). There are a diversity of research areas, including information processing and management (Aboelmaged & Mouakket, 2020), medicine (Akmal et al., 2020; Kiraz & Demir, 2020; Xie et al., 2020), computer science (Dabbagh et al., 2019; García-Sánchez et al., 2019) and policy-making(Liang & Liu, 2018), numerous bibliometric investigations have been carried out. Therefore, this review aims to serve as a pioneering endeavor in mapping the

landscape of electronic health in India using a bibliometric approach. It intends to highlight current insights while also paving the way for future research directions in this field.

To identify existing bibliometric studies in the field of eHealth research in India, we conducted multiple search queries across various online databases. These databases include Scopus, IEEE Xplore, Web of Science (WoS), Springer Link, ScienceDirect, and Wiley Online Library. Our objective was to comprehensively review the literature and gather insights from previously conducted bibliometric analyses in this domain. The search results indicate that there are few comparable bibliometric research papers on the subject of eHealth research. Most work on bibliometric analysis in E-health is being done globally (Müller et al., 2018; Sikandar et al., 2021a; Tian & Chen, 2022a) but not in Indian perspective, while some work is being done in India but in different sectors of health care (R. R. Pai & Alathur, 2021) and on the barriers of eHealth in India (D. Das & Sengar, 2022). As can be shown, the Indian viewpoint on eHealth research hasn't been thoroughly examined, taking into account all the fields where it has been applied. We found a dearth of analysis on a variety of subjects, including the intellectual and research fronts of the field, intrinsic connections among journal articles, scholars, keywords, pre-existing networks of collaboration, most recent innovations, significant topics, and the most influential authors, and articles. The void that our work seeks to close is this one. To demonstrate how eHealth is constructed as a methodology and how it has changed over time in India, the study will do a bibliometric analysis. For this, we examine and understand the behavioural, philosophical, and networking site structure of eHealth research along with the growth, achievement, and cyclical aspect of the area using performance evaluation and scientific mapping approaches.

Our research advances knowledge in two separate ways:

a) In contrast to past analyses of the literature, it elicits the cognitive, psychological, and social network patterns of the eHealth research domain.

b) Rather than relying on qualitative analysis, it based its findings on quantitative data.

As a result, by examining cutting-edge research on eHealth from the standpoint of many fields of study, this study contributes to academia. Additionally, it highlights the key patterns and suggests new areas for study. The target of the study is to examine the electronic health

(eHealth) literature that has been published about India. It also offers several study strategies used by scholars in this field and reviews the most significant research papers.

(Dittmann, E., & Börner, 2005)and (Cobo et al., 2011)both provided descriptions of the science mapping tools and process. (Zupic & Čater, 2015) proposed a standardized process for conducting bibliometric studies, comprising five distinct steps: study design, data collection, analysis, and interpretation. Their framework was developed following an analysis of 81 bibliometric studies in the fields of management and organization, as well as a review of literature on bibliometric methodology. This science mapping workflow methodology is used in our study as suggested in (Aria & Cuccurullo, 2017). A general description of these stages is shown in the Fig 2.1 Following is a breakdown of the objectives and tasks carried out at each stage:

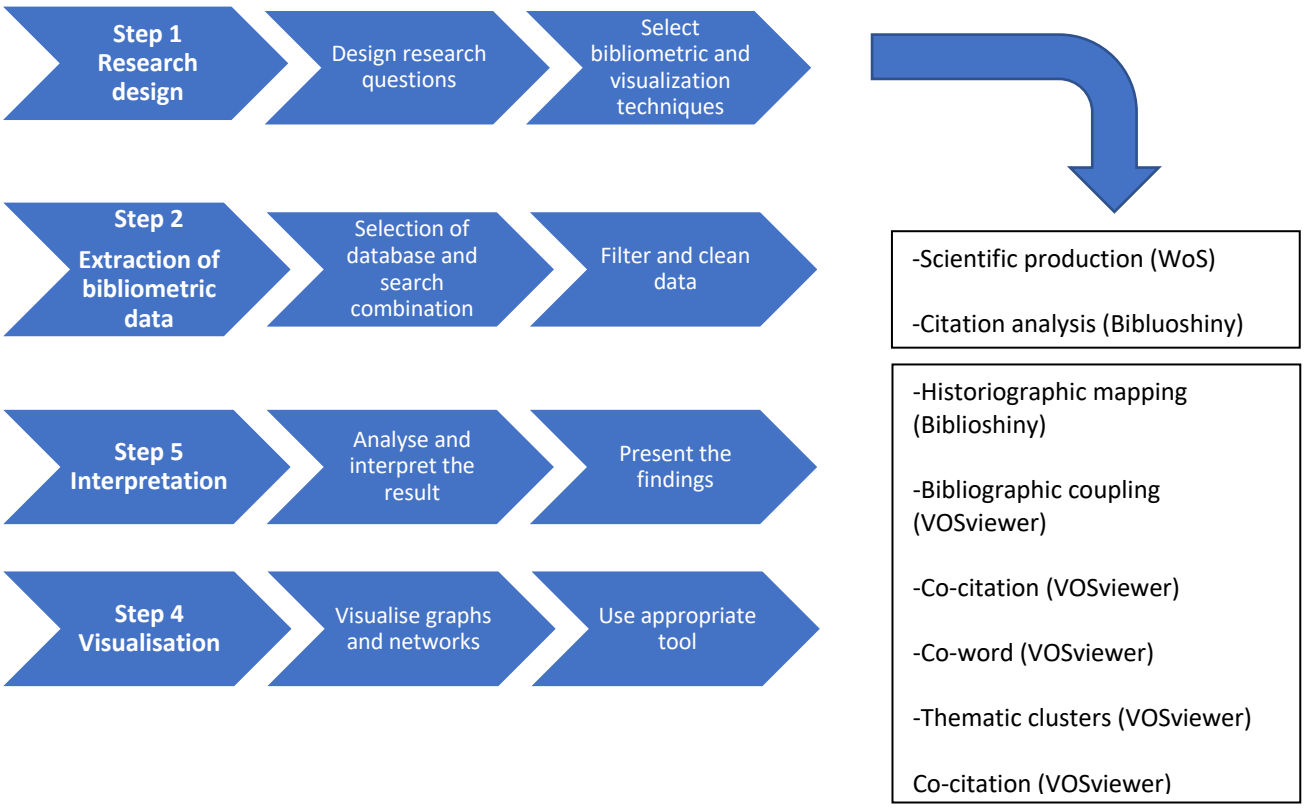


Figure 2.1 The procedure used to perform this bibliometric study

Step 1. Research design:

The following step tries to outline the study's research questions and specify the best approaches for responding to each of them. The major goal of our study is to describe the framework of eHealth in India as a newly emerging field and how it got evolved. To perform this, the given method has been carried out:

a) **Descriptive analysis:** When considering the achievements of the author, institution, and nation concerning the production and development of research, a descriptive analysis offers helpful information. It assists in identifying the most creative or significant authors, as well as the books and journals that receive the most citations. Observing how those indicators change over time, gives academics a glimpse of how the discipline is developing.
b) **Intellectual structure analysis:** An investigation of the field's conceptual structure reveals how the theoretical foundation was made. And analysing the links and nodes of varied networks will aid researchers in determining how publications influence the development of the research field.
c) **Analysis of social network structures:** The evaluation of the collaboration structure of a field's related authors aids in the discovery of research groups that can be consolidated.
d) **Analysis of conceptual structure:** This technique is used to pinpoint a field's research front and monitor its development over time.
e) **Production counting:** It entails assessing the author's production based on the volume of independently and jointly written papers. The counting method which is mentioned in our study has been the full-counting method, which completely honour's each author who contributed to a publication (Dittmann, E., & Börner, 2005).
f) **Citation analysis:** measures the influence of academics' work on the research community by looking at the citation rates of the papers(Bornmann & Daniel, 2008).
g) **Co-citation analysis:** It is the process of citing two articles in the same third article. Strong co-citation relationships are analysed to identify the publications that have a significant connection to a study topic and, as a result, exists the core publications for that field (Small, 1973). A co-citation network can be used to show the connections between cited sources, which aids in depicting clusters and the potency of co-citation connections.

h) **Bibliographic coupling:** When two articles cite the same third article, this is known as bibliographic coupling. The likelihood that two publications treat the same topic is increased by the number of references they share(Kessler, 1963)

i) **Historiographic mapping:** A innovative graph called historiography makes it easier to visualize how a discipline's theoretical foundations have changed throughout time. It benefits from data on direct citations among the publications in a dataset (Garfield, 2004).

j) **Co-authorship analysis:** aids in putting into perspective how researchers in a certain subject cooperate to develop fresh research. It is shown as a network that makes it possible to identify well-established research groups and key figures who connect various groups (Peters & Van Raan, 1991).

k) Co-word analysis: By using the term co-occurrence, co-word analysis aids in the discovery of connections between study themes. Words that appear in the title, abstract, or as keywords in a network are probably closely connected. Visualizing research clusters is helpful (Callon et al., 1983)**.**

l) **Thematic evolution analysis:** It is feasible to uncover study topics and follow their evolution over time by employing a thematic/strategic analysis and longitudinal co-word mapping (Callon et al., 1991).

Step 2. Gathering of bibliometric data:

Building the dataset that will be used for a bibliometric study is the goal of this step. At the beginning of the process, decisions must be made on the database that will help to retrieve the data, the search words that will be used, the length of the searches, etc. Once a decision has been made, searches must be run and the relevant data must be downloaded. The choices made at this stage determine the size of the dataset that will be used for the analysis, which has a significant impact on the study's findings and validity. We used WoS to create a dataset of the eHealth literature in India (WoS). The search method was designed to find English-language articles listed in the WoS core collection that contained any variants of the term **(eHealth* OR Ehealth OR eHealth) etc**., in the title, abstract, or keywords. Fig 2.2 provides specifics on the design of the search procedure. The original dataset, which includes 185 papers, was taken from WoS in July 2022. The publications that were unrelated to this study because they were in an area other than eHealth were removed from this dataset by removing it. A modest number of articles were also excluded due to certain

reasons: (1) because they contained duplicate content.; (2) they lacked crucial information, like the author names; (3) their publication dates fell beyond the scope of the search; and (4) they were irrelevant from an Indian perspective. The final dataset, after this procedure of eliminating the initial dataset, had 141 publications. The finished dataset was exported to several file types so that the study's processing tools could work with it.

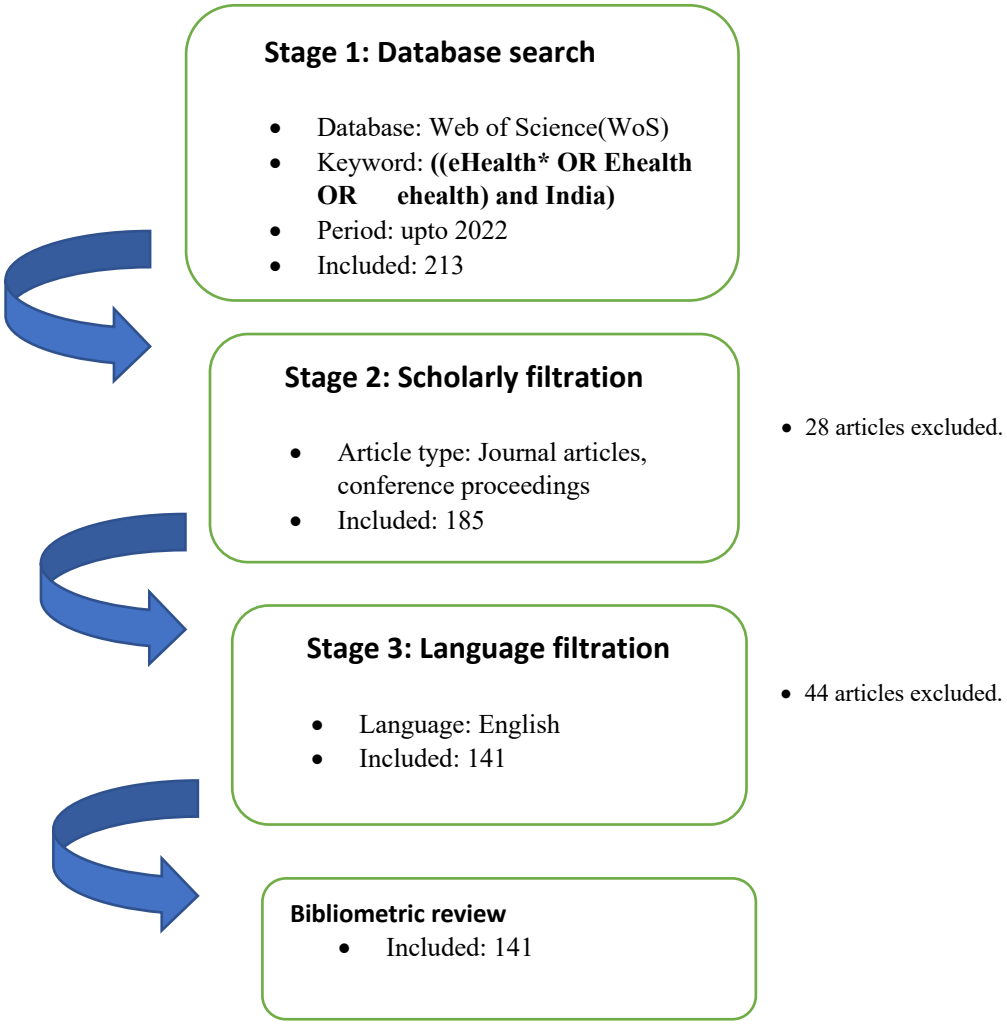


Figure 2.2 Search and filtration strategy for bibliometric review.

Step 3. Analysis:

During this phase, data is collected using bibliographic methods to address the research questions. The required insights can be gleaned from the dataset using a variety of software techniques.

Step 4. Visualization:

This step closely relates to Step 3 and tries to visualize the analysis data generated to make it easier to comprehend and interpret, and the tools described above were used in this study for both analysis and visualization.

Step 5. Interpretation:

The interpretation of the analyzed data gathered is the final phase in a bibliometric investigation. The dataset's articles must be carefully examined to ensure the veracity of the findings drawn before the results can be properly interpreted. This step's final objective is to present the study's primary conclusions and findings concisely through the use of a scientific publication.

RQ1: What is the publishing growth trend of eHealth-related publications in India over the past decade?

Table 2.1: The information of the publications

Description	Results
INFORMATION ABOUT DATA	
Timespan	2007: mid-2022
Sources	110
Documents	141
Average years from publication	4.12
Average citations per documents	7.021
Average citations per year per doc	1.208
References	4795
TYPES OF DOCUMENTS	
article	59
article; book chapter	3
article; early access	1
article; proceedings paper	1
editorial material	6
proceedings paper	56
review	15
CONTENTS IN THE DOCUMENT	
Keywords Plus (ID)	266
Author's Keywords (DE)	545
AUTHORS	
Authors	687
Author Appearances	751
Single-authored documents	3

Multi-authored documents	684
AUTHORS COLLABORATION	
Single-authored documents	3
Documents per Author	0.205
Authors per Document	4.87
Co-Authors per Documents	5.33
Collaboration Index	4.96

As previously mentioned, the dataset for this investigation includes information from 141 articles. TABLE 2.1 contains comprehensive summary data regarding our dataset. Our goal is to assess the literature that has been published in the Indian context, although the research has been dispersed across a variety of fields. There are 110 different sources from which eHealth research has been published. These include articles (59), proceedings papers (56), reviews (15), book chapters (3), editorials (6), and books (1). 545 keywords among all have been used by authors to describe their research and received an average of nearly 7 citations. Concerning the total group of authors, 687 authors have contributed to 141 articles, yielding a 4.96 collaboration index.

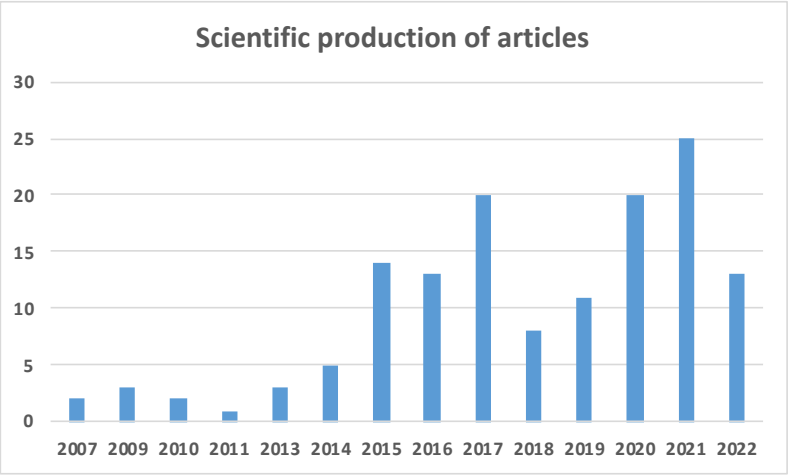


Figure 2.3: The publishing trend in eHealth research in India.

Figure 2.3 depicts the rate of growth, estimated as the ratio of the number of articles published over two consecutive years. 2 in addition to the monthly number of papers (TP). In 2007, the very first studies in this area of study were published. The average annual growth rate from that point until 2021 is 15.49%. Additionally, it was discovered that between 2015 and 2021, the number of publications in the journals grew, indicating growth in an extension of the study field.

RQ2: Which organizations have contributed to eHealth research in India?

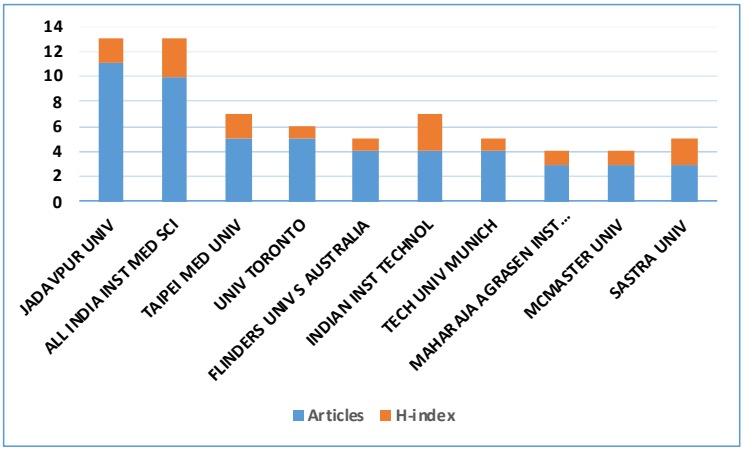


Figure 2.4: Top-10 most influential organizations (number of citations)

Figure 2.4 reduced to the level of the ten most-prominent organizations working for eHealth in India. Jadavpur University (Kolkata**)** is the most contributing organization, with 11 publications, followed by the AIIMS (All India Institute Medical Science) (Delhi) with 10 publications, and the Taipei Medical University (Taiwan) and University of Toronto (Canada), with 5 publications each, working collaboratively in India respectively. Flinders University (Australia) and the Indian Institute of Technology Association close the list with the most contributing organizations, Not reported and Tech University (Munich) with 4 publications each. The Indian Institute of Technology Association and AIIMS (All India Institute Medical Science) (Delhi), with an h-index of 3, is the organization conducting the most influential research.

Although numerous eHealth topics have been researched in the health - care research conducted in these organizations, the implementation and consequences of eHealth in a) academic achievement and b) universal health care, mainly strenuous workout and wellness, emotional wellbeing, and highly specialized ailments, such as liver fibrosis, have been the most commonly examined topics across these organizations.

When it concerns research on the use of ICT in healthcare and the effects that eHealth has on four important technologies, i.e satellite, world wide web, cell phone, and cloud for the provision of health services, the Indian Institute of Technology Association stands out. They even research formalizing the parametrized security classes needed for the design of security

policies in typical e-health systems in hospitals and employ static type checking to find instances of policy breaches. Even the Indian Institute of Technology (IIT) - Roorkee in collaboration with Liverpool Hope University has worked on an e-health model which deals with the psychological issues of adolescents in India named Yuva. The goal of the work done by the Indian Institute of Technology (IIT) - Kharagpur is to build feature variables related to daily living behaviour utilizing sensor data and smartphone usage to forecast the mental health of students. In AIIMS (Delhi), marketing uses of eHealth such as consumer involvement, crowdsourcing, and mobile marketing have also been researched. Finally, this widely cited study focused on the structural underpinnings of eHealth awareness and attitudes among Indian patients and physicians. The impact of an emergency nurse coordinator on workflow optimization within an emergency department in Delhi, as well as the difficulties nurses encounter when utilizing electronic health records during clinical practices, were extensively investigated in a comprehensive study involving nurses.

The severe acute covid-19 pandemic has sparked considerable anxiety and concern. As of October 19, 2021, India alone had recorded more than 34,094,373 cases reported of COVID-19 and 452,454 deaths associated with it. By May 2021, the number of new COVID-19 cases per day will have surpassed 400,000, putting the healthcare system in jeopardy. This information demonstrates that perhaps the covid-19 pandemic has emphasized the necessity to introduce together research results from various fields of study, develop strong industry consensus, and be a driving factor for multi-sectoral, cross-disciplinary collaboration. Despite the disastrous scenario, the public's reaction was seen in their attempts to come up with new inventions for potential pandemic-fighting methods. Researchers from Taipei Medical University (Taiwan) and the University of Toronto (Canada) have also been interested in this situation as part of their eHealth assistance for trying to promote covid-19 experience with understanding, protective behaviours, and diminishing pandemic anguish among gender minorities (#safehandssafehearts).

Last but not least, Jadavpur University (Kolkata), the organization that has contributed the most and received the most citations, has worked on an eHealth sensor kit as smart cities become more prevalent. However, there is a critical need for proper health care as the world's population shifts toward metropolitan areas.

RQ3: Which are the most influential publication in eHealth research in India?

Highly cited publications are significant when examining a certain area of research since they have encouraged and piqued the curiosity of those researchers. We used Martnez et al H-Classics's approach to find the most influential publications in the field of eHealth (Martínez et al., 2014). This method, based on the H-index (Hirsch, 2005), manages to combine assessments of published volume and impact to identify highly cited works, also known as citation classics, within a specific field of study. According to Martnez et al., "H-Classics of a study area A might be described as the H-core of A, which is made up of the H highly cited publications with more than H citations received" (2014). As a result, after selecting the data for the study, the procedure for identifying H-Classics requires digital technology the H-index of a dataset's gathering of articles published before trying to locate the H prominent research documents.

The 40 publications with the highest citation counts are listed in Appendix I. The total number of citations (TC) and an average number of citations per year (AVG CIT) for each publication are displayed together with basic details like the title (TI), authors (AU), publication year (PY), and digital identifier (DOI). Seventy-five percent of the highly cited works were written as journal articles. The academic publications that have been publishing the most highly cited articles include Health Affairs, MIS Quarterly, and Technology in Society.

The most influential publication (J. G. Kahn et al., 2010)with a total citation of 515, is an empirical study on Mobile health, or M-health published in the journal Health Affairs. In this article, the author examines the persistent burden of communicable diseases and the steady rise in the frequency of chronic diseases in emerging nations. M-health also referred to as "mobile" health, is the application of mobile technologies, such as cell phones, to improve clinical care and public health. It can reduce the burden of both types of diseases. Regional, local, and individual health care are significantly impacted by mobile technology, which is generally accessible.

There are enough works on this list that fall under the categories of survey-style literature reviews, systematic reviews of the literature, and informal reviews. All of these studies examine published materials to discover empirical proof of eHealth's influence on healthcare

applications, infant mortality in rural India (Venkatesh et al., 2016), its applications in post-treatment cancer survivorship(Kapoor et al., 2020), a technique for building Intelligent Health-care system to built a Smart City (Bhunia et al., 2014a), accelerating technologies to deliver better quality healthcare for the citizen of India(R. Bhatia, 2021), marketing(Dash et al., 2022), and tourism (Srivastava et al., 2015), and the Health informatics as a service (HIAAS) (Paul & Das, 2017).

The subsequent publications detail empirical studies conducted in actual settings to evaluate various facets of eHealth, particularly its educational efficacy and the outcomes of various digital health components. All of the publications detail research projects conducted in educational environments (Chhabra et al., 2018; Kodali et al., 2015). These studies mainly aim to characterize the effects of eHealth on the inspiration, commitment, and cognitive performance of university students as well as to investigate the impacts of various digital health components. The remaining publications discuss eHealth implementations in non-educational settings, such as IoT deployment (Patan et al., 2020), addiction disorders(Bandawar et al., 2018), analysis of diabetes and hypertension disease(S. Gupta et al., 2020) interview-based studies (Jarosławski & Saberwal, 2014), and electronic health records (M. M. M. Pai et al., 2021).

RQ4: Which are the influential journals in eHealth research in India?

Table 2.2 The most cited top-10 Journals for eHealth research in India

Source	H_index	TC	NP
Health Affairs	1	224	1
Information Access Evaluation: Multilinguality, Multimodality, And Visualization	1	88	1
Technology In Society	2	69	2
MIS Quarterly	1	58	1
European Spine Journal	1	39	1
JMIR	3	38	9
International Conference on Information and Communication Technologies,2014	1	37	1
Sustainable Cities And Society	1	27	2
Recent Advances In Intelligent Computational Systems, IEEE 2015	1	27	1

10th International Conference On Wireless And Mobile Computing, Networking And Communications, IEEE 2014	1	21	1

The publications that publish cited articles and consequently influential eHealth studies are listed in Table 2.2. The (TP) total number of eHealth articles, (TC) total number of citations and h-index are all displayed for each journal. The journals are arranged in TC order.

Journal of Medical Internet Research (JMIR) has the most publications (9), while Health Affairs has received the most citations (224), as seen in this table 5. The next journal, information access evaluation: multilingualism, multimodality, and visualization, reaches a high number of citations, (88). Nearly 25% of the works published in the top 10 most influential journals are included in both journals. Considering the h-index of these prestigious journals, JMIR has an h-index greater than 3 in addition to health issues and access to information analysis: multilingualism, multimodality, and visualization. The h-index of the remaining journals is all between 1 and 2, while technology in society is 2.

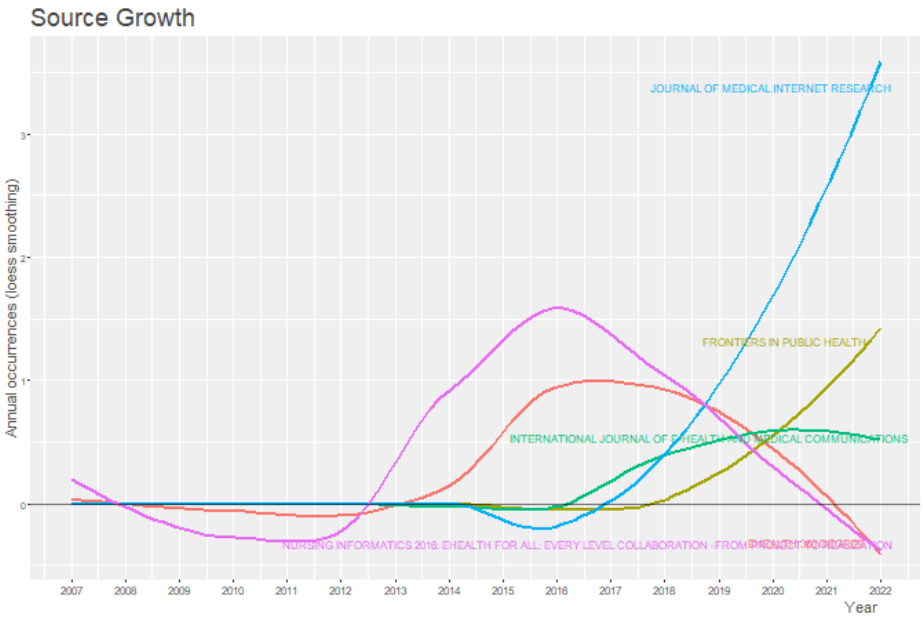


Figure 2.5: eHealth research in India source growth dynamics.

Figure 2.5 depicts the dynamic nature of the five main Indian outlets for eHealth research. Again, three well-known journals, the *Journal of medical internet research, Frontiers in public health, and the International Journal of eHealth and medical communication*, show how interest in eHealth has increased in the time from 2017 to the present.

RQ5: Which are the top authors in eHealth research in India?

To evaluate the innovative and influential researchers in eHealth research, Table 2.3 showcases the top 10 authors in eHealth research, ranked by the total number of articles authored. Meanwhile, Table 7 exhibits the top 10 authors based on the total number of citations accrued.

Table 2.3: Top eHealth researchers in terms of productivity

Ordered By TP				
Author	**H_Index**	**Tc**	**Tp**	**Py_Start**
Gupta A	2	9	6	2015
Mukherjee N	2	30	6	2014
Agrawal D	1	4	4	2016
Chatterjee P	3	26	4	2015
Xavier T	1	4	4	2016
Armentano RL	3	24	3	2015
Cymberknop LJ	2	16	3	2017
Edoh To	1	3	3	2016
Gupta D	1	26	3	2020
Pal A	2	9	3	2017
Ordered By Tc				
Author	**H_Index**	**Tc**	**Np**	**Py_Start**
Kahn JG	1	515	1	2010
Kahn JS	1	287	1	2010
Yang JS	1	224	1	2010
Chapman WW	1	88	1	2013
Elhadad N	1	88	1	2013
Goeuriot L	1	88	1	2013
Jones GJF	1	88	1	2013
Kelly L	1	88	1	2013
Leveling J	1	88	1	2013
Martinez D	1	88	1	2013

TABLE 2.3 shows the top contributing authors, Gupta A has the most publications in the dataset, starting from 2015, and an h-index of 2. The gap between the next author, Mukherjee N, and the other top contributing authors is very large. He has the same six publications in the dataset and has the most citations 30 in the list. They have also co-authored three works, the most well-cited of which were published in 2016 (A. Gupta & Mukherjee, 2016) 2017 (A. Gupta & Mukherjee, 2017), and 2021(A. Gupta & Mukherjee, 2020)

The organization in India that has made the largest contribution to eHealth research is Jadavpur University (Kolkata), where both authors are affiliated and also have similar research interests in a wide range of eHealth topics. As we previously learned, Jadavpur University is the largest university in India. Their most popular articles explain how patients in remote healthcare

facilities are equipped with many sensors, and the data collected is sent to the cloud where it is used by doctors to make diagnoses. The difficulty is in giving accurate information because any inaccuracy results in the patient's diagnosis being wrong. Along with experimental findings using virtual sensors in the fields of eHealth and environmental monitoring, this paper also includes various case studies. When ordered by total citation the most cited author Kahn JG has published (J. G. Kahn et al., 2010), with a total citation of 515, is an empirical study on Mobile health, or mHealth in 2010 and published in the journal Health Affairs. And followed by one of his co-authored Kahn JS and stands second best with another publication (J. S. Kahn et al., 2009) with a total citation of 287 in 2009. According to the author, there is a gap between what patients suggest they desire and require from this digital tool for tracking their health information and what is already obtainable in personal health records (PHRs). PHRs are unlikely to be widely used until that gap is closed. Cost, concerns about data security and privacy, interruption, design defects, and the incapability to transfer information between organizations are all deterrents to patient use of PHRs. However, PHRs will probably prove to be quite useful in the future once these issues are resolved and health data are portable and intelligible (in both content and format).

Table 2.4: The most influential authors in eHealth research in India

Author	H_Index	TC	NP	PY_Start
Chatterjee P	3	26	4	2015
Armentano RL	3	24	3	2015
Mukherjee N	2	30	6	2014
Pant M	2	21	3	2014
Srivastava S	2	21	3	2014
Meher SK	2	19	2	2009
Cymberknop LJ	2	16	3	2017
Udayasankaran JG	2	13	2	2018
Gupta A	2	9	6	2015
Pal A	2	9	3	2017
Liaw St	2	9	2	2017
Narasimhan P	2	9	2	2017

TABLE 2.4 displays the top 10 authors with the most citations, regardless of the number of articles individuals have produced, to evaluate the most eminent authors in aspects of citations received. Mukherjee N, who has the most publications on the list and the most citations, is at

the top of the list. Following one of his co-authors, Armentano RL follows Chatterjee P, have acquired the second-highest number of citations. IoT is mentioned in their study as being extremely important in the context of eHealth since connected patient data will enable more effective and thorough treatment. Virtually storing the patient information and making it publicly accessible to concerned healthcare workers would be the initial step toward knowledge exchange. Another essential element of using this connected data is the development of an intuitive clinical decision-support system, which would assist the doctors in every way possible during the therapy phase. In the paper, a paradigm with an integrated model to the IoT devices in the eHealth situation has been built to establish a smart health environment and provide better flexibility at their best. The trend of eHealth infrastructure will assist medical treatment to reach the underserved by providing final monitoring equipment even in remote places.

It's fascinating to observe that some of the top ten authors who receive the most citations have made only a few contributions to the area. There is only one piece of writing by two authors. However, there were many citations for such works. According to this information, authors who don't routinely contribute to the field but have written two or three widely referenced papers may be among the extending credit authors in Indian eHealth research. The significant majority of the authors that receive the most citations began writing on the subject of eHealth between 2014 and 2015.

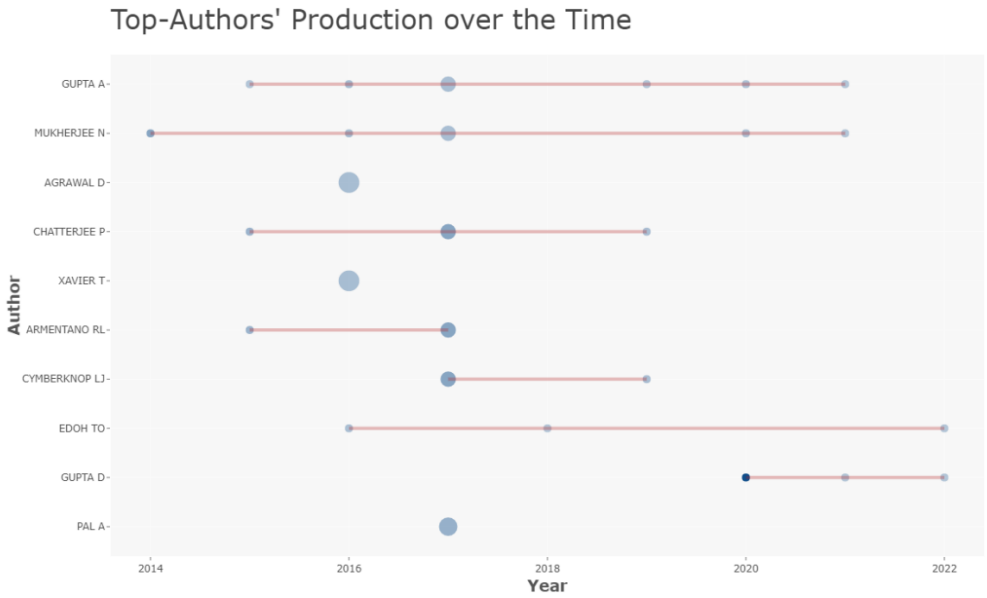


Figure 2.6: Most-productive authors' production over time

The top ten most productive authors are depicted throughout time in Figure 2.6. A chronology for an author is shown by the horizontal line. The bubble size reflects how many contributions someone made in a given year, and the intensity of colour reflects how many citations they received overall. The most significant author in this group, Mukherjee N, whose debut book was in 2014, is also the earliest publisher. He only wrote one article in 2014, but it was the most quoted piece of eHealth studies at the time. He continued to submit one or two essays each year after that, except for the years 2015, 2018, and 2019. There have been six improvements to the field overall. Gupta A, exploring the eHealth of learning, started publishing in 2015 and contributing every year till 2021. Finally, Gupta D published from the last three years consecutively, also has one publication in the year 2020 with the highest citation in this list.

RQ6. How has the knowledge in the field been constructed over time in India?

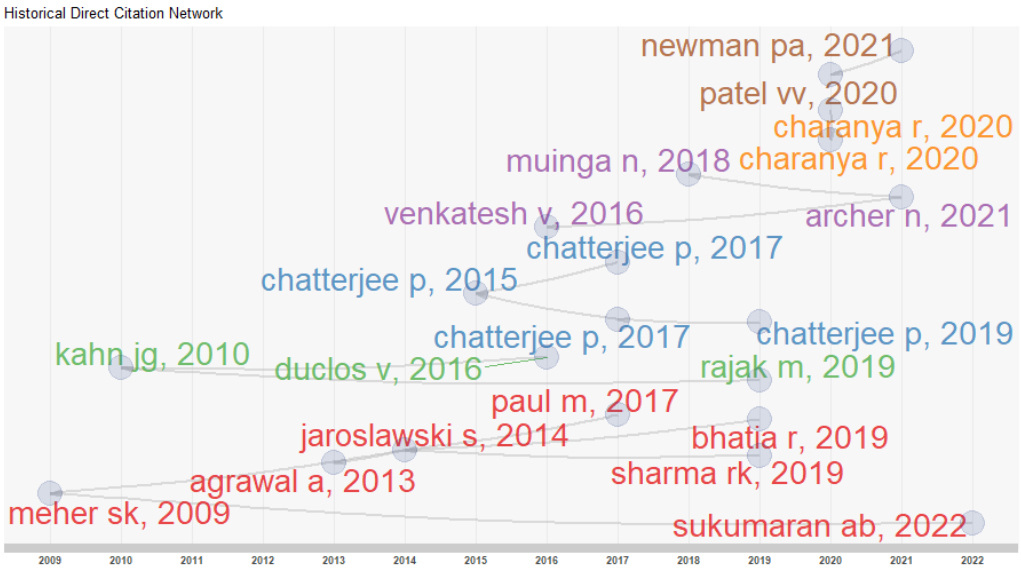


Figure 2.7: Historiographic structure of the eHealth field

Klavans and Boyack [106] suggested that co-citation and bibliographic coupling are less accurate than straight citations in reflecting a research front. The direct reference network for the 20 publications that have had the greatest impact on the discussion of eHealth in India is shown in Figure 2.7. The publications in the historiography date from 2009 to 2022. These articles have gotten 1,100 worldwide citations altogether. 240 of them match up with nearby citations (LCS, Local Citations Score). This confirms the papers in our dataset have made an

appreciable contribution to the area of eHealth in India, with around 57% of the relevant reports issued by these publications coming from these publications. The historiography demonstrates the field's quick evolution in the middle of the studied era.

The two relevant publications in 2007 with no LCS and GCS score it is not been mentioned in the graph, then from 2009, 3 publications were done, then again 2 publications in the following year 2010, and almost again in the following one in 2011, a preceding year with none, with 3 publications in 2013 and 5 publications in the year 2014, then the score started increasing to 14 publications in 2015, then a little downfall on 2016 with 13 publications, but raises to 20 publications in 2017. The score drops down in 2018 with 8 publications, but raises to 11 publications in 2019, then again with 20 publications in 2020, and in 2021 with 25 publications, till now in 2022 it has achieved 14 publications. This evolution reveals that, thus far, the most fruitful years in terms of significant contributions have been 2017, 2020, and 2021. There aren't enough citations for recent 2021 and 2022 papers yet.

The core cluster which spanned from 2014 to 2021, was commenced by a (Jarosławski & Saberwal, 2014) paper *on the nature of work done and what needs to be done towards eHealth in India*, which is the most prominent work in eHealth. Although, the historiography also denotes that this significant work achieved massive attention over the years and was originally cited by (Paul & Das, 2017), which was further cited by(R. K. Sharma & Prashar, 2019) (R. Bhatia, 2021), followed by numerous links of citations among authors. Also, the statistic demonstrates that it took a while before the article became a crucial source for eHealth research (Jarosławski & Saberwal, 2014).

RQ7: What are the authors` collaborative structures in eHealth research in India?

A network of writers who regularly work together to create important eHealth research can be used to identify these groupings. We examined the authors' network of collaboration in the dataset to get the answer to this research problem. In our dataset, there are 4095 eHealth authors. We have studied the authors whose contributions to eHealth are not anecdotic and who have made a difference in the community to create a relevant and transparent co-authorship map. Since approximately 83% of the authors in this dataset have only published one paper and 33% have not even earned one citation, establishing a minimal level of contribution to the area is very crucial. For these reasons, we set a criterion of selecting authors who have published at least two articles and received nearly ten citations overall. Given that each paper

receives an average of 7 citations (see Table 4), this limit appears acceptable and not overly restrictive. The total number of authors in the dataset who meet these criteria is 134, accounting for 7.2% of all authors.

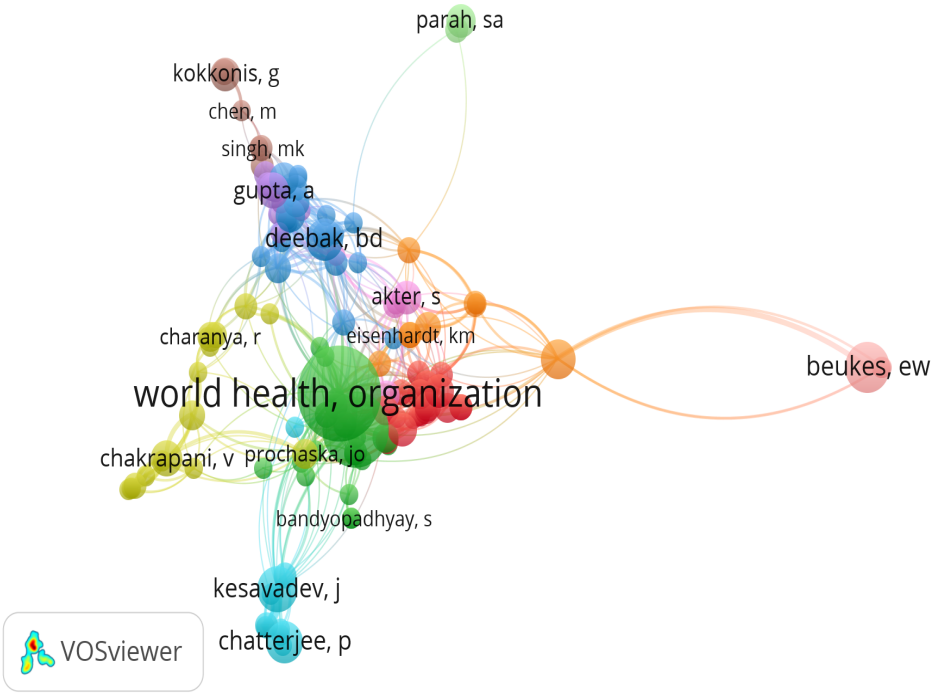


Figure 2.8: Authors' collaboration network.

Figure 2.8 depicts the collaboration network of the 134 authors with the highest overall link strength or the cumulative strength of a particular author's connections to other authors in co-authorship to keep the network understandable. A node in the network represents each author. In addition, the size of the node varies directly concerning the author's output. The links between both nodes reflect the relationships of author collaboration. There are 11 collaborative clusters made up of nodes. The colour of the node indicates the group of contributing writers to which the author belongs. The clusters of collaboration are dispersed from one another and vary in size, as seen in Figure 9. According to this structure, there are regular structures on specific research themes (intra-cluster collaboration) but little collaboration across other research areas (inter-cluster collaboration). The total number of co-authored articles on a given academic topic is represented by the author collaboration network. The network has very few connections, which suggests that there aren't many collaborative research initiatives in the eHealth literature (Alnajem et al., 2021).

The network also illustrates how eHealth research is primarily associated with the WHO (World Health Organization), with other authors occupying the most prominent place in the collaboration network from 2008-2020. There are also several scattered subnetworks, which indicate a relatively low level of engagement in eHealth research and are comparable to the structures of collaboration in other scientific domains. The WHO has conducted numerous international and Indian surveys on eHealth. Several resolutions on eHealth were adopted by the World Health Assembly of the World Health Organization and three of the six WHO Regional Committees.

RQ8: What is the conceptual framework of eHealth research in India?

Figure 2.9: The word cloud of 40 most frequent keywords.

The papers undergoing study have been described using a total of 800 author keywords (DE). Figure 2.9 displays the 40 most typical ones. If we concentrate on what these most popular search terms reveal about eHealth research, we may conclude that the word "care," which appears the most frequently, reveals that the study in this area is primarily focused on patient health via eHealth.

In this group, the most popular keywords, mainly forty-five percent of them have a connection to the prevention of disease, *social media*, *information system*, *intervention*, *impact*, *patient*, *technologies*, quality, *decision making*, and *developing countries*, exposing one the most researched application domains. Big data and glycemic control seem to be prevalent in many of the documented experiences. One of the common goals of these encounters is to increase participant engagement in eHealth activities. Beyond the realm of education, eHealth has also been extensively researched in other areas of health, particularly in the area of mental health, which is directly related to the promotion of mental activity in India. Both industries view eHealth as a preventative measure that appears to transfer the advantages of telemedicine, online health, and patient diagnosis to the spheres of education and healthcare.

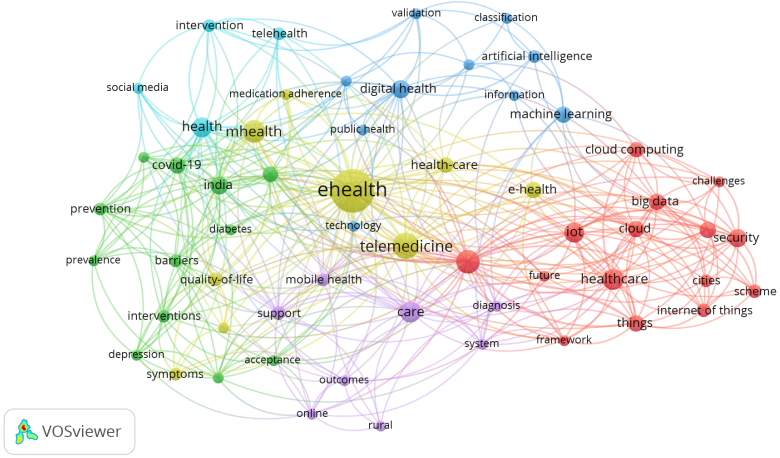


Figure 2.10: Keyword co-occurrences plot

To outline the conceptual framework of eHealth research, we conducted a co-word analysis of author keywords. These keywords were then clustered together and visualized in a word co-occurrence map, as depicted in Figure 2.10. Each node on the chart represents a keyword, with the size of the node indicating the frequency of occurrence of that keyword. Nodes are connected by links, and the strength of the link reflects the degree of co-occurrence correlation between the two keywords. Additionally, the color of each node signifies its affiliation with a particular cluster.

- **Cluster 1, shown in Red,** is the one with the most participants. It organizes 15 keywords. The cluster is made up of publications that strive to provide eHealth

experiences that improve the user's experience and cause them to change their behavior, according to a study of the keywords in the cluster. The healthcare and wellbeing domain is covered by the majority of the eHealth applications discussed in the publications of this cluster, whereas the cultural domain is covered considerably less frequently. Additionally, a group of keywords in this cluster relates to information technology such as *IoT, cloud computing, big data,* and *machine learning* revealing the interest of IT in healthcare to enhance *user engagement* and *experience* (Chauhan & Jaiswal, 2017a; Kodali et al., 2015).

- **Cluster 2, in green,** congregate 13 keywords. This cluster, which brings together publications focusing on the *barriers* to and relationships between *eHealth* and *India*, is characterized by the most common keyword, *India*. The persistent keywords in this cluster are *Covid-19*, which is a significant factor in eHealth research(R. Bhatia, 2021). When a new idea is generated there should be *barriers* to its implementation (D. Das & Sengar, 2022) mention there exist adoption barriers to eHealth in India. As the other keywords, *acceptance,* and *prevention are* adverse the same thing. Then there is a review carried out for adults dealing with *diabetes* and how eHealth can work for better interventions and the self-care role during the Covid-19 situation [110].

- **Cluster 3, in Yellow,** is grouped by 10 keywords. This cluster predominantly explores the different domains of eHealth such as *telemedicine and m-health*. The keywords relate to papers that deal with the use of subsets in eHealth (Ganapathy & Ravindra, 2009; Müller et al., 2018b; Sikandar et al., 2021b; Sood et al., 2007). Several nodes describing various pedagogical techniques are connected to the node of health care. These papers detail various educational-level experiments with the integration of healthcare and IoT (Kodali et al., 2015)*, and* its impact on *quality of life* (R. Bhatia, 2021; J. Das et al., 2012).

- **Cluster 4, in Violet,** groups 9 keywords. The frequently followed one cares, heed by keywords such *diagnosis, support, and rural*. With a significant number of publications required related to rural healthcare, the review of the rest keywords and the placement of the nodes within the network indicates that this cluster primarily examines aspects of eHealth that communicate as a common factor in the utilization of online support to diagnose ailments in rural areas of India and provide appropriate patient care (Agrawal

et al., 2013; Chattopadhyay, 2010; J. Das et al., 2012; Venkatesh et al., 2016) and also *online health* (Sikandar et al., 2021b).

- **Cluster 5, in Blue,** groups 8 keywords. The most frequent ones are *artificial intelligence, digital health,* and *public health*. The experiences that are detailed in these publications are primarily learning-focused and in the educational field (Chauhan & Jaiswal, 2017), use of AI in eHealth(Newman et al., 2021; Suominen et al., 2013) and research on the public health domain (Kalita et al., 2015).

- **Cluster 6, in Azure,** groups 4 keywords. This cluster formulates how *telehealth* in India developing (R. Bhatia, 2021; Scott & Mars, 2015) and through *social media* is helping in the *intervention* of diseases (Bassi et al., 2021; Cavero-Redondo et al., 2021; Hossain et al., 2019; Newman et al., 2021).

The results of this analysis reveal there are six eHealth research streams: a) Combining works of information technology in eHealth to increase the customer experience; b) the effect of Covid-19 on eHealth; c) the exploration of other domains of eHealth such as telemedicine and mHealth; d) the use of eHealth to promote rural healthcare in India; e) the analysis of how eHealth focuses in learning; and f) helping of eHealth in interventions of diseases.

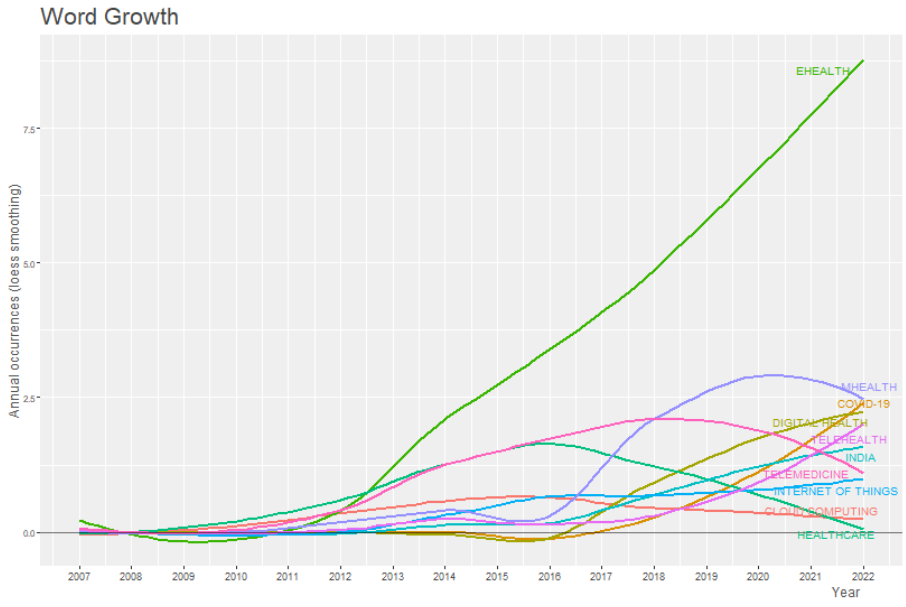


Figure 2.11: The evolution dynamics of authors' keywords over time.

We conducted a word evolution analysis (Figure 2.11) in addition to a word cloud analysis to identify possible research trajectories. We eliminated the obvious terms "eHealth" and "India" from our study. The graph demonstrates how since 2018, subjects like *COVID-19* and *telehealth* have become increasingly important. Even if *digital health* is becoming more and more popular every year, it has been discovered that *IOT* and *cloud computing can be thought of as research frontiers and access point trends*

RQ9: Where can future research (avenues) explore to enrich our understanding of the electronic health?

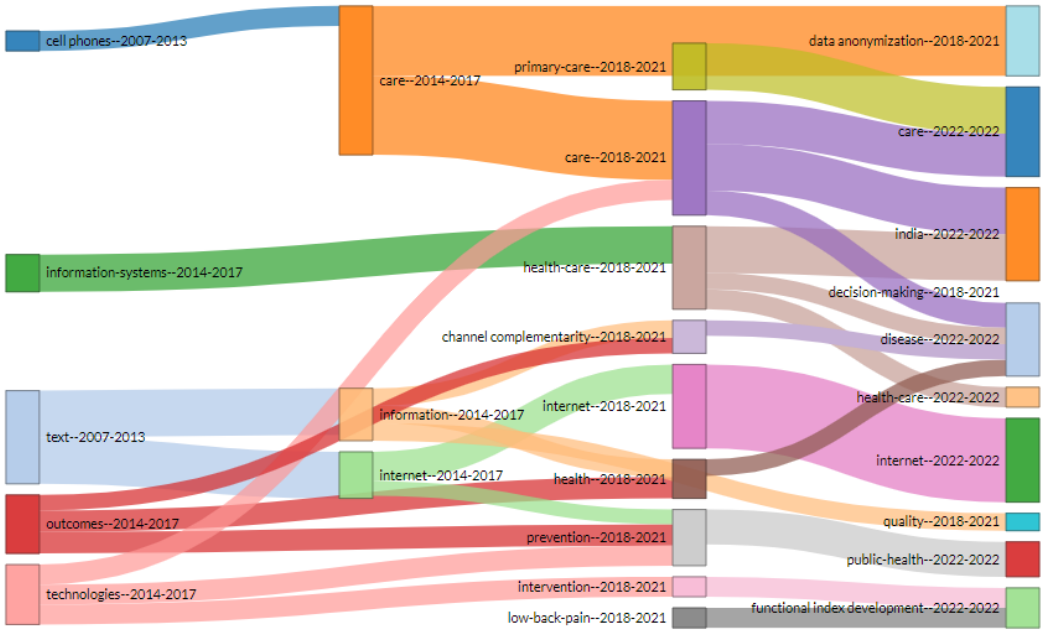


Figure 2.12: Sankey diagram of eHealth research

In addition, we used the Sankey diagram to analyse the flow and link between years and keywords in eHealth research (see Figure 2.12). The diagram, commonly referred to as a "three-field plot," is an effective tool for illustrating how different entities interact, with the width of the arrows and the size of the boxes depending on how frequently they are published. The labels for the themes in the figure correspond to the keywords that are used the most. The years

2007 to 2022 are divided into three years—the initial portion of 2007-2013 —have only two keywords texting and cell phones. We separated the rest dataset into two successive periods of four years each**, 2014-2017 and 2018-2021**, to study the conceptual development of the field. However, the co-word bibliographic networks were built using the published keywords from each era. Each network is subjected to a clustering method, and the resulting clusters represent the key study subjects of that time. Ultimately, each theme is depicted on a strategic or thematic map, utilizing the characteristics of the following two indicators to showcase the diverse range of topics uncovered.

- **Centrality: -** Measures how closely and strongly a cluster is connected to other clusters in the network. A cluster's linked topic is viewed by the scientific community as being more crucial the more central it is.
- **Density: -** Evaluates how well the words in a cluster are connected. The associated topic is more coherent and steady the higher the density.

The clusters are plotted vertically in order of increasing density and horizontally in order of increasing centrality to produce a strategic map. By splitting this graph into four quadrants, each cluster can also be classified into one of the subsequent groups: -

- **Motor themes-** These themes, which are in the upper-right quadrant, are seen as being well-developed and, as evidenced by their high centrality and density scores, are both highly interrelated and very coherent.
- **Basic and transversal themes-** These themes, which are located at the lowest right quadrant include the topics that are significant due to the numerous connections they have to other themes, but they have not yet been fully developed due to the weak internal connections.
- **Highly developed and isolated themes-** These themes, which are in the upper-left quadrant, are also well-developed, but their weaker interconnections with others indicate that they are more ancillary, such as exceptionally specialized topics.
- **Emerging or declining themes-** Located in the lower-left quadrant, they stand for concepts that are both ancillary and underdeveloped. In this quadrant, a subject could be either emerging or declining. To determine the nature of its contribution, the evolution of the system must be examined over time.

The thematic maps for every three years are depicted in Fig 2.13 and 2.14 as a result of a study using the bibliometrics R package.

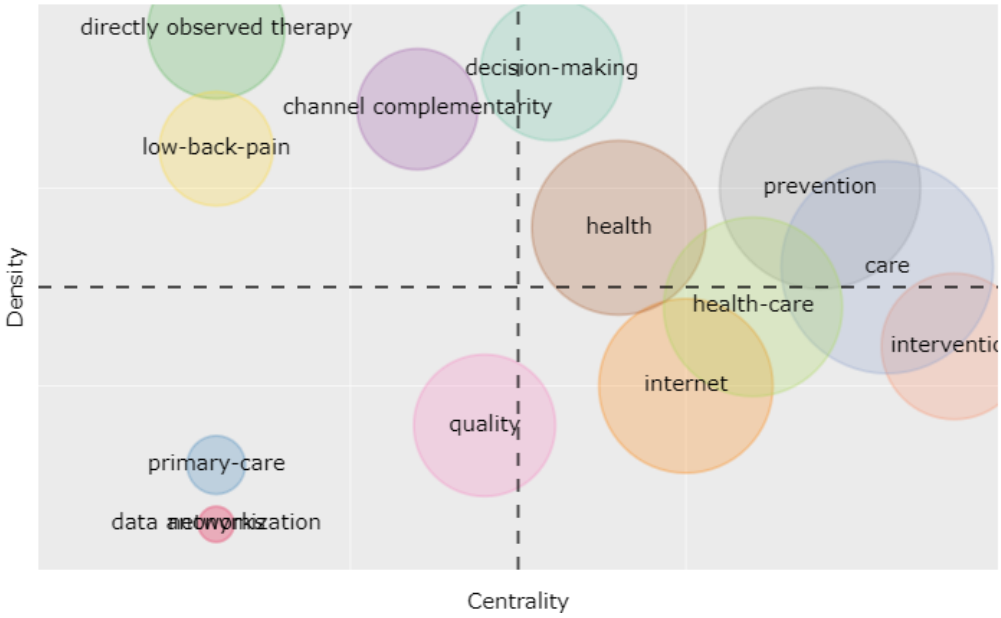


Figure 2.13: Thematic map of the period 2014-2017.

The first period (Figure 2.13) saw the emergence of thirteen major themes. *Internet* emerges as a common theme in the lower-right quadrant that is directly related to the enhancement of *healthcare* and *care* in patient participation. Although it occurs considerably less frequently, eHealth-related quality can be seen in this quadrant. When this theme's works are analysed, it becomes clear how internet *interventions* in healthcare have improved patient care more than other methods. The eHealth experiences that incorporate this technology are described by the theme of preventative measures, decision-making with health has the most impact, which initially appeared in the upper right quadrant with a high density but low centrality, implying that the topic has been comprehensively investigated throughout this time frame but is a very specialized and secluded theme.

Finally, in the left quadrant, where the upper one with themes observed directly with therapy and low back pain, after an opinion expressed by both search terms in this duration, we can summarize that the authors appeared to have employed both terms as the other way around, dependent on each other. The other word *channel* complementary uses here mentions the traditional methods of providing healthcare services by medical professionals are being changed as a result of e-Health, with the goals of rationalizing costs and increasing patient

happiness. In the lower left quadrant, *primary care* and *data synchronization* symbolize the primary care of the patient and the processes needed to ensure exchange and access to EHR data which is an effective tool for data synchronization. This quadrant mainly deals with themes that are not highly developed or needs a certain time to develop.

Table 2.5: The most cited publications and references in the period 2014-2017

Most cited publications
Ven Venkatesh, V et al., (2016). Combating Infant Mortality in Rural India.
Chetty, G., & Yamin, M. (2015). Intelligent human activity recognition scheme for eHealth applications.
Kodali, R. K., et al., (2015). An implementation of IoT for healthcare.
Bhunia, S. S et al., (2014). iHealth: A fuzzy approach for provisioning intelligent health-care system in smart city.
Plageras, A. P.et al., (2017). Efficient large-scale medical data (eHealth big data) analytics in internet of things.
Most cited references
Mukherjee, N et al., (2016). Virtual Sensors in Remote Healthcare Delivery: Some Case Studies.
Plageras, A. P et al., (2017). Efficient large-scale medical data (eHealth big data) analytics in internet of things.
Jarosławski, S., & Saberwal, G. (2014). In eHealth in India today, the nature of work, the challenges, and the finances: an interview-based study.
Luna, D et al., (2014). Health Informatics in Developing Countries: Going beyond Pilot Practices to Sustainable Implementations: A Review of the Current Challenges.
Islam, S. R et al., (2015). The internet of things for health care: a comprehensive survey.

TABLE 2.5 displays the five most cited papers and references published during this period. One of the most cited documents published during this time frame is related to the common

framework of eHealth. The first publication explains the situation of rural India in dealing with infant mortality(Venkatesh et al., 2016), and the rest of them discuss the uses of Information technology in healthcare through different modes such as human activity recognition scheme, advancement of intelligence computational systems(Kodali et al., 2015), making of smart city (Bhunia et al., 2014b)and then using of eHealth data in IoT (Plageras et al., 2017).

The references cited as highly influential in shaping knowledge during this period include two articles elucidating the functioning of virtual sensors in remote healthcare(Mukherjee et al., 2016) and how eHealth big data in IoT(Plageras et al., 2017) being the second highest in the references and lowest in the most cited publication, and the third references of the publication describe eHealth in India today describing its challenges (Jarosławski & Saberwal, 2014), respectively, and, two providing knowledge about using health informatics and IoT as healthcare tools(Luna et al., 2014) (Riazul Islam et al., 2015).

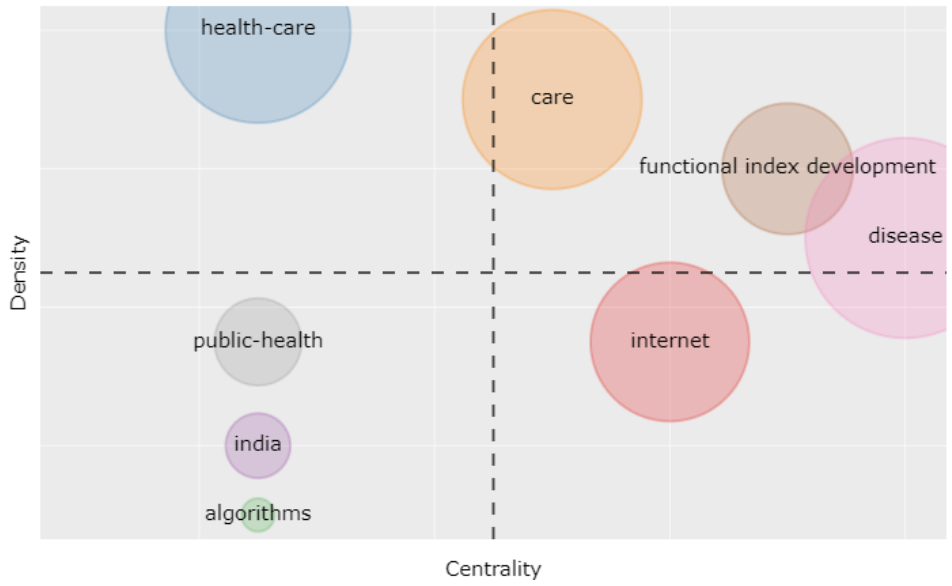


Figure 2.14: Thematic map of the period 2018-2021.

In the following period (Figure 2.14), eHealth research oscillated on eight themes of research in India. According, to the upper-right quadrant it can be seen that the keywords *care, functional index development and disease* are interrelated and have high centrality. And the second part lower right quadrant, the keywords *internet* have numerous connections with other themes but are not fully developed due to no interconnections within the quadrant. The other part of the strategic map left quadrant in which the upper part consists of only the *healthcare*

in which the published work has been done. The lower part consists of *public health, India, and algorithms,* in which public health is been shown as the more known field than others, and algorithms have been the lesser-known and most underdeveloped field during this duration.

Table 2.6: The most cited publications and references in the period 2018-2021.

Most cited publications
Rajak, M., & Shaw, K. (2019). Evaluation and selection of mobile health (mHealth) applications using AHP and fuzzy TOPSIS.
Chhabra, H. S et al., (2018). Smartphone app in self-management of chronic low back pain: a randomized controlled trial.
Patan, R et al., (2020). Smart healthcare and quality of service in IoT using grey filter convolutional based cyber-physical system.
Magsamen-Conrad, K et al., (2020). Using technology adoption theory and a lifespan approach to develop a theoretical framework for eHealth literacy: extending UTAUT.
Gupta, S., et al (2020). Role of self-care in COVID-19 pandemic for people living with comorbidities of diabetes and hypertension.
Most cited references
Chellaiyan, V. G., et al., (2019). Telemedicine in India: Where do we stand?.
Escriva-Boulley, G., et al., Social Representations of Digital Health Technology in different contexts: Why People Keep or Quit Using It?
Farahani, B., et al., (2018). Towards fog-driven IoT eHealth: Promises and challenges of IoT in medicine and healthcare.
Gupta, A., et al., (2021). Handling Errors in eHealth Sensors Using Interval Mapping and Fuzzy Modeling.
Long, L. et al., (2018). Digital technologies for health workforce development in low- and middle-income countries: a scoping review.

TABLE 2.6 displays the five most cited publications and also the references published during this time frame. Again, the most-cited documents compiled during this time frame are related to the broad topic of *eHealth*. The three publication deals with the mHealth application and its

uses to manage chronic low back pain, diabetes, and hypertension (Chhabra et al., 2018; Rajak & Shaw, 2019)(S. Gupta et al., 2020), the rest two publications deal with developing of eHealth literacy and smart healthcare in India (Patan et al., 2020)

The top-5 most cited references list presents in topmost what is the present position of telemedicine in India(Ganapathy & Ravindra, 2009), the second highest deals with the context of cancer in digital health technology, and the rest two examine the eHealth in IoT and handling sensors(Farahani et al., 2018) (A. Gupta & Mukherjee, 2020). Only the publication by (Long et al., 2018), disclaim the list of top five highly cited references in this time frame implies the digital technologies implemented in lower and middle-income countries.

THEME-BASED LITERATURE REVIEW

The shortlisted articles have been reviewed in detail and have been grouped based on the patters or themes on which studies have been conducted on the main topic of implementation of eHealth in India. We have looked related issues on the basis of definitions of abstract terms, methodologies, agreements and disagreements, different findings or approaches, statements or concepts, which helped us to understand what each of these contributes to the conversation. We then broke up the sources by the identified themes and rearranged them according to the learnings from each on the themes. In order to understand the process of literature review, let us imagine a series of buckets, each representing a theme, into which we are sorting each article's contributions to the understanding of the topic and what is known or needs further exploration. It is noted that not every article contributed to every theme and some articles contributed to more than one theme. In this study, literature was gathered to address the specific research requirements within a domain, enabling citation of studies relevant to the domain. A theme-based approach was employed to search diverse sources of literature. The reviewed sources included industry reports, research papers, articles, and newspaper articles.

Theme-based systematic literature review is a methodology used to identify, analyze, and present patterns or themes within data (Braun and Clarke, 2006). This approach involves an inductive analysis, meaning that themes emerge from the data itself rather than being predetermined by the author (Ahmad and Usop, 2011). Therefore, data collection and analysis occur simultaneously (Ahmad and Usop, 2011). Thematic analysis also enables the

interpretation of various aspects of the study (Boyatzis, 1998) and facilitates the organization and detailed description of data (Braun and Clarke, 2006). In the context of the dissertation, the literature review focused on three main themes, complemented by literature on the Normalization Process Theory and the Technology Acceptance Model, which are relevant to the research topic. Through this review, key insights and gaps in the existing literature were identified, providing valuable inspiration for the current research. The literature collected from the search was then compiled and categorized based on these major themes.

THEME 1: STUDY OF eHEALTH

E-health represents an emerging field situated at the intersection of medical informatics, public health, and commerce. It encompasses health services and information delivered or enhanced via the Internet and associated technologies. In a broader context, e-health embodies "a state of mind, a way of thinking, an attitude, and a dedication to networked, global thinking to improve health care locally, regionally, and globally through the use of information and communication technology" (Eysenbach, 2001). To designate Information & Communication Technology (ICT) applications in the service of health, various definitions have been utilized over time. Around 1970, the phrase "medical informatics" was used to describe the computer processing of medical data, which was considered cutting-edge technology at the time. However, as evidenced by the incredibly rapid development of the Internet, the importance of "information processing" was quickly replaced by that of "information communication." Health applications were dubbed "health telematics" or "telemedicine" at the time and are today known as "telemedicine." “e-health".

eHealth is an absolute necessity and a big challenge for the country. To accomplish effective implementation in the healthcare setting using current communication networks, teamwork in eHealth is still a challenge. All possible players across the industry, government, research, healthcare, and other fields should synchronize their skills and efforts. Without a question, this is a Sisyphean task. But once it's done, everyone who pays taxes will benefit because everyone will have access to high-quality, reasonably priced healthcare anytime and anywhere. Indian consumers suffer as a result of ineffective procedures, greater expenses, and subpar service quality in the traditional healthcare journey through pharmacies, doctors (for consultation), and diagnostics centers. However, with the introduction of eHealth, many of the problems with conventional healthcare have been resolved through practical, effective, and

inexpensive services supported by cutting-edge technology. But with the advent of eHealth, many of the problems with conventional healthcare have been resolved through practical, effective, and affordable services supported by cutting-edge technology.

The Covid-19 outbreak provided the much-needed push that the eHealth industry needed to reach a tipping point. In India, there are over 5,295 health tech businesses, 133 of which are sponsored eHealth start-ups. By 2025, it is anticipated that the nation's eHealth market will be worth $10.6 billion. The overall addressable healthcare industry, by 2025 is projected to grow to $638 billion, and will only make up 1.6% of that total. This eloquently highlights the eHealth sector's tremendous development potential and opportunities. The eHealth sub-segment with the highest potential is telemedicine, which may have a market worth of $5.4 billion by 2025. Among the top start-ups in this category are DocTree, Practo, Lybrate, CallHealth, and DocPrime. In the upcoming years, the market is anticipated to be driven by an increase in consumer health awareness, a significant expansion of digital infrastructure, rising investor interest, and government support through initiatives like the National Digital Health Mission and the establishment of telemedicine guidelines. Briefly said, the pandemic has sped up the implementation of IT in the healthcare industry. More to it existed. During this time, several public-private partnerships (PPPs) were established to aid in the pandemic response. For instance, Practo and Thyrocare worked together to develop detection tests for new coronavirus that were authorized by the ICMR. The Karnataka government and Portea Medical, a Bengaluru-based home healthcare business, teamed up to offer a telemedicine solution to diagnose Covid-19 cases.

The eHealth sector in India has also been propelled by new trends and opportunities. These include, among other things, the development of para-telemedicine solutions, the usage of software with AI integration, the expansion of insurance coverage for remote health services, and accessibility to one-stop healthcare solutions. In the upcoming years, the eHealth industry is anticipated to expand due to rising consumer tech knowledge, a variety of eHealth models, technological developments, a rise in eHealth start-up activity, and government backing.

The complex socioeconomic dynamics of India's vast nation are reflected in its healthcare systems. Primary care physicians are in short supply in semi-urban and rural locations (Agrawal et al., 2023; Rao et al., 2011), and those who work in rural areas must

constantly update their knowledge (Syed-Abdul et al., 2011). The practice of licensed medical professionals might drastically diverge from accepted standards of care, and many of them have no formal training at all (Das et al., 2012; Venkatesh et al., 2016). Approximately 80% of the population relies on natural medicine (Gogtay et al., 2002), and a study of the Indian pharmaceutical sector concluded that just 30% of the population in India has access to modern treatment. In India, out-of-pocket expenses make up about 80% of all healthcare costs (Das and Hammer, 2007; Reddy et al., 2011), may also be exaggerated by the price of traveling, both in metropolitan and in rural locations (J. C. Bhatia, 2001). As a result, many illnesses are either left untreated or are only controlled by over-the-counter prescription drugs (Bhatia and Cleland, 2001) or by faith healers. Because of this, 70% of people, especially those in rural areas, have inadequate access to quality medical care. Last but not least, epidemiological data are frequently unavailable or unreliable (Jha et al., 2005), making it challenging to establish preventive health programs with knowledge(Sikandar et al., 2021). According to experiences from other developing nations (Lewis et al., 2012) and references therein, (Piette et al., 2012), By easing access to excellent medical care and health information and by raising the bar for health-related data, ICT utilized in the context of healthcare (eHealth) can advance each of these objectives (Patan et al., 2020; Reddy et al., 2011).

THEME 2: STUDY OF BARRIERS IN eHEALTH

The challenges influencing the adoption of eHealth in India, as identified from prior research, have been consolidated into thirty-seven distinct issues, as presented in Table 2.7. These challenges have been categorized into eight main groups: customer-related, regulatory, technical, organizational, practitioner-related, marketing, administrative, and economic challenges. Each of these categories, along with their respective sub-factors, is elaborated below:

Table 2.7: Different barriers and their sub-barriers

Barriers	Sub-barriers	References
Customer related Barrier (CRB)	CRB1: Health consciousness CRB2: Literacy in eHealth CRB3: Lack of motivational value for elderly people CRB4: Unclear benefits CRB5: Learning new technology CRB5: Lack of trust/Confidence CRB6: Less knowledge of health experts CRB7: Cultural ethical challenge	Cho et al, 2014 pack et al. 2012 Botella et al. 2009 Ehrishman et al, 2015Gour et al, 2010
Regulatory Barrier (RB)	RB1: Lack of standard for implementation RB2: Lack of Federal laws RB3: Lack of Guidelines	Ross et al, 2016 Fisher et al, 2004 Ajax et al, 2013
Technical Barrier (TB)	TB1: Lack of system feedback TB2: Health app use efficacy TB3: Security issues TB4: Lack of technical support TB5: Privacy issue TB6: Lack of internet connectivity TB7: Lack of medical equipment's	Chenthra et al, 2019Alkhadi et al, 2014 Harrison et al, 2006Kaur et al, 2006

Organisational barrier (OB)	OB1: Lack of strategic planning OB2: Unethical malpractice OB3: Lack of management of implementation OB4: Structural misfit OB5: Lack of insurance coverage and reimbursement	Natarajan et al, 2010Gunjan et al, 2017 Alkhadi et al, 2014
Practitioners barrier (PB)	PB1: Lack of proper training/education of health practitioners PB2: Resistance of rural practitioners (fear of losing patients) PB3: Licensing issue PB4: Lack of faith on technology effectiveness	Anderson et al, 2007 Gour et al, 2010 Rutledge et al, 2017 Ehrishman et al, 2017
Marketing Barriers (MB)	MB1: Promotion MB2: Customer engagement MB3: Customer loyalty	Rao et al, 2016 Jaroslawski et al, 2014
Administrative barriers (AB)	AB1: Inflexible system AB2: Employee resistance AB3: Lack of training of health care workers AB4: Lack of technical staff	Hill et al, 2009 Rutledge et al, 2017
Economic barriers (EB)	EB1: Equipment cost EB2: Software cost EB3: Staff training cost	Simoens, S. (2009)

Customer related barriers (CRB)

Health-conscious individuals devote more time to exercise, engage in healthy activities, and actively seek health-related information from various sources (Dutta-Bergman, 2004). However, they may lack trust in eHealth due to various obstacles in accessing information. Improved accessibility and comprehension of online health information are associated with increased likelihood of utilizing electronic sources for health purposes (Basu and Dutta, 2008). Adoption of eHealth faces challenges when healthcare professionals lack sufficient knowledge about eHealth literacy. Additionally, barriers exist concerning senior individuals' access to healthcare services, particularly those that enable patients to receive care at home. Despite the promise of telemedicine technology, its actual implementation presents difficulties (Norman and Skinner, 2006).

eHealth refers to the use of technology to improve health and healthcare services. However, one obstacle to its adoption is the need for individuals to learn how to use new technology effectively, which requires them to understand the benefits it offers (Mehtab, 2019). Complicated guidelines, often filled with irrelevant information, can also hinder the adoption of eHealth. While eHealth tools have the potential to assist with managing diseases, their usefulness for individuals with multiple chronic conditions is uncertain (Ehrismann and Stegwee, 2015).

Security is a major concern in eHealth services, with many researchers highlighting the risk of data breaches and hacking as barriers to adoption (McKnight et al., 2002; Gour and Srivastava, 2010). Without robust security measures, patients' sensitive medical information could be compromised. Healthcare professionals' attitudes toward technology also play a significant role in its acceptance. Studies show that clinicians often focus on barriers such as resource limitations, financial incentives, interoperability issues, and regulatory concerns about confidentiality and privacy (Anderson, 2007). Additionally, cultural and ethical challenges, especially regarding customer-related factors, pose barriers to eHealth adoption in India (Jokinen et al., 2021; Ross et al., 2016).

Regulatory barriers (RB)

One of the prominent regulatory obstacles in India is the absence of standardized guidelines for e-health implementation (Fleisher and Dechene, 2004). This discrepancy between the use

of eHealth and its practical application complicates the planning and execution of eHealth initiatives. The absence of comprehensive and coherent regulatory frameworks results in scattered and ambiguous legal and regulatory landscapes governing eHealth (Ajami and Arab-Chadegani, 2013).

In India, there is a notable scarcity of legal scholarship specifically focused on eHealth. The broad scope of eHealth, encompassing various economic models, poses challenges for comprehensive governance. The absence of clear government policies and legal regulations hinders the development and implementation of effective eHealth strategies, representing a significant impediment (Ajami and Arab-Chadegani, 2013). Moreover, the absence of national information standards and code sets, coupled with inadequate funding, physician concerns, and interoperability issues, exacerbates the challenges linked with eHealth integration (Kao and Liebovitz, 2017). These regulatory obstacles collectively impede the efficient implementation and adoption of eHealth solutions in India.

Technical barriers (TB)

Addressing the technical challenges of eHealth implementation is crucial for its successful adoption. One significant technical obstacle is the presence of gaps in system feedback, which hinders demand-driven health information exchange (Parmanto et al., 2013). Despite these challenges, studies demonstrate that well-designed eHealth applications have the potential to empower patients, enhance medication adherence, and reduce healthcare costs (Zhou et al., 2019). However, the adoption and sustained use of eHealth apps face hurdles, as evidenced by the decline in the downloading rate of mHealth apps in recent years (Natarajan, 2010). Factors contributing to app abandonment include hidden fees, high data entry requirements, loss of interest, and concerns about security and privacy (Harrison and Lee, 2006). Additionally, disparities in digital literacy and access contribute to a lack of technical support and hinder widespread adoption (Kaur and Gupta, 2006).

Moreover, bandwidth limitations pose a significant technological challenge, particularly for real-time healthcare claims-processing companies that rely heavily on data-intensive operations (Gunjan and Dasgupta, 2017). In India, infrastructure issues, such as limited internet connectivity and inadequate medical equipment, further compound the challenges faced in

implementing eHealth solutions (Alkhaldi et al., 2014). Addressing these technical hurdles is imperative to ensure the effective deployment and utilization of eHealth services in the country.

Organizational barriers (OB)

To enhance patient engagement, organizations must prioritize strategic planning to ensure effective implementation of eHealth solutions (Kaur and Gupta, 2006). Ethical considerations should be paramount, and any unethical behavior must be unequivocally condemned. Additionally, fair procedures should be established to promote transparency and accountability within the organization. Workflow disruptions can significantly hinder the adoption and effectiveness of eHealth systems. To mitigate these disruptions, it is essential to incorporate workflow analysis into system design and integration processes. This involves aligning eHealth systems with existing care processes, adopting user-friendly technologies, and minimizing interruptions during system installation (Gunjan and Dasgupta, 2017). By addressing these factors, organizations can optimize workflow efficiency and promote greater engagement among both patients and healthcare providers.

Inadequate implementation management can also lead to shifts in established professional roles, responsibilities, and work methodologies (Alkhaldi et al., 2014). Ensuring project quality management during implementation (Boonstra and Broekhuis, 2010), offering advanced training (Lluch, 2010), adapting technologies to integrate roles, activities, and workflow processes, and employing dedicated technical staff are crucial for mitigating barriers related to disruptions in work processes, functions, and responsibilities that may arise from eHealth implementation. Additionally, the absence of a financial structure, such as insurance or a social security agency, is another significant reason for eHealth barriers (Prinja et al., 2012).

Practitioner ‘s barriers (PB)

Most medical practitioners are currently untrained in the use of modern telecommunications technology and hence are unaware of the legal, ethical, and practical implications of doing so (Dignum, 2018). Rural practitioners are more familiar with the new technology; they are less likely to endorse it. They are afraid of losing patients because a rural patient can obtain care from a city doctor who seems to be a considerable distance (Hardavella et al., 2017). A doctor or institution is required by law to seek a license before doing anything with a patient’s data.

The ultimate impediment is trust in technology's efficacy Ehrismann and Stegwee, 2015). Many healthcare providers lack knowledge about essential data security practices, such as securely deleting patient files from computer hard drives or encrypting email messages to protect patient privacy. Although federal standards for safeguarding medical information during transfer are under development, the legal protections for both patients and healthcare practitioners remain uncertain (Fleisher and Dechene, 2004). This lack of clarity regarding data protection standards and legal regulations poses significant challenges to ensuring the privacy and security of patient information in eHealth systems.

Marketing barriers (MB)

In the medium-to-long term, eHealth has the potential to revolutionize healthcare by shifting the focus towards preventive measures aimed at improving quality of life and reducing healthcare costs, rather than solely providing services for treating illnesses (Kumar and Preeth, 2012). This proactive approach to healthcare can also contribute to increased productivity in various sectors of society. However, achieving this goal requires active involvement and education of individuals about preventive measures to mitigate the risk of outbreaks such as H1N1 or seasonal infections. One significant challenge hindering the adoption of eHealth is the lack of effective promotion strategies.

In consumer marketing, websites are commonly utilized to disseminate organizational information. Similarly, in healthcare, eHealth platforms can enhance efficiency by streamlining processes, reducing duplication of diagnostic or therapeutic interventions, and facilitating improved communication among healthcare stakeholders and patient engagement. This efficiency not only leads to cost savings but also enhances overall quality of care. Moreover, eHealth enables the integration of patients as additional agents for quality control, thereby enhancing healthcare quality (Rao et al., 2016; Jarosławski and Saberwal, 2014). By leveraging the accessibility of clinical data through the Internet, eHealth initiatives can foster a transition from customer engagement to customer loyalty, thereby enhancing the overall healthcare experience for patients.

Administrative barriers (AB)

To ensure effective governance of the healthcare system, both federal and state governments should play a role in its regulation and oversight. Clear delineation of control, responsibility, incentives, and risks is essential to prevent any conflicts of interest. In India, there is a concerted effort to promote e-health programs, both domestically and in collaboration with international partners. Many state governments are taking proactive steps to address infrastructural challenges and create a conducive environment for the establishment of new healthcare facilities to facilitate cross-border healthcare trade.

Despite these efforts, the implementation of eHealth initiatives often faces resistance from employees within organizations (Sahoo et al., 2012). Resistance to organizational change is natural and understanding the reasons behind it is crucial for managers to address them effectively. Merely having technological infrastructure in place is not sufficient for the success of eHealth initiatives. It is equally important to ensure that the technology interfaces are user-friendly, easily accessible, and staffed by well-trained personnel (Safi and Thiessen, 2018). Proper recruitment and training of personnel are essential to ensure that they can effectively utilize technology to deliver healthcare services, especially in remote areas (Kohl, 2018; Rutledge et al., 2017).

Economic barriers (EB)

Economic barriers, such as the costs associated with equipment, software, and staff training, contribute to the lower adoption of eHealth in India (Simoens, 2009). Unlike the pharmaceutical industry, the medical device industry lacks robust mechanisms for assessing resource utilization and pricing, hindering efficient allocation of resources (Barber et al., 2019). There is a need for more rigorous assessment mechanisms for medical equipment and software to address this issue. Additionally, there is a lack of computer-aided education in medical and nursing fields.

Ontology concerns the nature of truth, while epistemology explores how we understand the world, and strategy addresses how we gather information within the context of reality's nature (GUIDANCE, 2009). Analytic Hierarchy Process (AHP) is a Multi-Criteria Decision-Making (MCDM) approach that incorporates both quantitative and subjective perspectives to characterize comparative positions and conduct comparative analyses to rank various factors

(Cheng and Li, 2002). AHP is suitable for practical scenarios as it accommodates fuzziness and variability in judgment.

THEME 3: STUDY OF CUSTOMER ENGAGEMENT BARRIERS IN eHEALTH

Various studies have confirmed the multidimensionality of customer engagement (Brodie et al., 2011; Dessart, Veloutsou, and Morgan-Thomas, 2016). Dessart et al. (2016) conducted comprehensive research on consumer engagement studies in marketing, revealing diverse approaches to its conceptualization. While some researchers focus on a single dimension, often emotional, behavioral, or motivational, contemporary literature predominantly adopts a multidimensional perspective, recognizing behavioral, affective/emotional, and cognitive dimensions (Brodie et al., 2011; Dessart et al., 2016). Some studies also incorporate a social dimension (Vivek et al., 2012). However, there is still no consensus on the optimal representation of engagement or the precise meaning of its dimensions (Dessart et al., 2016, p. 402).

Behavioural customer engagement

It refers to the process of actively interacting with customers based on their actions, behaviours, preferences, and needs. Behavioral customer engagement in the context of electronic health barriers refers to the use of strategies and technologies to address obstacles or challenges that individuals may face in accessing or utilizing electronic health services. Here's how behavioral customer engagement constraints are related to the barriers identified for electronic health:

1. **Personalization:** Electronic health barriers can include issues such as lack of understanding of how to use health technologies, concerns about privacy and security, or difficulty navigating complex interfaces (Archer, 2020). Behavioral customer engagement approaches can tailor interactions and support to address these specific barriers. For example, personalized tutorials or guided walkthroughs can help individuals overcome usability challenges, while targeted communication can address concerns about privacy and security.
2. **Proactive communication:** Behavioral customer engagement involves reaching out to individuals based on their actions and behaviors. In the context of electronic health

barriers, proactive communication can be used to provide timely support and assistance (Braunstein, 2019). For instance, automated reminders or prompts can encourage individuals to complete tasks such as scheduling appointments or refilling prescriptions, reducing the likelihood of forgetting or procrastinating due to barriers such as forgetfulness or procrastination.

3. **Feedback loop:** Continuous feedback is essential for identifying and addressing barriers to electronic health engagement (Cortez, 2018). Behavioral customer engagement strategies can include mechanisms for soliciting feedback from users about their experiences with health technologies, such as surveys or feedback forms. This feedback can then be used to identify common barriers and inform improvements to the design and functionality of electronic health systems.
4. **Omnichannel presence:** Electronic health barriers can vary depending on factors such as age, technological literacy, and access to resources. Behavioral customer engagement approaches should consider these differences and ensure that support is available across multiple channels and platforms (Gao et al., 2019). For example, providing telephone support alongside online resources can help individuals who may be less comfortable or familiar with using digital technologies.
5. **Value-driven interactions:** To encourage adoption and sustained use of electronic health services, it's important to demonstrate the value and benefits of these technologies to users (Mohamed, 2017). Behavioral customer engagement strategies can emphasize the positive outcomes that individuals can achieve through engagement with electronic health services, such as improved health outcomes, greater convenience, or better access to care.

By applying principles of behavioral customer engagement, healthcare organizations can better understand and address the barriers that individuals face in accessing and utilizing electronic health services, ultimately improving engagement, satisfaction, and health outcomes for patients.

Cognitive customer engagement

It refers to the use of cognitive computing technologies, such as artificial intelligence (AI) and machine learning, to interact with customers in a more intelligent, personalized, and proactive

manner. It involves leveraging advanced algorithms to understand customer behavior, preferences, and needs, and then using this insight to deliver tailored experiences and support across various touchpoints.

1. **Personalized Support:** Cognitive computing technologies can analyze individual patient data, including health records, preferences, and behavior patterns, to deliver personalized support and recommendations (Luo et al., 2020). For example, a cognitive virtual assistant can help patients navigate complex healthcare systems by providing tailored guidance based on their specific needs and circumstances, thus overcoming barriers related to lack of understanding or confusion.
2. **Proactive Communication:** Cognitive customer engagement can enable proactive communication with patients to address potential barriers before they arise (Bickmore et al., 2018). For instance, automated reminders and alerts can help patients stay on track with their treatment plans, appointments, and medication schedules, reducing the risk of non-adherence due to forgetfulness or lack of awareness.
3. **Intelligent Decision Support:** Cognitive computing technologies can assist healthcare providers in making more informed decisions by analyzing vast amounts of patient data and medical literature to identify the most effective treatments and interventions (Kulikowski et al., 2014). This can help overcome barriers related to uncertainty or lack of expertise, ultimately improving the quality of care delivered to patients.
4. **Behavioral Insights:** Cognitive customer engagement can provide valuable insights into patient behavior and preferences, helping healthcare organizations better understand and address barriers to engagement (Mann et al., 2019). For example, analytics tools can identify patterns of non-adherence or gaps in care, allowing providers to intervene proactively and offer targeted support to at-risk patients.
5. **Natural Language Interaction:** Cognitive computing technologies, such as natural language processing (NLP) and chatbots, can facilitate more intuitive and accessible interactions with healthcare systems (Laranjo et al., 2018). Patients can ask questions, report symptoms, or request assistance using natural language, making it easier to overcome barriers related to technological literacy or language barriers.
6. **Continuous Learning and Improvement:** Cognitive systems can continuously learn and adapt based on user interactions and feedback (Halamka et al., 2018), enabling healthcare organizations to refine their engagement strategies over time. This iterative

process helps overcome barriers by ensuring that systems remain relevant and effective in addressing the evolving needs of patients.

By harnessing the power of cognitive customer engagement, healthcare organizations can mitigate electronic health barriers, improve patient engagement and outcomes, and ultimately enhance the delivery of healthcare services in a rapidly evolving digital landscape.

Emotional customer engagement

It refers to the establishment of a strong emotional connection between a customer and a brand, product, or service. It involves creating positive emotional experiences and interactions that resonate with customers on a deeper level, fostering loyalty, trust, and advocacy. Emotional customer engagement in the context of electronic health barriers involves leveraging emotional connections to overcome obstacles and enhance the adoption and utilization of electronic health services. Here's how emotional customer engagement can be related to addressing electronic health barriers:

1. **Empathy and Understanding:** Electronic health barriers such as technological complexity or privacy concerns can create frustration and anxiety for users. Emotional customer engagement involves demonstrating empathy towards these challenges and providing support that acknowledges and addresses users' emotions. For example, offering personalized assistance or guidance tailored to the user's specific concerns can help alleviate anxiety and build confidence in using electronic health services (Smith, 2001).
2. **Creating Positive Experiences:** Positive emotional experiences can help mitigate the negative perceptions associated with electronic health barriers. By designing user-friendly interfaces, providing intuitive navigation, and offering seamless experiences, healthcare providers can create positive emotional moments that make users feel valued and supported. Positive experiences can also help overcome reluctance or resistance to using electronic health services by highlighting the benefits and convenience they offer (Johnson et al., 2003).
3. **Authenticity and Trust:** Establishing trust is essential for overcoming electronic health barriers related to concerns about privacy, security, and reliability. Emotional

customer engagement involves communicating authentically and transparently about how user data is handled, ensuring that users feel confident and secure when using electronic health services. Building trust through honest communication and consistent reliability can help mitigate concerns and encourage greater adoption of electronic health technologies (Brown et al., 2019).

4. **Community and Support:** Creating a sense of community and support can help users feel less isolated when navigating electronic health barriers. Emotional customer engagement involves fostering connections between users, whether through online support groups, peer-to-peer networks, or community forums. By providing opportunities for users to share experiences, offer advice, and support one another, healthcare providers can create a supportive environment that encourages engagement and collaboration (Garcia et al., 2012).
5. **Personalization:** Tailoring interactions and support to individual user needs and preferences can enhance emotional engagement and overcome electronic health barriers. By understanding users' unique challenges and offering personalized solutions, healthcare providers can demonstrate that they care about users as individuals and are committed to helping them overcome barriers to accessing electronic health services. Personalized support can include targeted resources, recommendations, and assistance tailored to the user's specific circumstances, making the experience more relevant and meaningful (White et al., 2009).

Overall, emotional customer engagement can play a crucial role in overcoming electronic health barriers by fostering positive emotional experiences, building trust, and providing personalized support that addresses users' needs and concerns. By prioritizing emotional connections alongside functional benefits, healthcare providers can enhance the adoption and utilization of electronic health services and improve overall patient outcomes.

Social customer engagement

It refers to the interaction between a company or brand and its customers through social media platforms. Social customer engagement can play a significant role in addressing electronic health barriers by leveraging social media platforms to provide support, information, and resources to individuals facing challenges in accessing or utilizing electronic health services. Here's how social customer engagement can be related to overcoming electronic health barriers:

1. **Community Support and Empowerment:** Social media platforms can serve as hubs for communities of individuals facing similar health challenges or navigating similar electronic health barriers. By fostering a supportive online community, healthcare organizations can empower individuals to share experiences, offer advice, and provide emotional support to one another, helping to overcome feelings of isolation or confusion associated with electronic health barriers (Huh et al., 2014).
2. **Education and Awareness:** Social media provides a powerful platform for disseminating information and raising awareness about electronic health services and resources available to address specific health needs or conditions. By sharing educational content, infographics, videos, and other resources, healthcare organizations can help individuals better understand how to access and utilize electronic health services, thereby reducing barriers related to lack of awareness or understanding (Moorhead et al., 2013).
3. **Responsive Customer Support:** Social media channels offer convenient channels for individuals to reach out for support or assistance with electronic health services. Healthcare organizations can provide responsive customer support through social media platforms, addressing inquiries, troubleshooting issues, and providing guidance in real-time. This can help overcome barriers related to technical difficulties, confusion, or frustration with using electronic health platforms (Vayena et al., 2015).
4. **Peer Support and Guidance:** Social customer engagement allows individuals to connect with peers who have successfully navigated electronic health barriers or overcome similar challenges. By facilitating peer-to-peer interactions and knowledge-sharing, healthcare organizations can provide valuable insights, tips, and advice to help individuals overcome obstacles and feel more confident in using electronic health services (Househ et al., 2014).
5. **Feedback and Improvement:** Social media provides a valuable feedback mechanism for healthcare organizations to gather insights into the electronic health barriers individuals are facing and identify opportunities for improvement. By actively listening to feedback, addressing concerns, and implementing changes based on user input, healthcare organizations can enhance the usability, accessibility, and effectiveness of electronic health services, ultimately reducing barriers to adoption and utilization (Gibbons et al., 2016).

Overall, social customer engagement can be a powerful tool for addressing electronic health barriers by providing support, education, community, and feedback mechanisms that empower individuals to overcome obstacles and access the care and resources they need effectively. By leveraging social media platforms to engage with individuals facing electronic health barriers, healthcare organizations can improve access to care, enhance the patient experience, and drive positive health outcomes.

eHealth applications have garnered significant attention from various stakeholders, including patients, providers, insurance companies, and researchers. These applications offer numerous benefits, such as improved decision-making, chronic disease management, and enhanced patient/provider communication (Varshney et al., 2014). However, despite these advantages, eHealth applications face challenges, with customer engagement being a prominent concern. Many users give up on new apps within seconds due to usability issues, highlighting the importance of improving user engagement and retention strategies. Understanding consumer engagement in healthcare can be complex, with varying definitions focusing on addressing patients' needs and preferences at individual, organizational, and policy levels.

The widespread adoption of health applications has raised expectations for user-friendly and intuitive interfaces (Dameff and Clay, 2019). However, not all applications meet these expectations. Assessments using models like Nielsen's highlight concerns regarding learnability, satisfaction, and efficiency. As technology in healthcare continues to evolve, it's crucial to address challenges faced by demographic groups unfamiliar with new technologies or unable to use eHealth apps. To address barriers to customer engagement, this study categorizes them into five categories: involvement, interaction, intimacy, experience, and satisfaction. These categories are further broken down into thirty specific barriers, providing insight into how each interacts with the others (Table 2.8).

Table 2.8: List of customer engagement barriers and sub-barriers to the adoption of e-health in India.

Factors	Sub -factors	References
Customer Involvement **(CIB)**	Less activity Time (CIB1) Less Page Visit Frequency (CIB2) Lack of Communication involvement (CIB3) Lack of Personal factors (CIB4) Lack of Object factors (CIB5) Lack of Situational factors (CIB6)	(Hage et al., 2013) (Arcury et al., 2020) (van Limburg et al., 2011) (Huba & Zhang, 2012) (Martela & Steger, 2016) (Alsoufi et al., 2020)
Customer Interaction **(CINB)**	Lack of Patient appreciation **(CINB1)** Lack of Address concerns **(CINB2)** Lack of resolving issue **(CINB3)** Lack of Customer support (CINB4) Availability of inimical website **(CINB5)** Lack of customer empowerment **(CINB6)**	(Anshari & Almunawar, 2012) (Füller et al., 2010) (Crawford & Serhal, 2020) (Lunn et al., 2019) (Hepziba & John, 2020) (Anshari et al., 2013)
Customer Intimacy **(CINTB)**	Lack of Adaptability **(CINTB1)** Lack of Customer centric policies **(CINTB2)** Patient training **(CINTB3)** Word-of-mouth sentiment **(CINTB4)** Lack of Customer churn **(CINTB5)**	(Phares et al., 2021) (Terho et al., 2022) (Pustokhina et al., 2020) (Sashi & Brynildsen, 2022) (V. Agarwal et al., 2022)
Customer Experience **(CEB)**	Lack of Engagement Channels **(CEB1)** Need of Product Portfolio **(CEB2)** Shortfall in Usage Patterns **(CEB3)**	(Lee et al., 2019) (J. Zhang & Qi, 2021) (Dwivedi et al., 2016) (Salminen et al., 2022)

	Deficit of Customers Personas **(CEB4)** Lack of commitment **(CEB5)** Inconvenient access to support **(CEB6)** Low first call resolution rate **(CEB7)**	(Smith & Magnani, 2019) (Sezgin et al., 2020) (Valsecchi et al., 2012)
Customer Satisfaction **(CSB)**	Reliability **(CSB1)** Lack of Responsiveness **(CSB2)** Courteous towards patient **(CSB3)** Lack of Security **(CSB4)** Accessibility **(CSB5)** Absence of Credibility **(CSB6)**	(Ali et al., 2021) (Łukasik & Porębska, 2022) (Sreejesh et al., 2022) (Bellekens et al., 2016) (R. Bhatia & Taneja, 2018) (R. Bhatia & Taneja, 2019)

Customer Involvement Barrier (CIB)-

Customer involvement is described as a subjective psychological state describing a customer's personal relevance and significance of a product/service (Zaichkowsky, 1985). Health technologies can help people feel less of the effects of this lockdown by enabling them to communicate with their healthcare providers remotely at any time and from any location, which cuts down on activity time. We can now check our symptoms, communicate with doctors, and do a lot more (Hage et al., 2013). It is a barrier to older generations having no access to mobile devices and internet (Arcury et al., 2020). Firstly, in order to provide a fantastic digital involvement phase, the eHealth website or apps must be able to communicate with users and understand their intentions or purposes when they visit (van Gemert-Pijnen et al., 2011) . Secondly, when it comes to personal involvement, what is the need or particular illness that would cause patients to prefer online doctor visits over in-person ones? (Huba & Zhang, 2012). Thirdly, objective factors, are they looking for alternatives or without any intention of using it,

or are they looking for inspiration? (Martela & Steger, 2016). Last but not least, situational factors such as particular circumstances may make patients more in need of engaging with doctors virtually may be due to a pandemic (Alsoufi et al., 2020). These insights can be used to develop an effective digital customer involvement strategy that improves frequent customer engagement and journeys while tackling common issues.

Customer Interaction Barrier (CINB)-

A customer interaction is a two-way conversation between a company and a customer (Gruner & Homburg, 2000; Anshari & Almunawar, 2012). Turning negative experiences into positive ones and maintaining strengthening customer relationships can be accomplished by reaching out to these customers and showing them that you appreciate them in order to fix the issue (Füller et al., 2010). It's crucial to listen to customers' concerns and understand their behaviours and preferences in order to satisfactorily address and resolve their problems (Crawford & Serhal, 2020). However, gathering customer data alone is insufficient. Therefore, customer service should be more helpful to patients by empathetically facilitating interactions and avoiding scripted or inattentive speech (Lunn et al., 2019). It's also essential to make it simple and easy for customers to use digital touchpoints and navigate them (Hepziba & John, 2020). In the realm of e-health, empowerment refers to patients' enhanced ability to access their medical information through information communication technology (ICT). Empowered patients are empowered to actively engage in healthcare management and decision-making processes (Anshari et al., 2013).

Customer Intimacy Barrier (CINTB)-

Customer intimacy is a more innovative form of customer-centric business that entails learning every bit feasible regarding the customers, whether as individuals or as small segments of the industry and addressing their particular needs with the ultimate objective of improving patient acquisition, clinical outcomes and retention (Kai-Uwe Brock & Yu Zhou, 2012). Developing customer intimacy in eHealth-care necessitates a potent interaction between patients and providers, as well as a healthy two-way communication channel to better explain customer requirements and drive loyalty (Martens et al., 2019). Lack of adaptability happens due to narrow knowledge of activities associated, so for better implementation customer-centric policies and sufficient patient training will inevitably gain to engage people in the right way

(Phares et al., 2021; Terho et al., 2022 ;Pustokhina et al., 2020). Inspite of these two implementations which increases engagement of customers is a positive word-of-mouth (WOM) which works as a potent marketing tool (Sashi & Brynildsen, 2022). Nowadays, the ability to predict user churn in the sector of electronic health care is crucial for increasing user health as well as business revenue (V. Agarwal et al., 2022). A business is more inclined to take precautionary measures to retain those patients as clients if it can identify the clients who are the most likely to leave.

Customer Experience Barrier (CEB)-

Customer experience encompasses every aspect of a business's product or service, including customer service, advertising, ease of use, and reliability (Meyer & Schwager, 2007). To enhance the efficiency and customer-friendliness of the healthcare system, industries must grasp how the eHealth customer experience operates and take appropriate steps (Cobelli & Chiarini, 2020). Customers do not perceive digital channels separately; instead, they seamlessly transition between them as part of their overall customer experience. Personalized experiences that empathise across all digital channels must be developed with an appealing product portfolio in order to enhance digital customer experiences (Lee et al., 2019 ;Zhang & Qi, 2021). Additionally, data regarding customer base that share comparable goals, needs, expectations, behaviours, and motivational factors need to be gathered with customer personas, to fail shortfall in usage patterns (Dwivedi et al., 2016 ; Salminen et al., 2022). An excellent digital customer experience must go far beyond commitment, which is the basic necessity in the customer engagement phase (Smith & Magnani, 2019). Customers expect quick delivery times and simple app installation in the digital health market (Sezgin et al., 2020). Even prescription medications should be delivered promptly, securely, and safely. Therefore, healthcare call centres need to improve if their FCR (first call resolution) rate is under 70% (Valsecchi et al., 2012).

Customer Satisfaction Barrier (CSB)-

Customer satisfaction can be defined as an indicator of how satisfied consumers have been with the services, facilities, and resources of the company (Vukmir, 2006). Both demographic factors and the standard of healthcare delivered have an impact on how satisfied consumers are with electronic healthcare services. Patient satisfaction is frequently used by e-Healthcare

providers to assess the calibre of their offerings (Verma et al., 2020). Patient doesn't differentiate between online and offline, marketing and eCommerce, owned and non-owned, what matters is trustworthy the app or process is, and they anticipate being able to follow its directions (Ali et al., 2021). According to research, the primary emotions of the customer need to be valued, respected, assisted, and empowered, no fake or wrong information should be shared so that they can feel the transparency and simplicity (Sreejesh et al., 2022; Łukasik & Porębska, 2022;Bellekens et al., 2016). It can be mentioned, accessibility and affordability are different words but in eHealth, services only becomes accessible when it is affordable (R. Bhatia & Taneja, 2018). So, for a eHealth sector to provide a better customer satisfaction they need to demonstrate that they are fair, open and don't have a hidden agenda (R. Bhatia & Taneja, 2019).

MAJOR GAPS DERIVED FROM LITERATURE REVIEW:

- There are various barriers which have been identified for the adoption of eHealth globally. But extensive research needs to be conducted to identify the potential barriers, prevent the adoption of eHealth in India.
- Studies in India have considered either digital health or m-Health as a whole, but there is not much research considering a depth study in eHealth adoption in India.
- Framework or models have concentrated more on infrastructure, technology in general, and not on engagement of customers in particular. Customer engagement barriers and its sub-barriers need to be investigated in regard to eHealth implementation in India.
- The majority of studies in the eHealth research domain are conceptual or review studies, with limited empirical research available.
- There is a scarcity of studies specifically addressing the challenges faced in the adoption of eHealth in India, along with solutions to overcome these challenges.

The chapter provides an in-depth review of literature across various themes, including theoretical premises, methods, and techniques applied in eHealth research. Through a systematic approach, the scope of each theme is outlined, and relevant studies are reviewed comprehensively. Identifying research gaps serves as a foundation for future exploration, aiming to address and fill these gaps. Beginning with an overview of electronic health, the

literature review aids in constructing a theoretical framework. Ultimately, the findings from the literature review inform the development of a model to guide future research endeavors.

THEORETICAL UNDERPINNING

Theoretical approaches play a crucial role in research efforts, whether they involve generating new theories or applying existing ones to the topic under examination. They are based on inductive and deductive reasoning derived from experience or practice, facilitating the comprehension and explanation of complex, intangible phenomena. Theory involves the development of abstract concepts that, when interconnected, can be used to conceptually explain a phenomenon in its entirety. It encompasses constructs, definitions, and propositions aimed at providing a systematic view of phenomena by establishing relationships among variables to understand or predict phenomena (Kerlinger, 1973).

Researchers utilize theory in various ways, such as formulating hypotheses and guiding data collection. It is commonly employed to aid in the description, interpretation, and understanding of intricate processes. Three types of theories—grand theory, mid-range theory, and micro-level theory—exist, each with its own specialization. Grand theories explore universal principles applicable to all operations or issues within a field, whereas mid-range theories focus on local systems, providing a more concrete theoretical foundation. Micro-level theories concentrate on the personal and particular situation (Reeves et al., 2008).

In health research, mid-range theories are frequently used to comprehend and explain complex phenomena. They can be descriptive, explanatory, or predictive. Descriptive theories categorize various parts of an event into chronological, modular, or simultaneous perspectives, often developed through qualitative and quantitative descriptive studies. Explanatory theories describe relationships between components and their interactions, often derived from correlational research. Predictive theories forecast element interactions and event outcomes, typically originating from experimental research (Peterson and Bredow, 2009).

This study primarily relies on theory to investigate and explain the factors driving consumer digital health involvement and participation. By uncovering the challenges encountered by customers, healthcare providers, and consultants in eHealth engagement and enrollment, this research adopts a descriptive theoretical approach. This approach is essential for

understanding the complexity of these initial steps within the larger implementation process, enabling the identification of crucial elements and a more user-friendly portrayal of abstract concepts. Previous research in healthcare technology usage has yielded a diverse array of theories and frameworks, providing insights into various customer-related, social, technical, and cultural factors at play (Miller et al., 1995; Berg, 1999).

NORMALIZATION PROCESS MODEL

The Normalization Process Theory (NPT) has been developed and refined over several years through extensive research and theoretical exploration across various clinical settings, predominantly focusing on the integration of new technology into medical practices (McEvoy et al., 2014). The initial iteration of NPT was known as the Normalization Process Model (NPM), which was designed to identify factors facilitating or impeding the implementation of complex interventions in practice. NPM was developed and validated through data from numerous studies, aiming to provide researchers with a conceptual framework to guide the implementation of intricate interventions (May et al., 2007). NPM consists of four key constructs that evolved through iterative analysis and the formulation of analytical propositions:

1. **Interactional Workability:** This construct examines the impact of a new intervention on individuals and their work practices. It comprises two aspects: congruence and dispositional effects.
2. **Relational Integration:** This construct elucidates how individuals communicate and establish confidence in their ability to implement the intervention. It encompasses two dimensions: accountability and trustworthiness.
3. **Skill-set Workability:** This construct refers to the set of skills possessed by individuals involved in implementing the intervention. Workability assesses how tasks related to the implementation are assigned and executed. It includes two dimensions: allocation and performance.
4. **Contextual Integration:** This construct focuses on the process through which individuals and organizations acquire and deploy the resources necessary for implementing the intervention. It involves two aspects: enactment and

realization (May and Finch, 2009).

Table 2.9: Normalization Process Model Constructs (NPM)

Interactional Workability	**Relational Integration**	**Skill-set Workability**	**Contextual Integration**
Congruence -	**Accountability-**	**Allocation -**	**Execution -**
investigates how people collaborate and collaborateto implement a novel intervention with existing resources.	People's own knowledge about the new intervention,if it's adequate, and how tobest share it with others.	Policies for distributing implementation tasks, identifying and evaluating skills to make this work possible, and reviewing what has been accomplished.	How are resources distributed to persons to carry out the intervention,who bears the costs, and how are they evaluated.
Disposal -	**Confidence -**	**Performance -**	**Realisation -**
investigates the consequences of these acts, determining whether they were shared expectations orif the intervention's aims were negotiated and accomplished over time.	external knowledge about the new intervention, such as whether it is legitimate and dependable, and how toevaluate and apply it most effectively.	How these abilities are managed and measured, aswell as the skills consumers use to organiseand implement a new intervention into their day-to-day work routines.	how to define and manage the risks connected with the new intervention, as well ashow to allocate resources to this end.

As the Normalization Process Model (NPM) began to be applied in various healthcare settings, researchers recognized its limitations. NPM primarily focuses on the intermediate stages of the implementation process, where individuals begin to engage in activities and utilize resources necessary to integrate a new intervention into their daily routines. However, NPM fails to address how healthcare professionals or patients initially comprehend and start using a new intervention. Additionally, NPM does not cover the later stages of adoption, where individuals assess the benefits and drawbacks of a new treatment that has been in use for some time, and determine whether adjustments are needed for long-term utilization.

To address these shortcomings and provide a more comprehensive analytical framework, NPM was expanded and refined over time, leading to the development of Normalization Process Theory (NPT) (Gask et al., 2010). NPT extends beyond the initial stages of implementation to encompass the entire lifecycle of a new intervention, from initial understanding and adoption to ongoing evaluation and refinement. By incorporating these additional dimensions, NPT offers a more robust and nuanced approach to understanding the normalization of innovations in healthcare contexts.

NORMALIZATION PROCESS THEORY

The Normalization Process Theory (NPT) is indeed a comprehensive framework that elucidates the various stages individuals traverse throughout the implementation process. It consists of four primary constructs: Coherence, Cognitive Participation, Collective Action, and Reflexive Monitoring. These constructs provide a systematic understanding of how new interventions become embedded and integrated into routine practices within healthcare settings (see Figure 2.15).

Figure 2.15: Four mechanisms of Normalization Process Theory (NPT)

1. **Coherence:** This construct pertains to how individuals make sense of a new intervention and understand its purpose and potential benefits. It involves the creation of shared understanding and agreement among stakeholders regarding the intervention's goals and relevance to their work.
2. **Cognitive Participation:** Cognitive Participation focuses on the engagement and commitment of individuals to actively participate in the implementation process. It involves the willingness of stakeholders to invest time, effort, and resources in incorporating the intervention into their workflow.
3. **Collective Action:** Collective Action refers to the coordinated efforts and actions undertaken by individuals and groups to enact and operationalize the new intervention. It involves the collaboration and teamwork necessary to implement the intervention effectively within the healthcare context.
4. **Reflexive Monitoring:** Reflexive Monitoring involves the ongoing evaluation and reflection on the implementation process and its outcomes. It encompasses the assessment of the intervention's impact, identification of challenges or barriers, and adjustment of strategies to optimize its integration and effectiveness.

By considering these four constructs, NPT provides a comprehensive framework for understanding the dynamics of implementation and normalization of innovations in healthcare settings. It offers insights into the factors that facilitate or hinder the successful adoption and embedding of new interventions, thereby guiding efforts to promote sustainable change and improvement in healthcare delivery.

Table 2.10: Normalization Process Theory Constructs (NPT)

Coherence	Cognitive Participation	Collective Action	Reflexive Monitoring
Differentiation - how work that has to be done to implement a new intervention is defined, divided, and classified.	Enrolment - how persons are chosen to carry out activities related to the implementation of a new intervention.	Skill-set Workability - how various responsibilities and functions are assigned and performed, and the abilities required to apply a new intervention on a regular basis.	Reconfiguration - based on their needs, how people alter or change tasks associated to a new intervention.

Communal Specification - how a person or group of people interprets shared versions of activities connected to implementing a new intervention.	Activation - how various jobs are organised and shared among various persons.	Contextual Integration - how a new initiative is supported within its environment by committing resources such as money and time to its deployment and ongoing use.	Communal Appraisal - how people evaluate whether or not a shared contribution to the work surrounding a new intervention is worthwhile.
Individual Specification - how an individual makes meaning of their own personal implementation duties.	Initiation - Individuals' organisation and planning of tasks connected to implementation.	Interactional Workability - how individuals and groups of people carry out and complete various tasks linked to the new intervention in order to accomplish the intervention's associated outcomes in practise.	Individual Appraisal - how an individual assesses and reflects on their own role in deploying and implementing a new intervention in practise.
Internalization - how individuals or groups of people learn how to carry out the work of implementing a new intervention in a given setting.	Legitimation - how individuals and groups make taking responsibility for implementing an intervention the proper thing to do.	Relational Integration - how people gain confidence in a new intervention and express their understanding of how it works in practise.	Systematization - assembling a trustworthy corpus of knowledge regarding how a new intervention was introduced and functions on a daily basis.

The Normalization Process Theory (NPT) has emerged as a valuable model in the healthcare industry, offering insights into how individuals and groups incorporate innovative products or services into their daily routines. Grounded in psychological theory, NPT helps elucidate the processes by which new interventions become integrated into everyday practices. This theory has been extensively utilized to investigate various aspects of adopting healthcare treatments, providing a framework for understanding the complexities of the implementation process (May & Finch, 2009).

In the context of this study, NPT serves as a foundational framework for examining user engagement in eHealth. By leveraging NPT, researchers can gain a deeper understanding of how new technologies are integrated into the daily lives of patients and the general public. NPT's emphasis on individual and group processes makes it particularly suitable for exploring user engagement in a community setting. Furthermore, NPT's flexibility and applicability to diverse healthcare contexts make it a valuable tool for studying the complete implementation

process of eHealth interventions. Given its direct relevance to the study's objectives and research questions, NPT was chosen as the underlying framework for analyzing user engagement in eHealth. By employing NPT, researchers can systematically investigate the factors influencing user engagement and identify strategies to promote the successful adoption and integration of eHealth technologies into everyday practice.

TAM (TECHNOLOGY ACCEPTANCE MODEL)

Electronic health has a critical role in extending out to people in need, particularly those who cannot afford basic healthcare. In order to provide a seamless experience with e-Health facilities, a lot of research has been done in the health industry (Venkatesh et al., 2007). It is critical to investigate aspects that influence the acceptability of e-Health services by both patients (customers) and medical practitioners (Doctors) for optimal e-Health utilisation (Chetley et al., 2006). As a social measure, researchers in this field have looked into a variety of models for delivering effective e-Health services in India (Chetley et al., 2006; Taylor. S et al, 2020). Providing e-Health services across the entire country in India can be difficult at times. As a result, the 'Technology Acceptance Model' was investigated to uncover factors impacting the acceptance of the e-Health model in India in order to build patient trust and comfort. The Technology Acceptance Paradigm (TAM) is a widely used model for determining "why customers accept or reject a intervention, as well as how user/customer acceptance might be grown through technology." The TAM was created in the 1989 by Fred D. Davis [Holden RJ et al.2010]. In addition, several extensions to the basic TAM have been incorporated to decrease the limits of the traditional model (Giovanis et al., 2007; Lee, 1991).

TAM2, TAM3, and the unified theory of acceptance and use of technology (UTAUT) are some of the most advanced variants of TAM that have been proposed so far (Venkatesh and Davis, 2000; Venkatesh et al., 2003; Venkatesh and Bala, 2008). In TAM2, an extension of TAM, social norm, brand, task usefulness, production efficiency, outcome trialability, and relative advantage of use are all drivers of perceived usefulness. It also mixes experience and voluntariness as moderators (Venkatesh and Davis, 2000). By combining TAM2 with a theory of predicators comfort of use through e - learning self, computer experience, computer amusement, judgments of external control, subjective enjoyment, and

objective usability, Venkatesh and Bala (2008) developed an integrated model of TAM3 (Venkatesh, 2000).

The fundamental TAM model incorporates the users' perceptions of 'perceived usefulness' and 'perceived ease of use,' which contribute to their 'intention to utilise' e-Health services (Venkatesh et al., 2007). Perceived usefulness is defined as "the amount to which a person believes that using a given technology improves one's performance," whereas perceived ease of use is defined as "the extent to which a person believes that using a specific system result in no effort or less work." TAM has thus offered a framework for understanding how a patient's "intention to use" of e-Health is translated into actual use (Wujh et al., 2007).
In addition to the criteria of 'perceived usefulness' and 'perceived ease,' the study looked into the factors of 'privacy' and 'trust' in TAM (Bagozzi, 2007). Researchers emphasised users' acceptance, doctors' attitudes, doctors' adoption, cultural and economic characteristics, communications capabilities, accompanying healthcare framework, and other elements in addition to those in the fundamental TAM model (Jung and Loria, 2010, Khan et al., 2012).

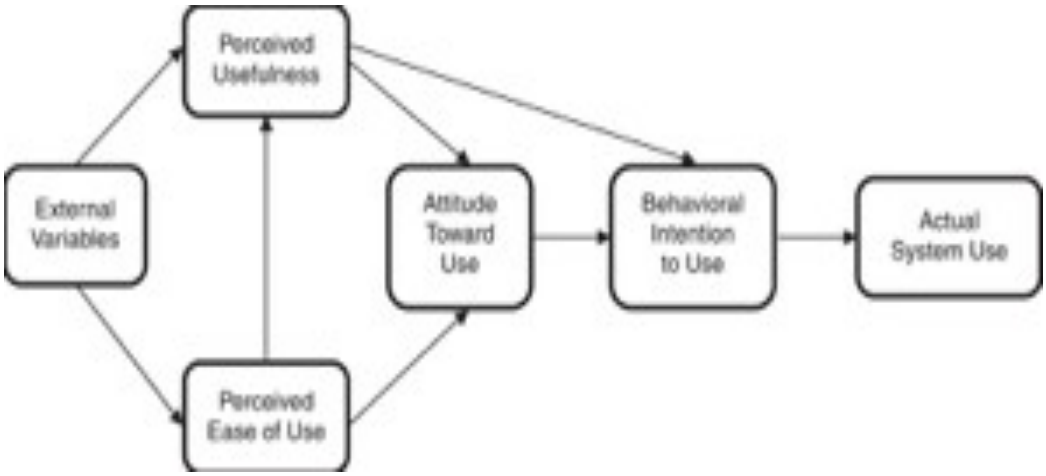


Figure **2.16: Technology Acceptance Model (TAM) For Adoption Of eHealth**

Perceived Usefulness - According to (Abdullah et al., 2016), perceived usefulness refers to "the extent to which an individual believes that adopting specific technologies will increase job performance." (Ching-Ter et al., 2017) imply that PU is the key determinant factor for new technology acceptability and use in various areas (Ching-Ter et al., 2017). External influences may influence a user's view of a technology's utility (Ching-Ter et al., 2017).

Perceived Ease of Use - Perceived ease of use refers to how confident a person is that a certain technology would be simple and straightforward to use (Davis et al., 1989). PEU is one of the most important TAM constructs for predicting consumer acceptance or rejection of new technologies (Schnall et al., 2015).

Attitude Towards Use - The intention to use eHealth services is significantly influenced by privacy concerns, with patients exhibiting hesitancy due to fears surrounding the security of their health information. This reluctance is particularly pronounced among patients in rural regions, who perceive technology use as posing risks to the confidentiality of their personal data, thereby eroding trust in eHealth platforms (Al-Emran et al., 2018). Interestingly, while patients express apprehension about sharing medical information digitally, healthcare professionals such as doctors or medical associates appear more comfortable with patients divulging their medical history and data (Kuyo et al., 2018). Furthermore, research has identified a strong association between user trust and the acceptability of technology (Abiy et al., 2018), highlighting how past experiences and perceptions of potential threats influence confidence in technology. Overall, patients' concerns about information leakage through digital platforms underscore the importance of addressing privacy issues to enhance user trust and facilitate the adoption of eHealth services.

Behavioural Intention to Use- Attitude is a predefined mental state about a system's benefits in improving work performance, time management to complete their task, and its effect on improving the quality of the work they complete (Petty and Cacioppo, 2012). User attitudes play an essential impact in the acceptance and productivity of information use in action, according to several research (Ward R et al., 2008). Because healthcare providers are the system's primary users, evidence from multiple studies show that their attitudes and acceptance are critical to the success of eHealth system implementation in medical systems. (Tilahun et al., 2015).

Actual System Use- The technological infrastructure of the organisation was addressed in this section, which included the availability of computers for use with eHealth systems, the hospital's existing infrastructure, and the current system that supports the hospital's existing infrastructure. Despite the fact that technological infrastructure is not one of the TAM elements, various research have found that conducive conditions have an impact on users' attitudes and

intentions to adopt technology (Wang et al. 2016). In this sense, technical infrastructure is expected to be one of the most important indicators of long-term eHealth adoption.

The objective of this study was to investigate the key factors influencing the "intention to use" and "actual usage" of eHealth services in India and to develop a model for optimal eHealth service utilization. In line with this objective, a positivist approach was deemed appropriate (Kim et al., 2012). Expanding upon the classic Technology Acceptance Model (TAM) proposed by Davis (Davis, 1989) and further developed by Venkatesh and Davis (Wilkowska et al., 2019) and Taylor and Todd, this study incorporates additional constructs such as privacy and trust (Tung et al., 2008). Specifically, the TAM model used in this study includes perceived usefulness, perceived ease of use, intention to use, and actual use. The inclusion of trust and privacy factors in the model was adapted from previous studies by Featherman and Pavlou (Featherman and Fuller, 2003; Giovanis et al., 2012), Chellappa and Pavlou (Chellappa and Pavlou, 2002), and Korgonkar and Wolin (Korgaonkar et al., 2002).

IDENTIFIED GAP FROM LITERATURE REVIEW ON THE THEORETICAL PREMISE

- Normalisation process theory has been used in digital health but extended study need to be done considering eHealth.
- The technology acceptance model can be very well used to understand the barriers affecting customer engagement so that efforts can be put to overcome the barriers of new technology and increase adoption of eHealth in India.
- Limited research exists regarding the utilization of Normalization Process Theory (NPT) and the Technology Acceptance Model (TAM) in examining eHealth within the Indian healthcare sector.

CHAPTER SUMMARY

The primary aim of Chapter Two is to conduct an exploratory study through a comprehensive review of relevant literature, aimed at identifying research gaps. A bibliometric analysis spanning from 2007 to the middle of 2022 was conducted to gain deeper insights into the various eHealth programs in India, including their nature, funding sources, and operational challenges. The literature review focused on three main themes: eHealth literature, literature on barriers to eHealth adoption, and literature on barriers to customer engagement in eHealth. Each theme was analyzed to identify research gaps. Additionally, the chapter discusses the theoretical foundations and their potential contributions to addressing eHealth issues, while also identifying gaps in the theoretical premise from the literature review. The subsequent chapter will delve into the Research Methodology (RM) adopted for the study.

CHAPTER 3
RESEARCH METHODOLOGY

OVERVIEW

This section of the report outlines how the study was conducted, including the methods used for data collection and analysis. Following Murray and Hughes (2008), the overall research approach is termed as 'methodology', encompassing the various techniques employed to gather and analyze data, referred to as 'methods'. The chapter starts by addressing the rationale behind the research and ends with a detailed overview of the methodologies and techniques utilized to meet the research objectives. It includes an extensive discussion on the questionnaire design and the strategies employed for data collection.

RATIONALE FOR THE STUDY

ehealth, facilitated by information and communication technologies, holds the potential to revolutionize healthcare globally, impacting infrastructure, costs, and service quality (Wickramasinghe and Misra, 2004; Wickramasinghe and Goldberg, 2004). However, despite its promise, the healthcare sector lags behind other government services in embracing e-health due to a lack of established standards (Skinner, 2003).

A crucial area of inquiry pertains to evaluating e-health services in India, including barriers to adoption and implementation. This research could provide valuable insights to support existing e-health projects and enhance the efficacy of future initiatives. Yet, despite its significance, the evaluation of e-health services remains inadequately addressed both theoretically and practically (Brender, 2006; Friedman and Wyatt, 2005). This study contributes to a broader research endeavor aiming to develop and assess a comprehensive evaluation framework for e-health services.

RESEARCH PHILOSOPHY

The concepts of ontology and epistemology are fundamental to research philosophy. Ontology addresses the question of reality, asking whether there is a single reality that exists within the scope of your research. For instance, an ontological question could be whether barriers to eHealth exist in India, with possible answers being "Yes, they exist" or "No, they do not exist." Epistemology, on the other hand, concerns the study of knowledge and explores how we come to know about the various barriers in eHealth in India. It delves into the validity, parameters, and methods of acquiring knowledge.

Research philosophy encompasses the beliefs, assumptions, and principles that guide our approach to a study, forming the foundation for the research strategy. When combined with research methodology, it forms a research paradigm. Research Methodology addresses the question of how we uncover strategies for customer engagement in eHealth, encompassing the processes of data collection and analysis. It should articulate how research is conducted and demonstrate the validity of the findings. Understanding research paradigms is crucial as they establish the philosophical basis of a research project. Once the research philosophy is established, an appropriate methodology can be selected. Moreover, a clear grasp of the philosophical underpinnings enhances the quality of research and improves performance in analysis. There are many approaches or paradigms, namely:

- **Positivism**
- **Interpretivism**
- **Pragmatism**

Positivism, as a research paradigm, often employs quantitative methodologies, frequently utilizing experimental or quasi-experimental research designs. Conversely, **interpretivism** typically aligns with qualitative methodologies, relying on data collection methods like interviews, observations, and textual analysis. **Pragmatism** takes a more flexible approach, prioritizing the usefulness and applicability of research findings over rigid philosophical stances. This allows for exploration of research questions that span philosophical boundaries, utilizing different perspectives as needed.

In a **pragmatic research paradigm**, both quantitative and qualitative methods are utilized based on the research questions and context. This often involves a mixed-method approach, combining different data types and analysis methods. We've chosen pragmatism as our research paradigm because we aim to understand solutions for the non-adoption of eHealth in India. Our study employs a mixed-method approach, involving both quantitative data collection and analysis, as well as in-person interviews to gather qualitative insights on respondents' perceptions and preferences regarding eHealth adoption. This holistic approach provides a comprehensive understanding of the method's effectiveness and practical implications, synthesizing both types of data. Such insights are valuable for problem-solving, seeking practical ways to address diverse research objectives.

RESEARCH DESIGN

Research methods encompass the strategies, procedures, or techniques employed to gather data or evidence for analysis, aiming to reveal new insights or enhance understanding of a subject. Various types of research methods utilize distinct tools for data collection, including:

- **Qualitative**
- **Quantitative**
- **Mixed**

Qualitative Research involves gathering data on live experiences, emotions, or behaviors, along with the meanings individuals attribute to them. It aids researchers in understanding complex concepts, social interactions, or cultural phenomena. This type of research is valuable for exploring the reasons behind occurrences, interpreting events, and describing actions.

Quantitative Research, on the other hand, collects numerical data that can be ranked, measured, or categorized through statistical analysis. It is useful for determining quantities such as how many, how much, how often, or to what extent.

Mixed Method Research combines both Qualitative and Quantitative Research approaches. It offers a comprehensive approach by integrating and analyzing statistical data alongside deeper contextual insights.

According to my research I identified that eHealth is a booming topic in this era and is well known concept globally even India is adopting it but there exist a lot of adoption barriers in eHealth. The issue has been identified through literature review as many barriers exists which is qualitative in nature. But then sample conduction and further detail through both qualitative and quantitative in each objective. This approach enables researchers to validate their findings by cross-referencing results obtained from both qualitative and quantitative methods. It allows for the verification of whether the outcomes observed using each method complement each other, and helps to explain any unexpected results from one method through insights gained from the other method. The more significance has been got regarding customer engagement as the top-most barrier and also its sub barriers have been identified. In this study objective 1 methodology adopted was FAHP which is the integration method of qualitative and quantitative methods. Then, objective 2 FAHP and DEMATEL is used which is again the qualitative attributes are converted into the quantitative attributes. Next, objective 3 we used ISM which is a quantitative decision-making technique used to analyze complex issues and relationships between different components or factors. It involves a pair-wise comparative analysis to describe and prioritize these relationships based on their importance and influence. So, **mixed method research** is needed to move to the further step.

"Systematic and scientific search for relevant information on a particular topic" is the definition of research. The arrangement of conditions for data collection and analysis in a way that aims to combine relevance to the research purpose with economy in procedure is described as research configuration by Kothari 2019(**Kothari, 2019**). According to Fagade 2011 (**Fagade, 2011**), there are two different types of mixed method research design:

- **Exploratory sequential**
- **Descriptive mixed method design**

The **exploratory sequential design** involves initially gathering qualitative data, followed by quantitative data. This mixed methods research approach is employed when the objective is to explore a topic thoroughly before collecting any quantitative data. A **descriptive mixed-method design** in research is an approach that seeks to both describe and understand a phenomenon by integrating qualitative and quantitative data collection and analysis methods.

This methodology allows researchers to gather a comprehensive understanding of the subject under investigation by leveraging the strengths of both qualitative and quantitative approaches.

Exploratory research involves investigating an undefined problem to gain a deeper understanding of the issue, although the results may not provide conclusive answers. Researchers start with a broad idea and use the study to uncover specific problems that merit further investigation. An essential aspect of this type of research is the researcher's readiness to adapt their approach based on new information or insights. Exploratory research is typically conducted during the early stages of problem identification and is often used to address questions like what, why, and how, earning it the alternative names of grounded theory or interpretive research. Interestingly, exploratory research can also take a quantitative approach, particularly when conducted with a large sample size. Despite its quantitative nature, this approach maintains the flexibility and open-endedness characteristic of interpretive research or grounded theory (Saunders B. et al., 2018).

According to my research I identified that eHealth is a booming topic in this era and is well known concept globally even India is adopting it but there exist a lot of adoption barriers in eHealth. The issue has been identified through literature review as many barriers exists. But sample conduction and further detail through qualitative manner more significance have been got regarding customer engagement as the topmost barrier and also its sub barriers have been identified. Both qualitative and quantitative research is needed to move to the further step. So, accordingly this research needs to be an exploratory in nature.

RESEARCH METHODOLOGY

To achieve the desired objectives, a thorough analysis of the collected data was carried out. Various methods were employed to review and evaluate the data with the aim of addressing the research questions and providing responses to the research inquiries. The techniques utilized to evaluate the collected data, along with the findings, are detailed in the subsequent chapters of the thesis. The study utilized a variety of statistical tools and techniques for data analysis, including

RO1: To identify and evaluate the factors that affects the adoption of eHealth in India.

A mixed-method study involves the collection and analysis of both quantitative and qualitative data. In the field of nursing and healthcare, where the delivery of services is increasingly complex, mixed methods research has gained popularity. This approach combines the strengths of both qualitative and quantitative methods, enabling researchers to explore issues from multiple perspectives and establish connections across various layers of research problems. Fuzzy logic, developed by Zadeh in 1996, was introduced to manage vulnerability and ambiguity in decision-making processes. Unlike classical set theory, which represents membership in binary terms (1 or 0), fuzzy logic allows for a continuum between these binary values, denoted as the degree of membership. This enables a more nuanced representation of uncertainty and ambiguity in decision-making. Triangular fuzzy numbers, commonly used in fuzzy logic, represent values as TFN (l, m, n), where l represents the lower value, m the medium value, and n the higher value.

Analytic Hierarchy Process (AHP) is susceptible to imprecision due to subjective assessments and linguistic expressions. Fuzzy AHP addresses this imprecision by providing a more accurate and logical representation of criteria performance, incorporating expert opinions in decision-making processes. It is particularly effective for datasets that are subjective or ambiguous and cannot be addressed using deterministic approaches. The methodology used in this research, which identifies and prioritizes significant barriers to eHealth adoption in India, is illustrated in Figure 3.1. The steps followed in the Fuzzy Analytic Hierarchy Process (FAHP) method are outlined as follows:

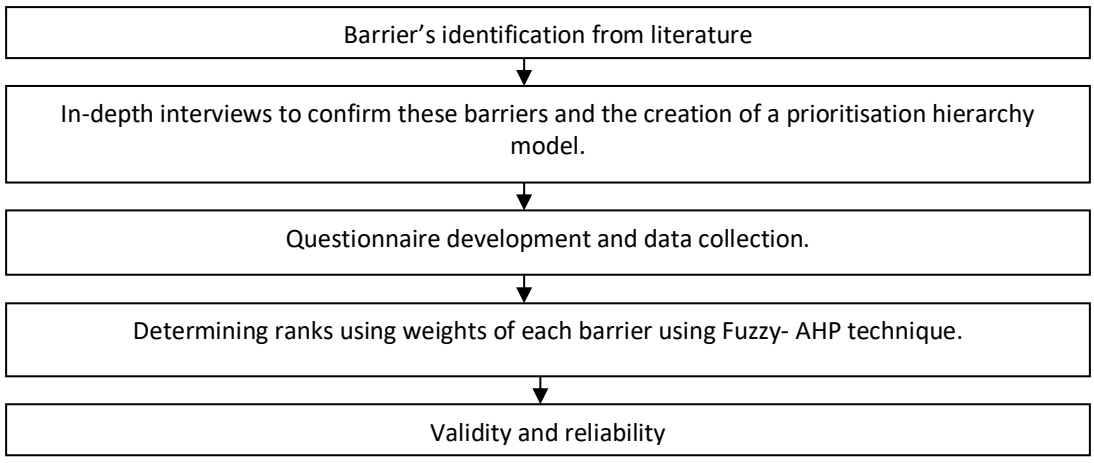


Figure 3.1: Flow diagram for Fuzzy AHP analysis

Step 1: Barrier's identification from literature

After conducting a comprehensive literature review on the factors influencing the adoption of eHealth in India, a list of barriers was identified.

Step 2: In-depth interviews to confirm the barriers identified in step 1 and the creation of a prioritization hierarchy model

Thirty-nine in-depth exploratory interviews with professionals from the Indian healthcare industry, including practitioners, patients, companies, governments, and policymakers, were undertaken to corroborate the barriers identified in step 1. In-depth exploratory interviews are performed in the natural settings of the respondents to get insights into an issue and are flexible. Following the interviews, a total of thirty-seven barriers were finalized and categorized into eight distinct groups. These categories include: customer-related barriers, regulatory barriers, technical barriers, organizational barriers, practitioner-related barriers, marketing barriers, administrative barriers, and economic barriers to the adoption of eHealth in India.

Step 3: Development of the questionnaire and the subsequent collection of data

The FAHP approach collects data using a questionnaire, which allows for a pair-wise comparison of all barriers and their categories to assess and rank them. The triangular fuzzy conversion scale used in this study is shown in Table 3.1. Respondents were provided with a detailed description of the study, barriers and the questionnaire completion process. For data collection, eighty-five respondents were contacted while data could be collected only from seventy-nine experts because of the unavailability of some of the experts. In FAHP, the responses are received only from the experts, hence less sample size is required since large samples lead to discrepancies (Lincoln and Guba, 1985). The judgemental sampling technique was used because data is collected only by the experts in the field who are competent enough to answer the question under the study (Chan et al., 2008). To ensure wider responses, data were collected from the experts including practitioners, patients, companies, governments, and policy- makers from the healthcare sector in India. The respondents are informed that the

purpose of this survey is to obtain their opinions on the importance of various hurdles to the adoption of eHealth in India. In a table format, the eight barriers have been divided into thirty-seven sub-barriers. Each table has a comparison between pair of criteria, evaluating importance relative to each other. The values on the left mean greater importance concerning another and vice – versa. The weights of each barrier were calculated using FAHP and fuzzy logic, followed by prioritisation and ranking.

Table 3.1: Scale for Triangular fuzzy conversion

Value	***Fuzzy pairwise comparison value***
Just equal	(1.0, 1.0, 1.0)
Weak	(0.5, 1.0, 1.5)
Fairly Strong	(1.5, 2.0, 2.5)
Very Strong	(2.5, 3.0, 3.5)
Absolute	(3.5, 4.0, 4.5)

Step 4: Determining weights for each barrier using the Fuzzy Analytic Hierarchy Process (FAHP) technique

AHP establishes a hierarchical structure. Making a pecking order is an important stage in AHP, but there is no one-size-fits-all approach. The creation of a chain of command could be a top-to-bottom, multi-level process that begins with the beat and works its way down (Chang, 1996). On a scale, the components of progressive levels are managed. The structure's other similar variables must be related to the components of the same pecking order level. The FAHP technique has been widely employed by a variety of authors in a variety of fields, and it is reliable in instances where uncertainty arises in the decision-making process, which is missing in traditional AHP (for example, the studies of (Sengar et al., 2020; Buckley, 1985; Dhingra et al., 2022; Sengar et al., 1996; Zadeh, 2019). FAHP is a multi-criteria decision-making strategy that employs both qualitative and quantitative approaches for data collection, to lessen the fuzziness in the data. Data is collected on a questionnaire using a pairwise comparison between the factors under the study. Weights for each barrier are calculated using this method that helps

in ranking them for prioritization of these barriers. A detailed description of the method is given in the next section.

Step 5: Validity and reliability

The reliability and validity of this study are checked and varied using peer debriefing and triangulation methods (Purcarea, 2019). The triangulation method uses a different type of data from different data sources using various data collection techniques that helps in keeping a check on the reliability and validity of the study.

FAHP METHODOLOGY

The FAHP technique used to compute the priority weights of the various barriers is explained below.

(a, b, c) is a triangular fuzzy number (TFN) as shown in (Fig 3.2) and (μ_m (f)) is the membership function (Chan et al., 2008; Fullér, 1991).

$$\mu_m(f) = \begin{cases} \frac{f-a}{b-a} & a \le f \le b \\ \frac{c-f}{c-b} & b \le f \le c \\ 0 & \text{Otherwise} \end{cases} \quad (1)$$

with $-\infty < a \le b \le c \le \infty$.

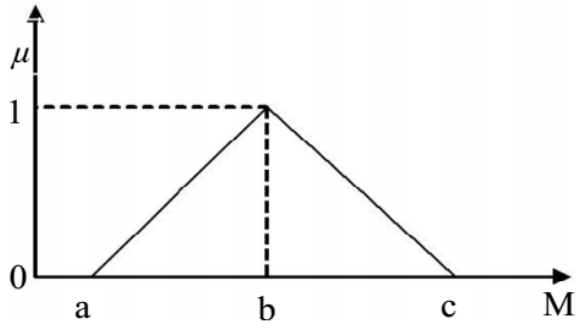


Fig. 3.2: Triangular fuzzy number

D_1 (d_1^-, d_1, d_1^+) and D_2 (d_2^-, d_2, d_2^+) are two TFN. A sample is shown in **Table 3.2**.

Table 3.2: Comparison matrix of categories of barriers

	CRB	RB	TB	OB	PB	MB	AB	EB
CRB	(1,1,1)	(4,5,6)	(3,4,5)	(3,4,5)	(1,1,1)	(0.25,0.33,0.5)	(1,2,3)	(1,2,3)
RB	(0.16,0.2,0.25)	(1,1,1)	(0.25,0.33,0.5)	(2,3,4)	(3,4,5)	(2,3,4)	(1,2,3)	(2,3,4)
TB	(0.2,0.25,0.33)	(2.3,4)	(1,1,1)	(1,1,1)	(0.25,0.33,0.5)	(0.33,0.5,1)	(3,4,5)	(3,4,5)
OB	(0.2,0.25,0.33)	(0.25,0.33,0.5)	(1,1,1)	(1,1,1)	(0.25,0.33,0.5)	(2,3,4)	(2,3,4)	(3,4,5)
PB	(1,1,1)	(0.2,0.25,0.33)	(2,3,4)	(2,3,4)	(1, 1, 1)	(1,2,3)	(1,2,3)	(4,5,6)
MB	(2,3,4)	(0.25,0.33,0.5)	(1,2,3)	(2,3,4)	(0.33,0.5,1)	(1, 1, 1)	(0.25,0.33,0.5)	(3,4,5)
AB	(0.33,0.5,1)	(0.33,0.5,1)	(0.2,0.22,0.33)	(0.25,0.33,0.5)	(0.33,0.5,1)	(2,3,4)	(1, 1, 1)	(3,4,5)
EB	(0.33,0.5,1)	(0.25,0.33,0.5)	(0.2,0.25,0.33)	(0.25,0.33,0.5)	(0.16,0.2,0.25)	(0.2,0.22,0.33)	(0.2,0.22,0.33)	(1, 1, 1)

Chang's extent analysis (Chang, 1996) explains the steps in the FAHP process as follows:

Step 1: Calculate the Fuzzy synthetic extent value.

$$\text{FNi} = \sum_{j=i}^{m} D_{gi}^{j} \otimes \left(\sum_{i=1}^{n} \sum_{j=1}^{m} D_{gi}^{j} \right)^{-1}, \qquad i = 1,2, \ldots \ldots . . n \tag{2}$$

$$\sum_{j=i}^{m} D_{gi}^{j} = \left(\sum_{j=i}^{m} D , \sum_{j=i}^{m} D_{ij} , \sum_{j=i}^{m} D_{ij}^{+} \right) \qquad i = 1,2, \ldots \ldots . . n \tag{3}$$

$$\left(\sum_{i=1}^{n} \sum_{j=1}^{m} D_{gi}^{j} \right)^{-1} = \left[\frac{1}{\sum_{i=1}^{n} \sum_{j=1}^{m} d_{ij}^{+}}, \frac{1}{\sum_{i=1}^{n} \sum_{j=1}^{m} d_{ij}}, \frac{1}{\sum_{i=1}^{n} \sum_{j=1}^{m} d_{ij}^{-}} \right] \tag{4}$$

Step 2: Calculate the degree of possibility for each fuzzy synthetic extent value.

If $D_2 = (d_2^-, d_2, d_2^+) \geq D_1 = (d, d_1, d_1^+)$ then $(D2 \geq D1 = \underset{y \geq x}{sup} \quad [\min (\mu_{d1}(x), \mu_{d2}(y)]$

x, y: Membership values

Step 3: Calculate the weight of each barrier.

$V (FN \geq FN_1, FN_2 \ldots FN_K) = \min V (FN \geq FN_i), \quad i = 1, 2, \ldots\ldots k$ (5)

$d (FN_i) = \min V (FN \geq FN_k) = WB_i^{'}$ k = 1, 2, ……, n and k ≠ I (6)

Weights, WB_i' of the factors are.

$$WB' = (WB_1', WB_2', \ldots\ldots, WB_n')^{T} \quad (7)$$

Step 4: WB' represents priority weights after normalization.

$$WB' = (WB_1, WB_2, \ldots\ldots, WB_n)^{T} \quad (8)$$

A detailed description of the concepts of fuzzy operations is provided by authors such as (**Sengar et al., 2020**), ((Buckley, 1985), (**Dhingra et al., 2022**), ((Wedding, 1997), (**Sengar et al., 2014**), and **(**(F. Zhang et al., 2017).

Weight calculation for barriers and respective categories (using equation 2)

FN(CRB) = (12, 15, 18) ⊗ (134.81,103.45, 75.20) $^{-1}$

= (0.09,0.14, 0.24)

FN(RB) = (9.16, 12.20, 15.25) ⊗ (134.81,103.45, 75.20) $^{-1}$

= (0.07,0.12, 0.20)

FN(TB) = (4.45, 5.58, 6.83) ⊗ (134.81,103.45, 75.20) $^{-1}$

= (0.03,0.05, 0.09)

FN(OB) = (2.70, 2.91,3.33) ⊗ (134.81,103.45, 75.20) $^{-1}$

= (0.02,0.03, 0.04)

FN(PB) = (6.20, 8.25, 10.33) ⊗ (134.81,103.45, 75.20) $^{-1}$

= (0.05,0.08, 0.14)

FN(MB) = (5.58, 8.83, 12.50) ⊗ (134.81,103.45, 75.20) -1

= (0.04,0.09, 0.17)

FN(AB) = (1.44, 2.08, 3.83) ⊗ (134.81,103.45, 75.20) -1

= (0.01,0.02, 0.05)

FN(EB) = (1.19, 1.61, 2.58) ⊗ (134.81,103.45, 75.20) -1

= (0.01,0.02, 0.03)

Using equations 6 and 7, calculate the minimum value of each barrier category:

$m(MB) = \min V (FN_l \geq FN_k) = 1$

Similarly, m(CRB) = 0.93421, m(RB) = 0.26335, m(TB) = 0.032743, m(OB) = 0.531919, m(PB) = 0.076494, m(MB) = 1, m(AB) = 0.83872, m(EB) = 0.06431

$WB_V = (0.93421, 0.2633, 0.0327, 0.5319, 0.0764, 1, 0.8387, 0.0643)^T$

Normalized weights:

WB = (0.2497, 0.0704, 0.0088, 0.1422, 0.0204, 0.2673, 0.2242, 0.0172)

Likewise, the weights of all the barriers are calculated Table 3.3. Local weights of the barrier and the weight of its respective category are multiplied to calculate the global weight of each barrier.

SENSITIVITY ANALYSIS

Sensitivity analysis serves to evaluate the consistency and dependability of the applied framework. It involves adjusting the weight assigned to specific criteria to observe variations in the final ranking of alternatives (Vishwakarma and Singh, 2019; Yadav et al., 2021). During sensitivity analysis, the weight of the criterion with the maximum weight is modified while keeping the weights of other criteria constant. Consequently, rankings are reassigned to all criteria. The objective of sensitivity analysis is to ascertain how changes in criteria weight affect the rankings of alternatives. This process aids in validating the rankings derived from statistical techniques and assists in selecting the most suitable alternative (Chen, 2010).

Marketing barriers have been identified as the most significant obstacle to eHealth adoption in India. Conducting a sensitivity analysis specifically focusing on marketing barriers would help discern their impact on other barriers. The range of values for marketing barriers varied from 0.1 to 0.9, as depicted in Tables 3.4 and 3.5. Its influence was examined on other barrier categories and the thirty-seven barriers categorized into eight barrier categories.

Table 3.3: Weights and ranking of barriers

			Relative preference weight	Relative rank	Local weights	Local rank	Global weights	Global rank
1	Customer related Barriers (CRB)		0.2497	2				
1.1	Health consciousness	CRB1			0.3263	1	0.0815	3
1.2	Literacy in eHealth	CRB2			0.0425	6	0.0106	23
1.3	Lack of motivational value for elderly people	CRB3			0.0178	7	0.0045	28
1.4	Unclear benefits	CRB4			0.1935	2	0.0483	10
1.5	Learning new technology	CRB5			0.0470	5	0.0117	22
1.6	Lack of trust/Confidence	CRB6			0.1335	3	0.0333	14
1.7	Less knowledge of health experts	CRB7			0.1335	3	0.0333	15
1.8	Cultural ethical challenge	CRB8			0.1059	4	0.0264	16
2	Regulatory Barriers (RB)		0.0704	5				
2.1	Lack of standard for implementation	RB1			0.6259	1	0.0441	11
2.2	Lack of Federal laws	RB2			0.0239	3	0.0017	32
2.3	Lack of Guidelines	RB3			0.3502	2	0.0246	17
3	Technical Barriers (TB)		0.0088	8				
3.1	Lack of system feedback	TB1			0.3458	1	0.0030	30
3.2	Health app use efficacy	TB2			0.2164	2	0.0019	31
3.3	Security issues	TB3			0.1274	3	0.0011	33
3.4	Lack of technical support	TB4			0.0988	5	0.0009	35
3.5	Privacy issue	TB5			0.0180	7	0.0002	37
3.6	Lack of internet connectivity	TB6			0.1072	4	0.0009	34
3.7	Lack of medical equipment's	TB7			0.0863	6	0.0008	36
4	Organizational barriers (OB)		0.1422	4				
4.1	Lack of strategic planning	OB1			0.0906	1	0.0129	21
4.2	Unethical malpractice	OB2			0.2378	3	0.0338	13
4.3	Lack of management of implementation	OB3			0.1173	5	0.0167	20
4.4	Structural misfit	OB4			0.3856	2	0.0548	9
4.5	Lack of insurance coverage and reimbursement (Financial health solutions)	OB5			0.1687	4	0.0240	18
5	Practitioner's barriers (PB)		0.0204	6				
5.1	Lack of proper training/education of health practitioners	PB1			0.2441	2	0.0050	25
5.2	Resistance of rural practitioners (fear of losing patients)	PB2			0.2191	3	0.0045	27
5.3	Licensing issue	PB3			0.2123	4	0.0043	29
5.4	Lack of faith on technology effectiveness	PB4			0.3244	1	0.0066	24

6	Marketing Barriers (MB)		0.2673	1				
6.1	Promotion	MB1			0.0852	3	0.0228	19
6.2	Customer engagement	MB2			0.6907	1	0.1846	1
6.3	Customer loyalty	MB3			0.2241	2	0.0599	8
7	Administrative barriers (AB)		0.2242	3				
7.1	Inflexible system	AB1			0.2808	3	0.0629	7
7.2	Employee resistance	AB2			0.3491	1	0.0783	4
7.3	Lack of training of health care workers	AB3			0.0210	4	0.0047	26
7.4	Lack of technical staff	AB4			0.3491	2	0.0783	5
8	Economic barriers (EB)		0.0172	7				
8.1	Equipment cost	EB1			0.1800	3	0.0403	12
8.2	Software cost	EB2			0.2858	2	0.0641	6
8.3	Staff training cost	EB3			0.5342	1	0.1197	2

Table 3.4: Influence of marketing barriers on other barriers

CRB	0.3067	0.2726	0.2385	0.2044	0.1704	0.1363	0.1022	0.0681	0.0341	0.3067
RB	0.0864	0.0768	0.0672	0.0576	0.0480	0.0384	0.0288	0.0192	0.0096	0.0864
TB	0.0107	0.0096	0.0084	0.0072	0.0060	0.0048	0.0036	0.0024	0.0012	0.0107
OB	0.1746	0.1552	0.1358	0.1164	0.0970	0.0776	0.0582	0.0388	0.0194	0.1746
MB	0.1000	0.2000	0.3000	0.4000	0.5000	0.6000	0.7000	0.8000	0.9000	0.1000
PB	0.0251	0.0223	0.0195	0.0167	0.0139	0.0112	0.0084	0.0056	0.0028	0.0251
AB	0.2753	0.2447	0.2141	0.1835	0.1530	0.1224	0.0918	0.0612	0.0306	0.2753
EB	0.0211	0.0188	0.0164	0.0141	0.0117	0.0094	0.0070	0.0047	0.0023	0.0211
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 3.5: Ranking of barriers using sensitivity analysis when the value of marketing barrier varies

Factors	Market-related barriers used for Sensitivity analysis.									
	0.1	0.2	0.2673	0.3	0.4	0.5	0.6	0.7	0.8	0.9
AB1	6	7	7	8	8	8	9	9	9	9
AB2	3	4	4	4	5	5	6	6	6	6
AB3	26	26	26	26	26	26	26	26	26	26
AB4	4	5	5	5	6	6	7	7	7	7
CRB1	2	3	3	3	4	4	5	5	5	5
CRB2	22	23	23	23	23	23	23	23	23	23
CRB3	28	28	28	28	28	28	28	28	28	28
CRB4	9	9	10	10	10	11	11	11	11	11
CRB5	21	22	22	22	22	22	22	22	22	22
CRB6	13	14	14	14	15	15	15	15	15	15
CRB7	14	15	15	15	16	16	16	16	16	16
CRB8	15	16	16	17	17	17	17	17	17	17
EB1	11	12	12	12	13	13	13	13	13	13
EB2	5	6	6	7	7	7	8	8	8	8
EB3	1	2	2	2	2	3	3	4	4	4
MB1	23	20	19	16	12	9	4	3	3	3
MB2	7	1	1	1	1	1	1	1	1	1
MB3	18	11	8	6	3	2	2	2	2	2
OB1	20	21	21	21	21	21	21	21	21	21
OB2	12	13	13	13	14	14	14	14	14	14
OB3	19	19	20	20	20	20	20	20	20	20
OB4	8	8	9	9	9	10	10	10	10	10
OB5	17	18	18	19	19	19	19	19	19	19
PB1	25	25	25	25	25	25	25	25	25	25
PB2	27	27	27	27	27	27	27	27	27	27
PB3	29	29	29	29	29	29	29	29	29	29
PB4	24	24	24	24	24	24	24	24	24	24
RB1	10	10	11	11	11	12	12	12	12	12
RB2	32	32	32	32	32	32	32	32	32	32
RB3	16	17	17	18	18	18	18	18	18	18
TB1	30	30	30	30	30	30	30	30	30	30
TB2	31	31	31	31	31	31	31	31	31	31
TB3	33	33	33	33	33	33	33	33	33	33
TB4	35	35	35	35	35	35	35	35	35	35
TB5	37	37	37	37	37	37	37	37	37	37
TB6	34	34	34	34	34	34	34	34	34	34
TB7	36	36	36	36	36	36	36	36	36	36

RO2: To identify and evaluate the factors of customer engagement that effects the adoption of eHealth in India.

To conduct effective research, there must be a systematic process. In a similar vein, it is crucial to confirm that the study's research techniques are supported by evidence on their applicability. To accomplish the above goals, the authors adopted a FAHP-DEMATEL strategy. As a result, the research flow is presented in this section, and the chosen approaches are covered in later sub sections.

THE DESIRED RESEARCH FLOWS

The Consumer Engagement (CE) drivers identified by various researchers were collated and presented to an expert panel for assessment and recommendations. The experts were tasked with categorizing the drivers into different groups and providing initial inputs for both the Fuzzy Analytic Hierarchy Process (FAHP) and the Decision Making Trial and Evaluation Laboratory (DEMATEL) approaches. The weights of the CE drivers were determined using the FAHP approach, while DEMATEL was employed to identify cause-and-effect drivers and explore their interrelationships. The research methodology utilized for the study is illustrated in Figure 3.3.

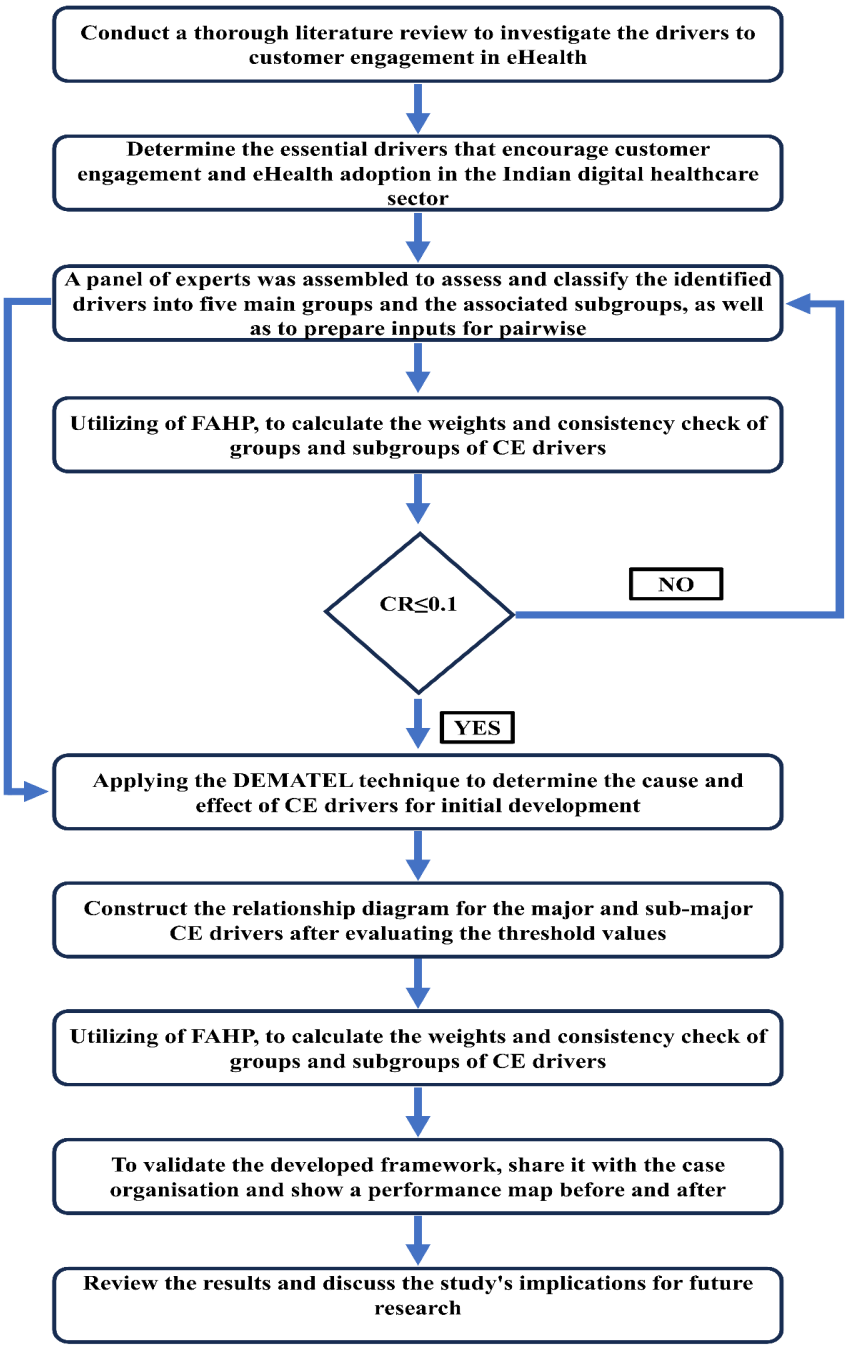


Figure 3.3: Flow diagram adopted for this study

FAHP METHODOLOGY

The AHP is a quantitative decision-support method that simplifies the resolution of multi-expert, multi-period, and MCDM problems introduced by Thomas Saaty (Saaty, 1988) . When dealing with issues involving numerous criteria, this strategy works well. AHP aims to collect expert viewpoints, however it is unable to handle human reasoning's tendency towards

ambiguity. As a result, fuzzy-AHP, a fusion of fuzzy and AHP, was introduced. When dealing with challenges requiring imprecision and ambiguity, fuzzy-AHP is able to make more accurate and sufficient decisions in real-time (You et al., 2022). The extent analysis approach was chosen for this study because it offers higher accuracy and consistency compared to the conventional Analytic Hierarchy Process (AHP) approach. To ensure the quality of inputs for computing the weights of the drivers, the authors utilized expert-made paired comparisons and examined their consistency. After conducting a comprehensive analysis of factors influencing customer engagement in eHealth implementation in India through literature review, a set of drivers was identified. Subsequently, a panel of experts was established to provide input for the Fuzzy Analytic Hierarchy Process (FAHP). The finalization of the CE drivers that enhance eHealth adoption was entrusted to the experts, who were asked to categorize them into groups with similar functions once they were selected for inclusion in the framework development process. The steps for the FAHP approach employed in this study are as follows:

A fuzzy number is depicted as illustrated in Figure 3.4, with (a, b, c) representing a triangular fuzzy number denoted as M, and (μm(w)) indicating the membership function (Chan et al., 2008; Fullér, 1991).

$$\mu_m(w) = \begin{cases} \frac{w-a}{b-a} & a \le w \le b \\ \frac{c-w}{c-b} & b \le w \le c \\ 0 & \text{Otherwise} \end{cases} \quad (1)$$

with $-\infty < a \le b \le c \le \infty$.

P_1 (p_1^-, p_1, p_1^+) and P_2 (p_2^-, p_2, p_2^+) are the two fuzzy triangular numbers.

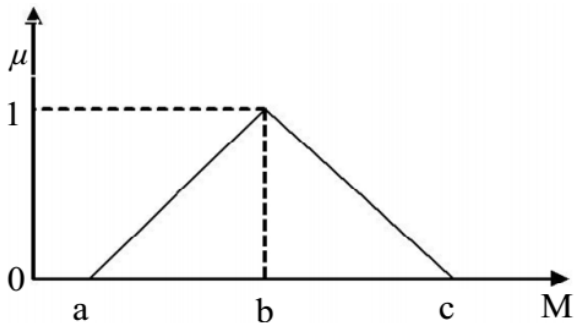


Figure 3.4: Triangular fuzzy number.

The Fuzzy AHP process has the following stages, according to Chang's extent analysis (Chang, 1996) :

Step 1: Calculation of Fuzzy Synthetic Extent Value with respect to the i[th] object, as per the methodology proposed by D. Y. Chang (1996) and Zhu et al. (1999):

$$\text{FNi} = \sum_{j=i}^{m} P_{gi}^{j} \otimes \left(\sum_{i=1}^{n} \sum_{j=1}^{m} P_{gi}^{j} \right)^{-1}, \qquad i = 1,2, \ldots \ldots n \qquad (2)$$

$$\sum_{j=i}^{m} P_{gi}^{j} = \left(\sum_{j=i}^{m} P_{ij}^{-} , \sum_{j=i}^{m} P_{ij} , \sum_{j=i}^{m} P_{ij}^{+} \right) \qquad i = 1,2, \ldots \ldots n \qquad (3)$$

$$\left(\sum_{i=1}^{n} \sum_{j=1}^{m} P_{gi}^{j} \right)^{-1} = \left[\frac{1}{\sum_{i=1}^{n} \sum_{j=1}^{m} P_{ij}^{+}}, \frac{1}{\sum_{i=1}^{n} \sum_{j=1}^{m} P_{ij}} , \frac{1}{\sum_{i=1}^{n} \sum_{j=1}^{m} P_{ij}^{-}} \right] \qquad (4)$$

Step 2: Calculation of the probability how each fuzzy synthetic extent value will be in a preferable position with respect to one another:

If $P_2 = (p_2^-, p_2, p_2^+) \geq P_1 = (p_1^-, p_1, p_1^+)$ then $(P2 \geq P1 = \sup_{y \geq x} [\min (\mu_{P1}(x), \mu_{P2}(y)]$

The membership values are x and y as represented.

Step 3: Calculate the weight vector and specify the minimal level of superiority possible for each barrier category:

The concept of a convex fuzzy number is as follows:

V (FN ≥ FN1, FN2 …FNK) = minV (FN ≥ FNi), i = 1, 2, …… k (5)

d (FNi) = minV (FN ≥ FNk) = WB_i' k = 1, 2, ……, n and k ≠ I (6)

Weights, WB_i' of the factors are.

$WB' = (WB_1', WB_2', \ldots\ldots, WB_n')$ T (7)

Step 4: The priority weights are displayed in W'.

$WB' = (WB_1, WB_2, \ldots\ldots, WB_n)$ T

(8)

The ideas of fuzzy numbers, fuzzy operations, and fuzzy sets are explained in detail in studies by authors like (Buckley, 1985), (F. Zhang et al., 2017), and (Wedding, 1997) . Table 2 shows the triangular fuzzy conversion scale which is utilized in the study for converting crisp values into fuzzy numbers.

THE SENSITIVITY ANALYSIS

It is utilized in this research to assess the methodology's efficacy. Customer interaction barriers have been identified as the most pertinent impediment in this study. A sensitivity test with customer interaction barriers would aid in determining its impact on other barriers as well. As shown in **Tables 3.6 and 3.7**, the range of the value of customer interaction barriers was between 0.1 and 0.9. Investigation was done to check the impact of how it affected the thirty barriers divided into five barrier categories and the other barrier sections. The change in customer interaction barriers had the greatest impact on customer involvement barriers and had the least impact on customer satisfaction barriers.

Table 3.6: Weights and ranking of overall criteria

	Criteria		Relative Preference Weight	Relative Rank	Local Weights	Local Rank	Global Weights	Global Rank
1	**Customer Involvement (CI)**		**0.279638**	**2**				
1.1	Time Consumption	(CI1)			0.296168	2	0.0828	4
1.2	Website visit Frequency	(CI2)			0.15975	3	0.0446	8
1.3	Interacting Sessions	(CI3)			0.044799	5	0.0125	19

1.4	Personal factors	(CI4)			0.129696	4	0.0362	10
1.5	Objective factors	(CI5)			0.331527	1	0.0927	2
1.6	Environmental Factors	(CI6)			0.03806	6	0.0106	20
2	**Customer Interaction (CIN)**		**0.333522**	**1**				
2.1	Patient appreciation	(CIN1)			0.203249	3	0.0677	7
2.2	Addressing concerns	(CIN2)			0.258679	2	0.0862	3
2.3	Issue resolving	(CIN3)			0.07951	5	0.0265	16
2.4	Customer support service	(CIN4)			0.039112	6	0.0130	18
2.5	Inimical website	(CIN5)			0.119128	4	0.0397	9
2.6	Empowerment of customer	(CIN6)			0.30032	1	0.1001	1
3	**Customer Intimacy (CINT)**		**0.255368**	**3**				
3.1	Easily Adaptable	(CINT1)			0.131214	1	0.033508	12
3.2	Prioritization of customers	(CINT2)			0.300845	4	0.076826	5
3.3	Educating Patient	(CINT3)			0.131214	2	0.033508	13
3.4	Word-of-mouth	(CINT4)			0.1358826	3	0.034700	11
3.5	Patient Retention	(CINT5)			0.300845	5	0.076826	6

4	**Customer Experience (CE)**		**0.092279**	**4**				
4.1	Proper Engagement Channels	(CE1)			0.026955	6	0.0024	29
4.2	Product Description	(CE2)			0.180393	3	0.0166	17
4.3	Widespread adoption	(CE3)			0.307367	2	0.0283	15
4.4	Patient Personas	(CE4)			0.315098	1	0.0290	14
4.5	Commitment	(CE5)			0.006663	7	0.0006	30
4.6	Affordability	(CE6)			0.105454	4	0.0097	22
4.7	Rate of resolution	(CE7)			0.05807	5	0.0053	25
5	**Customer Satisfaction (CS)**		**0.039192**	**5**				
5.1	Reliability	(CS1)			0.116507	3	0.004566	26
5.2	Responsiveness	(CS2)			0.183337	2	0.007185	24
5.3	Courteousness	(CS3)			0.246714	6	0.009669	23
5.4	Integrity	(CS4)			0.110096	4	0.004315	27
5.5	Accessibility	(CS5)			0.092965	5	0.003643	28
5.6	Credibility	(CS6)			0.250381	1	0.009813	21

Table 3.7: Normalised matrix of main criteria.

	CI	CIN	CINT	CE	CS
CI	**0**	0.3125	0.25	0.1875	0.125
CIN	0.3125	**0**	0.3125	0.1875	0.1875
CINT	0.0625	0.1875	**0**	0.125	0.0625
CE	0.125	0.1875	0.0625	**0**	0.0625
CS	0.25	0.1875	0.125	0.125	**0**

DEMATEL METHODOLOGY

The DEMATEL methodology, as highlighted by TZENG et al. (2007), is one of the most widely utilized study techniques in the domain of Multi-Criteria Decision Making (MCDM). This approach is particularly effective for analyzing complex situations and is renowned as a problem-solving technique. Essentially, DEMATEL aids in factor analysis, assisting researchers in understanding the contextual relations among the factors included in the problem structure. Moreover, it helps identify the strength of inter-relationships among these factors in comparison to other modeling approaches, as noted by Mehregan et al. (2014), Su et al. (2016), and Uygun et al. (2015).

Step 1: Construction of the Initial Direct Reachability Matrix (IDRM) and the Average Matrix:

This process aids in creating IDRM and the average matrix. The experts were asked to rank the drivers according to the strength of their influence. When determining the relative influence of the two drivers in this instance, a comparison was made. Utilizing Equation (1), the average direct-relation matrix M was computed.

$$m_{ij} = \frac{1}{H}\sum_{K=1}^{H} \mathrm{x}_{ij}^{k}$$

Step 2: Computation of the normalised matrix:

From the previous step the average matrix is utilised to derive the normalised matrix by using (Eq. (2)).

$$D = M*S \quad (2)$$

$$Here, S\ represents = min\left[\frac{1}{max\sum_{j=1}^{n}|m_{ij}|}, \frac{1}{max\sum_{i=1}^{n}|m_{ij}|}\right]$$

Step3: Construction of the total relational matrix:

After obtaining the normalised matrix finally the total relational matrix is calculated through (Eq. (3)).

$$T = D\ (I - D)^{-1} \quad (3)$$

As illustrated in Equation (3), □I represents the identity matrix. Following the derivation of the total relational matrix, row and column summations are performed. The row sum indicates the impact of each CE driver on every other driver, both directly and indirectly. Conversely, the column sum signifies the direct and indirect effects of one CE driver on the other drivers. Subsequently, the values "ri + cj" and "ri – cj" were determined. In this context, "ri + cj" represents the overall impact of a CE driver on other drivers, as well as the impact of all other drivers on it. Conversely, the equation "ri – cj" represents the net effects that the CE driver has on the entire system. CE drivers contributing to "ri + cj" are considered effect group drivers, while those contributing to "ri – cj" are regarded as cause group drivers.

Step 4: Evaluation of threshold value:

The complete direct relation matrix was employed to ascertain the threshold value. By computing the average of all values from the complete relation matrix, the threshold value was determined. This threshold value aids in delineating both the immediate and long-term effects of a particular CE driver on the overall system. Values exceeding the threshold signify how the CE driver impacts both the specific driver and the entire system. If a value exceeds the threshold, it indicates an association between criterion A and criterion B. Unidirectional interaction between selected factors is evident if only the i,j or j,i entry surpasses the threshold, while bi-directional interaction is observed if both i,j and j,i entries exceed the threshold. The relationship diagram is constructed based on these threshold value calculations.

In addition to assisting in determining the degree of effect of each CE driver, the FAHP-DEMATEL combination utilized in this study also predicts the relationships among them concerning their anticipated action during the eHealth adoption process. While there are various methods for determining the weights of the criteria, FAHP holds an advantage over other Multi-Criteria Decision Making (MCDM) procedures as it evaluates each criterion individually and effectively addresses the ambiguity in expert opinions. DEMATEL has been effectively used to document interactions among CE drivers distributed across different groups, which are often complex and may impact the outcomes.

DEVELOPMENT OF FRAMEWORK AND ITS VALIDATION

This section presents the development of the framework and its validation within the case company. The definition of the problem and an explanation of the organisation will be discussed initially. Further step, the creation of framework along with the formation of the expert panel are presented. The weights and connections between the selected drivers were then calculated using FAHP and DEMATEL. The details are given in the below subsections:

DESCRIPTION OF THE ORGANISATION AND THE PROBLEM

A digital healthcare organization was chosen to test the framework's applicability. For the smooth implementation of digital healthcare across the nation, this organization collaborates with top state and national medical associations. Thousands of doctors nationwide, collaborates with this institution for learning the ongoing development in digital healthcare. The company has a yearly revenue of about US$0.8 million, or 55 million Indian rupees. It employs about 180 people, including a team of senior doctors who are dedicated and experienced, strategic leaders, and a team of health researchers. The firm offers patients services like finding appropriate doctors, clinics nearby, diagnostic labs, Covid Hospital Clinic, health applications, patient profiles for doctors, even health policies for corporates, among many more. The business is divided into seven departments: strategic, product, finance, online, sales, operation, and HR.

Despite having numerous opportunities to communicate, the case company was experiencing trouble with patient inactivity and issues in engagement even regain of patients was less. The organisation was engaged in continuous improvement, but it was frequently

confronted with non-value-adding activities, even had made a number of strategy adjustments without finding the right solutions. This prompted them to embrace the CE framework as a remedy for their inefficiency issues. It's crucial to remember that CE framework had a high initial adoption cost, which is why they wanted to be sure their business could use it. With these expectations in consideration, they consented to assess the Consumer Engagement (CE) framework recommended by the authors of this study within their organization. The proposed CE framework was introduced and put into practice in January 2022, and the subsequent enhancements were recorded in January 2023.

CREATION OF PANEL AND DEVELOPMENT OF FRAMEWORK

A group of 80 experts and patients constituted the decision-making panel. The chosen specialists had more than ten years of expertise and exposure to CE, whilst a group of patients were contacted after the organisation itself provided information of those who had either stopped using their services or else have encouraged organisation to further changes. The CEO and CTO are on the panel, along with eight experts from each of the departments of strategy, sales, and online handling (such as online queries, answering emails, resolving queries in-call), three experts from each of the departments of finance, operations, and human resources, six experts chosen from the products department, 12 doctors, along with ten health researchers, and seventeen patients. In any large, medium, or small organisation of any size, CE is regarded as a well-proven practise for enhancing organisational effectiveness in engaging customers or patients. Therefore, any framework created by researchers or practitioners should be applicable to all different kinds of organisations. As a result, in this study, the above-mentioned criterion was taken into consideration while choosing specialists to participate in the framework development process.

With the help of the contributions from two brainstorming sessions, data from the experts was gathered. The first session is held to decide on the selection criteria for the development of framework. All the experts were given a comprehensive list of CE drivers to choose from, and they did so based on how well they would facilitate the adoption of CE by SMEs in developing nations. The specialists were then tasked with categorising the drivers who exhibited similar behaviours. In order to create a CE framework to promote its acceptance, the experts divided the chosen CE drivers into five distinct corporate aspects: customer involvement, interaction, intimacy, experience, and satisfaction (Fig. 3.5).

The three tiers of the CE framework were acquired with the help of this session. The framework is divided in to three levels: Level 1 symbolises the framework's objective, Level 2 are the primary groups of drivers, and Level 3 the subgroups of each primary group of drivers. The purpose of the second session was to collect data for the FAHP-DEMATEL method. When calculating driver weights in FAHP, each group's drivers were compared pairwise; however, in the DEMATEL approach, comparisons were used to determine how the drivers are inter-related to each other in the creation of the CE framework. To evaluate this framework, paired comparisons of CE drivers were made using the expert's judgements in order to compute their weights using the FAHP approach and then find the links between them using the DEMATEL.

FAHP APPLICATION

In this section, the Fuzzy Analytic Hierarchy Process (FAHP) approach was employed to calculate the weights of the Consumer Engagement (CE) drivers examined in the current research endeavor. Expert pairwise comparisons for the group under construction were conducted, as outlined in the previous section. Comparisons of the primary criteria drivers and sub-criteria drivers were developed based on the feedback from the experts. Table 3.6 presents the detailed expert comparisons for the primary criteria.

Following the receipt of opinions from the specialists, the methodology discussed in the previous part (research methodology) section was implemented. The consistency of each matrix comparison conducted by the experts was assessed. Initially, the *l*max and consistency index were calculated, and then the consistency index *CI* was evaluated. Only matrices with a *CI* value lower than 0.1 were considered for weight calculations. Any matrix found to be inconsistent was returned to the experts for further review (Das and Sengar, 2022; Kamoonpuri and Sengar, 2023). All expert matrix comparisons in the current scenario were deemed reliable. Once the criteria and sub-criteria weights were obtained, their overall weights were determined, as depicted in Table 3.7.

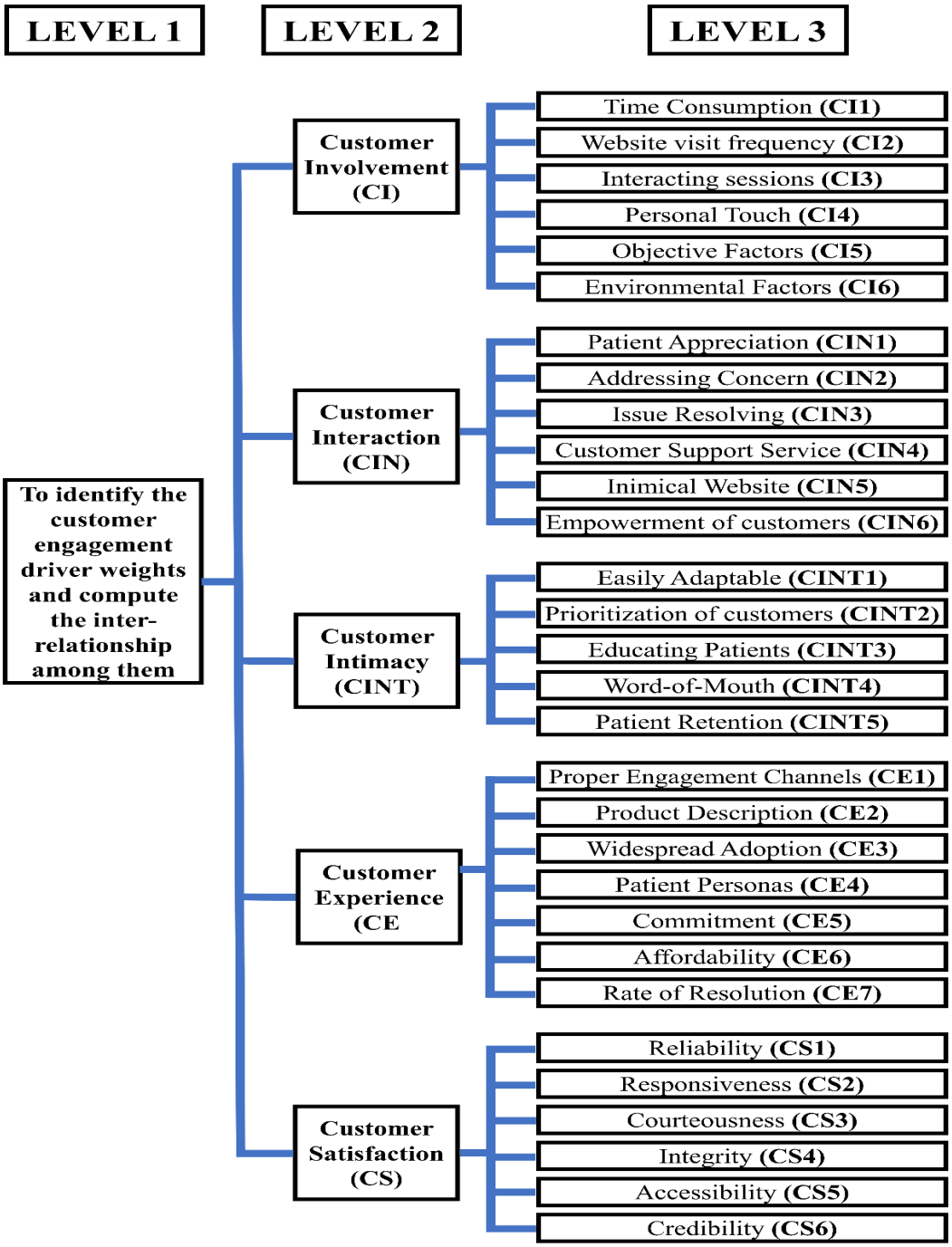

LEVEL 1
LEVEL 2
LEVEL 3
To identify the customer engagement driver weights and compute the inter-relationship among them
Customer Involvement (CI)
Time Consumption (CI1)
Website visit frequency (CI2)
Interacting sessions (CI3)
Personal Touch (CI4)
Objective Factors (CI5)
Environmental Factors (CI6)
Customer Interaction (CIN)
Patient Appreciation (CIN1)
Addressing Concern (CIN2)
Issue Resolving (CIN3)
Customer Support Service (CIN4)
Inimical Website (CIN5)
Empowerment of customers (CIN6)
Customer Intimacy (CINT)
Easily Adaptable (CINT1)
Prioritization of customers (CINT2)
Educating Patients (CINT3)
Word-of-Mouth (CINT4)
Patient Retention (CINT5)
Customer Experience (CE
Proper Engagement Channels (CE1)
Product Description (CE2)
Widespread Adoption (CE3)
Patient Personas (CE4)
Commitment (CE5)
Affordability (CE6)
Rate of Resolution (CE7)
Customer Satisfaction (CS)
Reliability (CS1)
Responsiveness (CS2)
Courteousness (CS3)
Integrity (CS4)
Accessibility (CS5)
Credibility (CS6)

Figure 3.5: Developed framework for eHealth adoption

***Table 3.8*: Comparison matrix of main categories**

	Customer Involvement	**Customer Interaction**	**Customer Intimacy**	**Customer Experience**	**Customer Satisfaction**
Customer Involvement	(1,1,1)	(0.25,0.33,0.5)	(0.2,0.25,0.33)	(2,3,4)	(1,1,1)
Customer Interaction	(2,3,4)	(1,1,1)	(1,2,3)	(0.2,0.25,0.33)	(0.2,0.25,0.33)
Customer Intimacy	(3,4,5)	(0.33,0.5,1)	(1,1,1)	(0.2,0.25,0.33)	(0.2,0.25,0.33)
Customer Experience	(0.25,0.33,0.5)	(3,4,5)	(3,4,5)	(1,1,1)	(0.25,0.33,0.5)
Customer Satisfaction	(1,1,1)	(3,4,5)	(3,4,5)	(2,3,4)	(1,1,1)

***Table 3.9*: Weights and ranking of overall criteria**

	Criteria		**Relative Preference Weight**	**Relative Rank**	**Local Weights**	**Local Rank**	**Global Weights**	**Global Rank**
1	**Customer Involvement (CI)**		**0.279638**	**2**				
1.1	Time Consumption	(CI1)			0.296168	2	0.0828	4
1.2	Website visit Frequency	(CI2)			0.15975	3	0.0446	8
1.3	Interacting Sessions	(CI3)			0.044799	5	0.0125	19
1.4	Personal factors	(CI4)			0.129696	4	0.0362	10
1.5	Objective factors	(CI5)			0.331527	1	0.0927	2
1.6	Environmental Factors	(CI6)			0.03806	6	0.0106	20
2	**Customer Interaction (CIN)**		**0.333522**	**1**				
2.1	Patient appreciation	(CIN1)			0.203249	3	0.0677	7
2.2	Addressing concerns	(CIN2)			0.258679	2	0.0862	3
2.3	Issue resolving	(CIN3)			0.07951	5	0.0265	16

2.4	Customer support service	(CIN4)			0.039112	6	0.0130	18
2.5	Inimical website	(CIN5)			0.119128	4	0.0397	9
2.6	Empowerment of customer	(CIN6)			0.30032	1	0.1001	1
3	**Customer Intimacy (CINT)**		**0.255368**	**3**				
3.1	Easily Adaptable	(CINT1)			0.131214	1	0.033508	12
3.2	Prioritization of customers	(CINT2)			0.300845	4	0.076826	5
3.3	Educating Patient	(CINT3)			0.131214	2	0.033508	13
3.4	Word-of-mouth	(CINT4)			0.1358826	3	0.034700	11
3.5	Patient Retention	(CINT5)			0.300845	5	0.076826	6
4	**Customer Experience (CE)**		**0.092279**	**4**				
4.1	Proper Engagement Channels	(CE1)			0.026955	6	0.0024	29
4.2	Product Description	(CE2)			0.180393	3	0.0166	17
4.3	Widespread adoption	(CE3)			0.307367	2	0.0283	15
4.4	Patient Personas	(CE4)			0.315098	1	0.0290	14
4.5	Commitment	(CE5)			0.006663	7	0.0006	30
4.6	Affordability	(CE6)			0.105454	4	0.0097	22
4.7	Rate of resolution	(CE7)			0.05807	5	0.0053	25
5	**Customer Satisfaction (CS)**		**0.039192**	**5**				
5.1	Reliability	(CS1)			0.116507	3	0.004566	26
5.2	Responsiveness	(CS2)			0.183337	2	0.007185	24

5.3	Courteousnes s	(CS3)			0.246714	6	0.009669	23
5.4	Integrity	(CS4)			0.110096	4	0.004315	27
5.5	Accessibility	(CS5)			0.092965	5	0.003643	28
5.6	Credibility	(CS6)			0.250381	1	0.009813	21

DEMATEL APPLICATION

The next step was to determine the relationships between all of the included drivers and the intensity of their cause and effect. The usual DEMATEL method, which was covered in the preceding section, was used for this purpose. The experts were once more asked to compare the relationships between the drivers, just as they did when calculating the driver weights. Each expert was invited to conduct independent comparisons, and a mean of all the expert evaluations for each comparison individually was then calculated to create an average direct relationship matrix.

Additionally, a normalised matrix **Table 3.7** was created for the drivers across all categories using the average matrix. As a result, the **Table 3.8** shows the total relation and the direct-indirect relationships for the value of r_i and c_j. The comparisons were employed by using the normal technique outlined in the preceding section.

Table 3.10*:* Normalised matrix of main criteria

	CI	**CIN**	**CINT**	**CE**	**CS**
CI	**0**	0.3125	0.25	0.1875	0.125
CIN	0.3125	**0**	0.3125	0.1875	0.1875
CINT	0.0625	0.1875	**0**	0.125	0.0625
CE	0.125	0.1875	0.0625	**0**	0.0625
CS	0.25	0.1875	0.125	0.125	**0**

Table 3.11: Total relation and direct-indirect relation matrix of main criteria

Main Criteria	CI	CIN	CINT	CE	CS	R_i	$R_i + C_j$	$R_i - C_j$
CI	0.449	**0.759**	**0.684**	**0.550**	0.401	2.842	5.289	0.395
CIN	**0.729**	**0.570**	**0.768**	**0.586**	**0.470**	3.124	5.938	0.31
CINT	0.311	0.436	0.262	0.325	0.220	1.553	4.123	-1.017
CE	0.374	0.454	0.341	0.226	0.230	1.624	3.752	-0.504
CS	**0.585**	**0.595**	**0.515**	0.441	0.244	2.381	3.946	0.816
C_j	2.447	2.814	2.570	2.128	1.565	**Threshold value = 0.461**		

RO3: To understand the relationship between the factors of customer engagement affecting adoption of eHealth in India.

The ISM technique was employed in this study to fulfill the research objective, drawing on its foundational mathematical principles elucidated by Harary, Norman, and Cartwright in 1965 (Harary et al., 1965). Across diverse domains such as management, global supply chains, higher technical education, rural management, value co-creation, and responses to Covid-19, ISM has been extensively utilized to uncover the interconnections among various drivers, facilitators, and hindrances (Digalwar et al., 2020; Raut et al., 2018; Raut et al., 2017; Kumar et al., 2008; Roy Ghatak et al., 2020; Sharma et al., 2023; Sharma et al., 2022; Tariyal et al., 2020). The research methodology adopted in the present study is depicted schematically in Fig. 3.6. The following outlines the various steps utilized in the ISM technique to analyze the barriers to customer engagement in eHealth adoption in India.

STEP 1: IDENTIFICATION OF BARRIERS

Various obstacles hindering customer engagement in India's eHealth sector have been identified through a comprehensive literature review and expert consultations. These sources encompassed books detailing eHealth initiatives implemented in India, research papers authored by renowned experts, newspaper articles primarily focusing on government initiatives like Yojna by the Government of India (GoI), and official government websites managed by the Ministry of Health and Family Welfare, designed by GOI, and developed and hosted by the

National Informatics Center (NIC). The review period spanned from September 2007 to August 2022.

Subsequently, focus group discussions (FGDs) were conducted to validate these barriers and identify any additional ones. FGDs involve small groups of six to ten participants engaging in open discussions under the guidance of a moderator (Morgan et al., 1996). In this study, eight to ten respondents per FGD, comprising practicing eHealth professionals, academicians, and their research scholars engaged in eHealth research in India, participated in six FGDs. Participants were selected through judgmental and convenient sampling from hospitals and educational institutions across India, aiming for a diverse representation of cultural and geographic backgrounds. Each FGD, conducted between September 2022 and November 2022, lasted between forty minutes to an hour. The outcome of these discussions finalized the 30 customer engagement barriers identified in the literature, with the key contribution being the identification of five groups for these thirty barriers.

STEP 2: ESTABLISHING CONTEXTUAL RELATIONSHIPS

To explore the contextual interconnections among the diverse barriers to customer engagement, a relationship matrix was formulated. This matrix was constructed based on insights gathered from open-ended and semi-structured interviews conducted with academic and hospital experts in electronic healthcare. In this matrix, the categorized factors are denoted as "I" and "J" in the current study. While Group "J" encompasses all factors arranged horizontally, Group "I" comprises all factors arranged vertically.

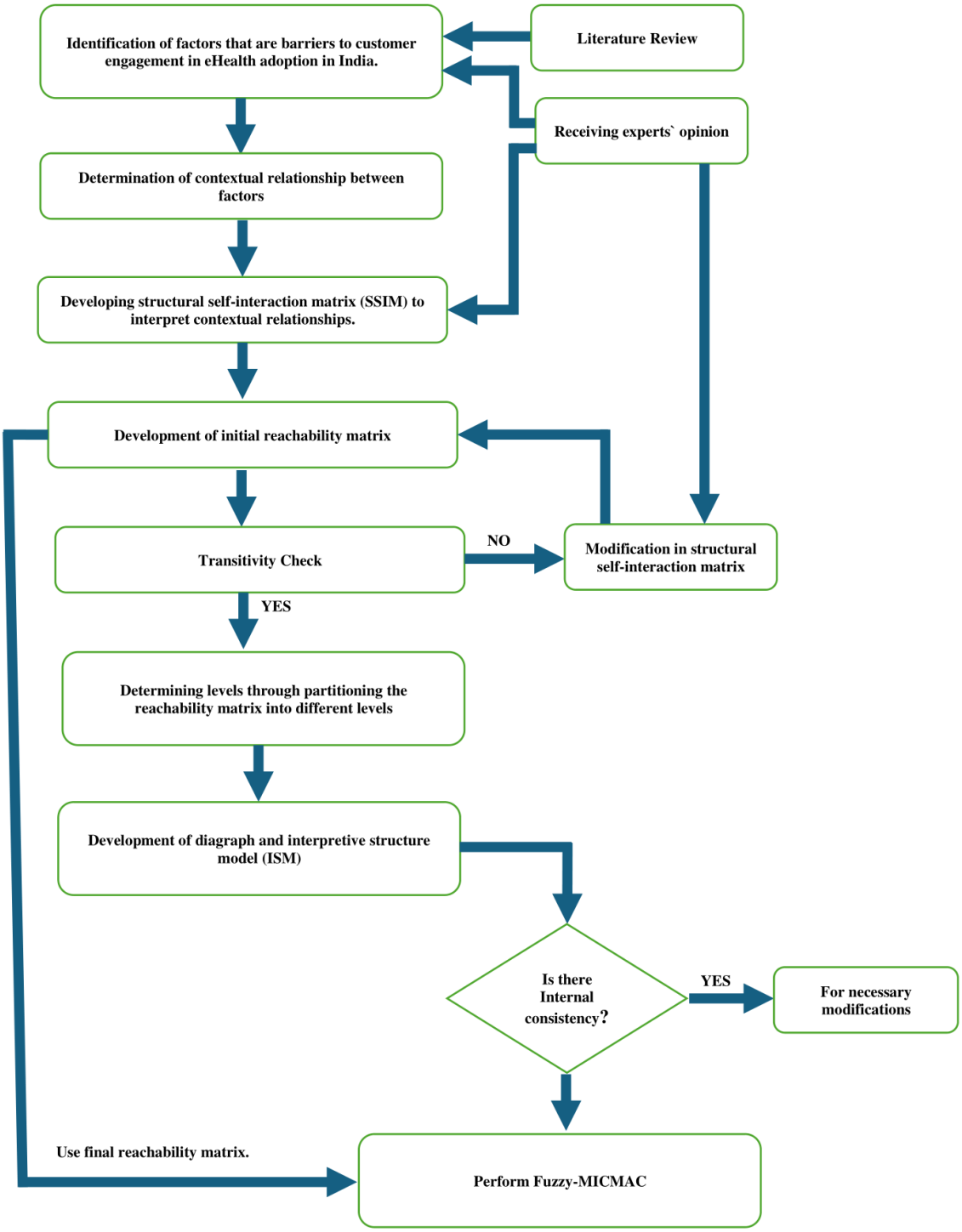


Figure 3.6: Preparation of ISM flowchart

STEP 3: UTILIZING THE STRUCTURAL SELF-INTERACTION MATRIX (SSIM) TO INTERPRET CONTEXTUAL RELATIONSHIPS

Interviews were conducted with a diverse group of 40 experts, including senior doctors (12), government officials (5), professors (8), research scholars (8), and patients (7), all of whom possessed expertise in or experience using eHealth. This sample size was deemed appropriate based on previous research suggesting that for this methodology, a sample size ranging from eight to forty-two experts is sufficient (Janes, 1988). Thirty interviews were conducted face-to-face, while the remaining were conducted via telephone, each lasting between 25 and 30 minutes. During the interviews, respondents were briefed on the main objectives of the study and were asked to specify the type of relationship existing between the barriers. Activities such as data extraction, data presentation, and conclusion drawing/verification were employed to analyze the collected data (Kumar et al., 2008; Pandey et al., 2022).

Four major symbols were utilized to represent the various types of interactions among drivers in the development of the Structural Self-Interaction Matrix (SSIM), as depicted in Table 1: "V" denotes "I leads to J," "A" denotes "J leads to I," "X" denotes "I leads to J and vice versa," and "O" denotes "no relationship between I and J." The Structural Self-Interaction Matrix (SSIM) is presented in Table 3.9.

STEP 4: FORMATION OF THE INITIAL REACHABILITY MATRIX

To create the Initial Reachability Matrix (IRM), all symbols from the Structural Self-Interaction Matrix (SSIM) are converted into binary digits. The symbols A, V, X, and O from the previous chart are represented by the numbers 0 and 1. These binary digits indicate the presence or absence of direct reachability connections between factors. The connections between factors are then depicted under groups I and J, reflecting the direct influence relationships within the system.

STEP 5: DEVELOPING FINAL REACHABILITY MATRIX THROUGH TRANSITIVITY CHECK

The final matrix is generated by examining the initial matrix for compliance with the transitivity rule. While interpretive logic and expertise form the basis for its development, the transitivity rule is enforced to ensure coherence. Following this rule, if factor A influences

factor B and factor B influences factor C, then factor A also influences factor C. Any modifications needed to enforce transitivity entail altering entries from 0 to 1 in the matrix. Table 3.10 illustrates the final Reachability Matrix, which outlines the direct and indirect causal connections between factors subsequent to the transitivity check.

Table 3.12: Initial Reachability Matrix.

	CIB1	CIB2	CIB3	CIB4	CIB5	CIB6	CINB1	CINB2	CINB3	CINB4	CINB5	CINB6	CINTB1	CINTB2	CINTB3	CINTB4	CINTB5	CEB1	CEB2	CEB3	CEB4	CEB5	CEB6	CEB7	CSB1	CSB2	CSB3	CSB4	CSB5	CSB6
CIB1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
CIB2	1	0	1	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1
CIB3	1	1	0	1	1	1	0	0	1	0	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0
CIB4	1	1	0	0	1	1	0	0	0	0	0	1	1	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0
CIB5	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0
CIB6	1	1	0	0	1	0	1	1	1	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0
CINB1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	1
CINB2	0	1	1	1	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	1
CINB3	0	1	1	1	0	0	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CINB4	0	0	1	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CINB5	1	0	1	0	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CINB6	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	0	1	0	0	1	1	1	0	0	1	1	1	1	1	1
CINTB1	0	1	0	0	1	1	1	0	0	0	1	1	0	1	0	0	0	1	0	0	1	1	1	0	0	1	1	1	0	0
CINTB2	0	1	1	0	1	0	1	1	1	1	1	0	0	0	0	0	1	1	0	0	0	0	0	1	1	1	1	0	0	1
CINTB3	0	1	1	0	1	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0
CINTB4	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	1	0	1	0	0
CINTB5	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0
CEB1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	0	1	0	1	1
CEB2	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1
CEB3	1	0	1	0	1	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
CEB4	0	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0
CEB5	0	1	0	1	0	0	1	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0
CEB6	0	0	1	0	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0
CEB7	0	0	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0
CSB1	0	1	0	1	1	1	1	0	0	0	1	1	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0
CSB2	0	0	0	1	0	0	1	1	0	0	1	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	1	1
CSB3	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	1	0	1	0	1
CSB4	0	1	1	1	1	0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	1	0	0	1	1
CSB5	1	1	1	1	1	0	1	1	0	0	0	0	0	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	1
CSB6	1	0	1	1	0	1	1	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0

Table 3.13: Level partition of reachability matrix.

Factors	Reachability set	Antecedent set	Intersection set	Level
Less activity Time (CIB1)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	I
Less Page Visit Frequency (CIB2)	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	II
Lack of Communication involvement (CIB3)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	I
Lack of Personal factors (CIB4)	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	II
Lack of Object factors (CIB5)	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	II
Lack of Situational factors (CIB6)	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	II
Lack of Patient appreciation (CINB1)	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 66	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	II
Lack of Address concerns (CINB2)	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CINTB4, CEB2, CEB3, CEB7, CSB3, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CINTB4, CEB2, CEB3, CEB7, CSB3, CSB5, CSB 6	II
Lack of resolving issue (CINB3)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	I
Lack of Customer support (CINB4)	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CINTB4, CEB2, CEB3, CEB5, CEB7, CSB4, CSB5	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB4, CSB5, CSB 6	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CINTB4, CEB2, CEB3, CEB5, CEB7, CSB4, CSB5	III
Availability of inimical website (CINB5)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	I
Lack of customer empowerment (CINB6)	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2 , CINB4 , CINB6, CINTB4, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3,	CIB1, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CINTB4, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5	II

		CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6		
Lack of Adaptability (CINTB1)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 8	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 8	**I**
Lack of Customer centric policies (CINTB2)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 9	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 9	**I**
Patient training (CINTB3)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 10	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 10	**I**
Word-of-mouth sentiment (CINTB4)	CINB4 , CINTB4, CEB2, CEB5, CEB7	CIB1, CIB3, CINB2 ,CINB3, CINB4 ,CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB4, CSB5, CSB 6	CINB4 , CINTB4, CEB2, CEB5, CEB7	**III**
Lack of Customer churn (CINTB5)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 12	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 1	**I**
Lack of Engagement Channels (CEB1)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 1	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 1	**I**
Need of Product Portfolio (CEB2)	CINB4, CINTB4, CEB5, CEB7	CIB1, CIB2, CIB3, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CINB4, CINTB4, CEB5, CEB7	**IV**
Shortfall in Usage Patterns (CEB3)	CIB2, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB2, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	**II**
Deficit of Customers Personas (CEB4)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	**I**
Lack of commitment (CEB5)	CINB4 , CINTB4, CEB2, CEB5, CEB7	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB3, CINB4 ,CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CINB4 , CINTB4, CEB2, CEB5, CEB7	**III**
Inconvenient access to support (CEB6)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 8	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 8	**I**
Low first call resolution rate (CEB7)	CINB4 , CINTB4, CEB2, CEB5, CEB7	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2 ,CINB3, CINB4 ,CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB4, CSB5, CSB 6	CINB4 , CINTB4, CEB2, CEB5, CEB7	**III**

Reliability (CSB1)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	**I**
Lack of Responsiveness (CSB2)	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	**I**
Courteous towards patient (CSB3)	CIB2, CIB4, CIB5, CIB6, CINB1, CINB2, CINB6, CEB2, CEB3, CEB5, CSB3, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB2, CIB4, CIB5, CIB6, CINB1, CINB2, CINB6, CEB2, CEB3, CEB5, CSB3, CSB5, CSB 6	**II**
Lack of Security (CSB4)	"CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	"CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	**I**
Accessibility (CSB5)	CIB2, CIB4, CIB5, CIB6, CINB2, CINB4, CINB6, CINTB1, CINTB4, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB2, CIB4, CIB5, CIB6, CINB2, CINB4, CINB6, CINTB1, CINTB4, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	**II**
Absence of Credibility (CSB6)	CIB2, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4, CINB6, CINTB2, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	CIB1, CIB2, CIB3, CIB4, CIB5, CIB6, CINB1, CINB2, CINB3, CINB4, CINB5, CINB6, CINTB1, CINTB2, CINTB3, CINTB4, CINTB5, CEB1, CEB2, CEB3, CEB4, CEB5, CEB6, CEB7, CSB1, CSB2, CSB3, CSB4, CSB5, CSB 6	CIB2, CIB4, CIB5, CIB6, CINB1, CINB2, CINB4 , CINB6, CINTB2, CEB2, CEB3, CEB5, CEB7, CSB3, CSB5, CSB 6	**II**

STEP 6: DETERMINING LEVELS THROUGH LEVEL PARTITIONING

The level partitioning is used to better understand the placement of barriers level-wise.
The “Reachability” and “Antecedent sets” for each barrier are determined by the Level Partition. A certain level is assigned to factors that share an intersection set and a reachability set. Each level is divided into different iterations based on where it is located. The various iteration and level sets depict the percentage of different factors’ dependence or independence. As seen in Table 3.11.

Table 3.14: Possibility of reachability.

Possibility of reachability	No	Very low	Low	Medium	High	Very high	Full

Membership grades	0	0.1	0.3	0.5	0.7	0.9	1

STEP 7: DEVELOPMENT OF DIAGRAPH AND INTERPRETIVE STRUCTURE MODEL (ISM)

Through level partitioning, the hierarchy of drivers in the Interpretive Structural Modeling (ISM) is revealed. As depicted in Figure 3.7, the ISM model is constructed from the parametric formation of the ultimate reachability matrix. The diagram is derived from the partitioning of levels and then the removal of transitivity. This process allows researchers to visualize the hierarchical structure of factors and their interrelationships within the system. By removing transitivity and organizing factors into distinct levels, the ISM model provides a clear representation of the complex relationships among drivers.

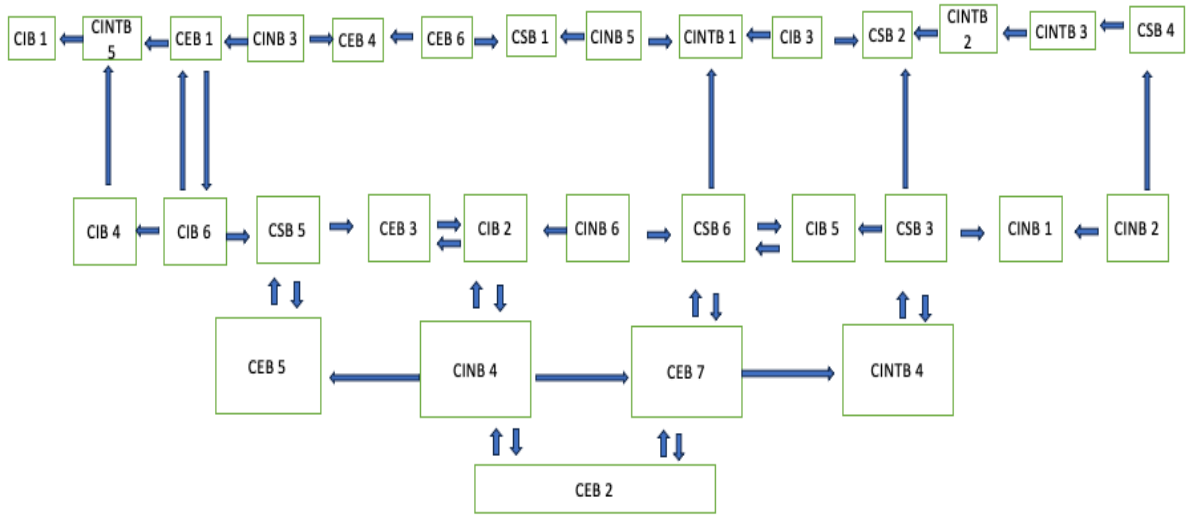


Fig 3.7: ISM based model of eHealth customer engagement

FUZZY-MICMAC ANALYSIS

The conception of Fuzzy- MICMAC is originated by Duperrin and Godet in 1973. This method can be used to locate and examine com- ponents of a complex system as well as to evaluate the

interdependence and driving force of the variables (Faisal et al., 2008; Kumar et al., 2019; Sengar et al., 2020; Sharma et al., 2023; Sharma et al., 2022;). The issue with the ISM process is that it fails to capture the strength of the bonding in between two factors, which can range from strong to medium to low. The fuzzy MICMAC employs the ISM model to address this issue, and studies by Kandel (1986), Abbasi and Arya (2000), and Gorane and Kant (2013) provide clear explanations of how it operates. By setting all of its diagonal elements to 0, the initial reachability matrix is used to create the binary direct relationship matrix (BDRM). As shown in **Table 3.15**, the grades for the relationship between the factors' membership can be determined by qualitative reflection on a scale of 0–1. Fuzzification is utilized to obtain membership grades from academic and industry experts with a variety of backgrounds using the innumerable expert direct method. Utilizing BDRM and the membership grades, fuzzy direct relationship matrix (FDRM) is produced in **Table 3.16.** Then the stabilised matrix yielded the final driver-dependence matrix Refer Fig. 3.8.

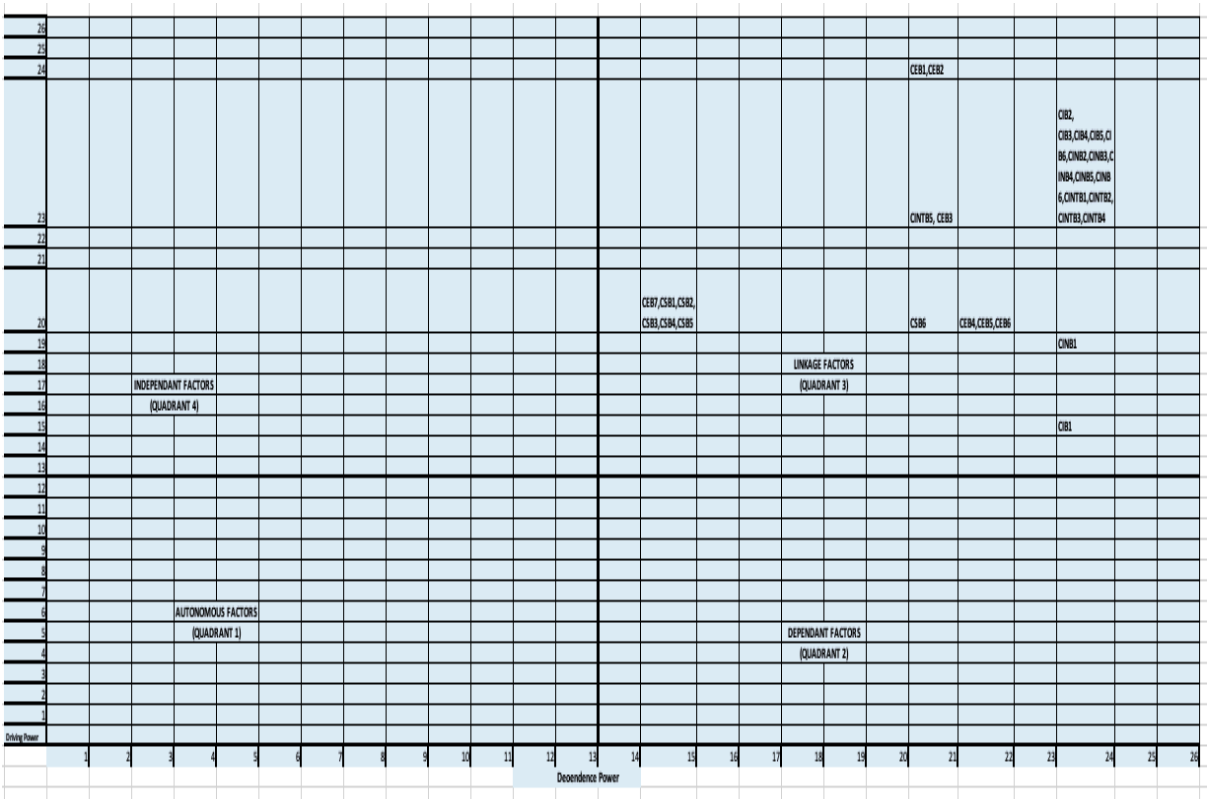


Figure 3.8: Fuzzy-MICMAC based model of eHealth customer engagement barriers.

Table 3.15: Possibility of reachability

Possibility of reachability	No	Very low	Low	Medium	High	Very high	Full
Membership grades	0	0.1	0.3	0.5	0.7	0.9	1

Table 3.16: Fuzzy direct reachability matrix

	CI B1	CI B2	CI B3	CI B4	CI B5	CI B6	CIN B1	CIN B2	CIN B3	CIN B4	CIN B5	CIN B6	CIN TB1	CIN TB2	CIN TB3	CIN TB4	CIN TB5	CE B1	CE B2	CE B3	CE B4	CE B5	CE B6	CE B7	CS B1	CS B2	CS B3	CS B4	CS B5	CS B6
CIB1	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5
CIB2	0.5	0	0.5	0.5	0.5	0.5	0.5	0.9	0.9	0.1	0.1	0.1	0.9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.7
CIB3	0.5	0.5	0	0.5	0.5	0.5	0.1	0.1	0.9	0.1	0.1	0.1	0.9	0.9	0.1	0.1	0.1	0.7	0.7	0.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1
CIB4	0.5	0.5	0.1	0	0.5	0.5	0.1	0.1	0.1	0.1	0.1	0.9	0.9	0.9	0.1	0.1	0.7	0.1	0.1	0.7	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
CIB5	0.5	0.5	0.1	0.1	0	0.1	0.5	0.9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7	0.7	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.1
CIB6	0.5	0.5	0.1	0.1	0.5	0	0.5	0.9	0.9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7	0.7	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.1
CIN B1	0.1	0.5	0.5	0.5	0.1	0.1	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7	0.1	0.1	0.7	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7
CIN B2	0.1	0.5	0.5	0.5	0.5	0.1	0.5	0	0.9	0.9	0.9	0.1	0.9	0.9	0.1	0.1	0.7	0.1	0.7	0.7	0.3	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.7
CIN B3	0.1	0.9	0.9	0.9	0.1	0.1	0.9	0.9	0	0.9	0.9	0.1	0.9	0.9	0.9	0.1	0.7	0.7	0.7	0.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.7
CIN B4	0.1	0.1	0.9	0.1	0.1	0.1	0.9	0.9	0.9	0	0.9	0.9	0.9	0.9	0.9	0.9	0.7	0.7	0.7	0.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.7
CIN B5	0.9	0.1	0.9	0.1	0.1	0.9	0.9	0.1	0.9	0.9	0	0.9	0.9	0.9	0.9	0.9	0.7	0.7	0.7	0.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.7
CIN B6	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.1	0.9	0.9	0	0.9	0.1	0.1	0.1	0.7	0.1	0.1	0.7	0.3	0.3	0.1	0.1	0.3	0.3	0.3	0.3	0.3	0.7
CIN TB1	0.1	0.9	0.1	0.1	0.9	0.9	0.9	0.1	0.1	0.1	0.3	0.3	0	0.3	0.1	0.1	0.1	0.7	0.1	0.1	0.3	0.3	0.3	0.1	0.1	0.3	0.3	0.3	0.1	0.1
CIN TB2	0.1	0.9	0.9	0.1	0.9	0.1	0.9	0.3	0.3	0.3	0.3	0.1	0.1	0	0.1	0.1	0.7	0.7	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.1	0.1	0.7
CIN TB3	0.1	0.9	0.9	0.1	0.9	0.9	0.9	0.1	0.3	0.3	0.1	0.3	0.3	0.3	0	0.3	0.7	0.7	0.7	0.7	0.3	0.3	0.1	0.1	0.3	0.3	0.3	0.1	0.1	0.1
CIN TB4	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.1	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0	0.7	0.7	0.7	0.7	0.1	0.1	0.1	0.1	0.3	0.1	0.3	0.1	0.1	0.1
CIN TB5	0.9	0.9	0.9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.3	0.1	0	0.1	0.1	0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.1	0.1
CEB 1	0.9	0.9	0.9	0.9	0.1	0.1	0.9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0.7	0.7	0.1	0.1	0.9	0.5	0.5	0.1	0.5	0.1	0.5	0.7
CEB 2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.3	0.3	0.3	0.1	0.3	0.3	0.3	0.3	0.1	0.7	0.7	0	0.7	0.9	0.1	0.9	0.5	0.5	0.1	0.1	0.5	0.5	0.7

CEB 3	0.9	0.1	0.9	0.1	0.9	0.9	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.1	0.1	0.1	0.7	0.1	0.1	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.1
CEB 4	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.3	0.7	0.1	0.1	0.1	0.1	0.1	0.7	0.1	0.1	0.7	0	0.9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
CEB 5	0.1	0.3	0.1	0.3	0.1	0.1	0.3	0.3	0.3	0.1	0.1	0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.7	0.1	0.1	0	0.9	0.1	0.5	0.5	0.1	0.1	0.1	0.1
CEB 6	0.1	0.1	0.3	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	0	0.5	0.5	0.5	0.1	0.5	0.5	0.1
CEB 7	0.1	0.1	0.3	0.1	0.3	0.3	0.3	0.3	0.1	0.3	0.7	0.7	0.7	0.1	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	0.9	0	0.5	0.5	0.5	0.5	0.5	0.1
CSB 1	0.1	0.3	0.1	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.7	0.7	0.7	0.1	0.1	0.1	0.7	0.7	0.1	0.7	0.1	0.1	0.1	0.1	0	0.1	0.1	0.5	0.1	0.1
CSB 2	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.3	0.1	0.1	0.7	0.1	0.1	0.1	0.1	0.1	0.7	0.1	0.1	0.7	0.1	0.9	0.1	0.1	0.5	0	0.1	0.1	0.5	0.7
CSB 3	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7	0.1	0.1	0.7	0.1	0.9	0.1	0.1	0.5	0.5	0	0.5	0.1	0.7
CSB 4	0.1	0.3	0.3	0.3	0.3	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.7	0.1	0.7	0.7	0.1	0.7	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0	0.5	0.7
CSB 5	0.3	0.3	0.3	0.3	0.3	0.1	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.7	0.7	0.7	0.7	0.1	0.7	0.7	0.1	0.1	0.1	0.1	0.5	0.1	0.5	0.5	0	0.7
CSB 6	0.3	0.1	0.3	0.3	0.1	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.7	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0

RO4: To propose solution towards the improvement in customer engagement for the adoption of eHealth in India.

QUALITATIVE RESEARCH

We opted for a qualitative research approach due to the nature of our research questions, which focus on understanding experiences, meanings, and perspectives primarily from the viewpoint of the participants. These types of data are often difficult to quantify or measure. Our qualitative research methods encompass various techniques, including small-group discussions to explore beliefs, attitudes, and normative behaviors, semi-structured interviews to gather focused views or insights from key informants, and in-depth interviews aimed at understanding personal experiences, conditions, or events. Additionally, we employ text and document analysis, such as examining government reports, media articles, websites, or diaries, to uncover distributed or private knowledge. Given the emphasis on exploring processes, understanding the "how" and "what," and providing rich descriptions of phenomena, qualitative research aligns well with our research problem and objectives (Creswell, 2014).

DATA COLLECTION

In our research study, we adopted an inductive approach to derive meanings from the interview data, aiming to identify patterns and relationships to develop a theory. Inductive content analysis, as one method within qualitative research, involves gathering and analyzing data without preconceived categories or theories. This approach provides flexibility, allowing the data to guide the analysis process and uncover emerging patterns, themes, and concepts (Patton, 1990). To enhance the validity of our research findings, we employed triangulation by collecting data from multiple sources. Interviews were conducted with three distinct groups: 1) patients or customers, 2) health professionals or doctors, and 3) healthcare researchers or industry personnel, using open-ended questionnaires. Additionally, interactions observed during interviews at various organizations were documented for inclusion in the analysis. Recognizing the critical role of data collection and analysis in the success or failure of research, we carefully selected appropriate methodologies to ensure the integrity and reliability of our findings.

INTERVIEWS

A qualitative research interview serves the purpose of delving into a person's experiences or perspectives on a specific subject, which may not be accessible through other methods. Through interviews, researchers can uncover individuals' thoughts, feelings, and intentions, as their narratives often contain valuable information that addresses research questions and elucidates phenomena of interest (Polit and Beck, 2004). Typically conducted between a participant and a researcher, interviews can take place face-to-face, over the telephone, or through other electronic means. Patton (2015) offers guidance on conducting interviews to facilitate interaction, maintain objectivity, control bias, and enhance the quality of collected data. It is imperative to respect the participant's perspective throughout the interview process to avoid researcher bias influencing the questions posed and responses provided. Open-ended questions are utilized to allow participants space for reflection and to respond naturally, while maintaining clarity in the line of questioning to prevent confusion. Active listening is another crucial skill employed during the interview process, enabling the researcher to ask pertinent follow-up questions and ensuring the interviewee feels valued and attended to from start to finish. The secondary dataset utilized in this thesis comprises 26 semi-structured interviews collected from three different questionnaires.

SCHEDULE

The schedule serves as the primary data collection tool utilized during the interview process. It consists of questions, statements (from which opinions are obtained), and blank spaces/tables to record responses from respondents. When constructing a schedule, careful consideration is given to the sequence of questions, the wording of response categories, the administration technique, as well as the introduction and explanation of the interview. The overarching goal of the ongoing review is to identify strategies and propose solutions for improving the adoption and implementation of eHealth in India. These issues need to be addressed not only from the perspective of customers or patients but also from the viewpoints of doctors, health researchers, and industry professionals to yield effective outcomes. With these objectives in mind, questionnaires were developed with a focus on thorough survey writing and well-qualified assessment (refer to Appendix A). Three questionnaires were designed to collect responses from patients or customers, health professionals or doctors, and healthcare researchers or industry personnel, emphasizing the challenges they face with the aim of resolving them. The

questionnaires primarily consisted of open-ended questions to elicit detailed or diverse responses. To ensure the validity of the questionnaires, they underwent testing for face and content validity by seeking the opinions of three academicians and five respondents working in the eHealth field. This process resulted in improvements to both the syntax and semantics of the questionnaire language, as well as modifications to the presentation of questions to enhance accuracy in responses. The schedule was designed to align with theoretical frameworks while avoiding biased opinions and maintaining relevance. The questionnaires and their corresponding sections were as follows:

- Twenty open-ended questions made up the first set of questionnaires, which were exclusively available to doctors. It is essentially divided into three sections: first, general information on eHealth and its barriers; second, barriers that doctors and their patients face during adoption; and third, suggestions and strategies for improved adoption and implementation.
- It contained fifteen open-ended questions designed specifically for the patients. There are fewer questions on this form because I was more conscious of getting patients involvement and learning about their reactions and fears related to adopting electronic health. The events from real life that they encounter while adopting it. In essence, what adjustments must be made, how patients should be aware for undertaking new interventions.
- The third was intended for eHealth researchers, mostly those employed by research institutes and companies. Again, there are twenty sets of questions in this. The questionnaire is structured into four sections: first, it asks basic questions regarding eHealth and its barriers; second, it includes TAM (Technology Acceptance Model) constraints to help understand the real-world applications of theory when accepting novel interventions. Thirdly, studies that have been conducted so far and those that are ongoing for improvement. Fourthly, in order to improve eHealth adoption in India, the strategies and solutions must be put into practice.

PILOT TESTING

A pilot study, as undertaken by a researcher, serves the purpose of practicing and evaluating the effectiveness of data collection and analysis techniques (Doody, 2015). It allows the researcher to refine and adjust the focus of the study as needed, leading to a better

understanding of the research endeavor. The primary benefit of conducting a pilot study is to provide the researcher with valuable insights into areas requiring adjustments before proceeding with the main study (Kim, 2011). In accordance with these considerations, a pilot study was conducted specifically involving doctors and eHealth researchers. It's important to note that the responses from the pilot study participants are not included in the main study sample. The pilot study involved 7 respondents, including 4 researchers and 3 doctors. Two key insights emerged from the pilot study, which were subsequently implemented in the main study:

- Not only the schedule but also the questions should be different for different types of respondents as it will be easy for understanding the reality of the adoption scenario in India.
- Instead of focusing on theoretical topics, the patient should ask more about practical issues that arise when adopting electronic health.

During the pilot study, discussions surrounding the questions proved invaluable in enhancing their quality. This process led to improvements in various aspects, including the wording of questions, the addition or deletion of relevant or irrelevant questions, and rephrasing questions to mitigate ambiguity or vagueness. As a result, the questions became more concise and aligned with the desired research objectives. Based on the insights gained from the pilot study, adjustments were made to the final questionnaire to eliminate any potential biases and minimize the occurrence of erroneous responses. This iterative process of refinement ensured that the questionnaire used in the main study was well-designed and effective in capturing the necessary data accurately.

SAMPLING

Sampling is a pivotal aspect of research design, particularly in qualitative research where it plays a crucial role in identifying specific features of a phenomenon of interest. In a research context, sampling refers to the process of selecting a subset of items from a defined population for inclusion in a study. Qualitative research often involves the investigation of groups of people, specific events or activities, or organizations to gain a deeper understanding of the

broader phenomenon being studied (Miles and Huberman, 1994). In qualitative sampling, researchers typically employ selective or subjective sampling methods, where the selection of participants relies on the researcher's judgement. **Judgement sampling**, as it's commonly known, involves selecting participants based on the researcher's discretion and judgement. This method allows researchers to choose individuals who are deemed most suitable or relevant to the research topic, or who possess certain characteristics that are of interest to the study (Marshall, 1996). It is often employed when researchers seek to gather insights from individuals who are considered experts or who have direct experience with the phenomenon under investigation. One of the advantages of judgement sampling is its efficiency and cost-effectiveness, as it allows researchers to quickly gather a diverse range of perspectives without the need for extensive resources. However, it's important for researchers to be mindful of potential biases that may arise from this sampling method and to consider the limitations associated with selecting participants based on subjective judgement.

TARGET POPULATION

The respondents selected for the present study are individuals who possess extensive knowledge, expertise, and proficiency in the field of electronic health (eHealth). Given that the research encompasses the entire landscape of eHealth adoption in India, it is crucial to gain insights from various stakeholders who play specific roles in this domain. By including respondents representing different facets of the eHealth ecosystem, such as healthcare professionals, industry experts, policymakers, and researchers, the study aims to capture diverse perspectives and experiences. These stakeholders are well-positioned to provide valuable insights into the challenges, opportunities, and best practices associated with eHealth adoption in India.

By soliciting feedback from these knowledgeable individuals, the research endeavors to develop a comprehensive understanding of the factors influencing eHealth adoption and to identify strategies for enhancing its implementation. Their input is instrumental in shaping the recommendations and implications of the study, ultimately contributing to the advancement of eHealth initiatives in India.

SAMPLE SIZE

In qualitative research, achieving data saturation is paramount as it ensures a comprehensive understanding of the phenomenon under investigation. As emphasized by Miles and Huberman (1994), there is no perfect sampling method, and data saturation lies at the heart of any qualitative technique. Sample size plays a crucial role in determining the depth and quality of a study's conclusions (Sandelowski, 1995). Broader research questions may require a larger sample size to reach saturation, whereas tightly focused studies risk being superficial regardless of sample size (Morse, 2000).Saturation is widely accepted as a methodological guideline, indicating that further data collection or analysis may not be necessary once no new substantive information emerges (Saunders, 2018). However, there is some uncertainty regarding how saturation should be conceptualized, leading to inconsistencies in its use.

In this study, twenty-six experts were contacted for data collection until saturation was achieved. Data was collected from different parts of India, including hospitals, research institutes, healthcare companies, and patients, covering the Northern, Western, Eastern, and Southern regions. This comprehensive approach allowed for a thorough examination of barriers to the adoption process across the country. In this study, data was collected until saturation was reached, such as data that was identical or overlapping. No more fresh inputs are been processed. The similar barriers, strategies and solutions are been given by the respondents from three of the groups. In this qualitative research, thematic saturation occurs when no new themes, patterns, or insights emerge from additional data collection or analysis. The data was reviewed continuously and nothing new information fails to offer new insights or perspectives. So, in this research new interviews or observations merely replicate what have already been found. Even new data consistently reaffirm existing patterns without introducing new information.

RESPONDENTS

We contacted a diverse group of individuals from the different locations through a combination of phone calls and emails. The consent form and pertinent participant information sheet were delivered to these individuals. Once they gave their approval and consented to the interview, it was conducted over the phone or in person, depending on what worked best for the respondents.

Total 21 doctors, 23 Researchers/industry personnel and 24 Patients/Customers overall were targeted out of which 7 doctors, 9 Researchers/Academicians and 10 Patients responded. Since various regions of a nation experience distinct situational barriers, taking this into account would be ideal for data analysis overall. Given the broad focus of this doctoral study on three distinct groups involved in the eHealth adoption process, namely:

1) **Patients or the customers.**
2) **Health professionals or the doctors.**
3) **Healthcare researchers or the industry personnel.**

This approach allowed for a comprehensive examination of the barriers faced by each group and the engagement strategies employed. By including a diverse range of participants, the study could capture a wide array of perspectives and experiences related to eHealth adoption in India.

Patients or the customers: In order to identify barriers and potential solutions, data on patients from all over India was gathered, primarily through doctors based on shared patient lists. Patients were also divided into urban and rural demographic groups based on their income levels; patients from hospitals where treatment and facilities are provided at no cost were included in order to see how they responded or utilised the technology. Patients from higher income brackets were also gathered in order to measure their level of engagement when better facilities are made available through technological advancements. Even friends, family, and relatives are first questioned about whether or not they have used electronic health services. If they have, they are then asked to share their positive or negative experiences. Another benefit of inquiring beforehand is that those who are utilising eHealth are able to clarify its benefits and drawbacks. Also different age groups are interviewed as it is related to new technology.

Health professionals or the doctors: The next portion of the timetable is for physicians, thus first a web search is conducted to identify the hospital names where medical services are provided electronically. The next step is visiting their website to identify the doctors and establishing a connection with them via LinkedIn. Occasionally, appointments for in-person interviews are made within secure rooms. Face-to-face interviews are conducted with doctors in order to obtain further information or gain a deeper understanding of the subject. In addition to being split into four Indian regions, the hospitals are further classified as urban or rural. Rural physicians encounter distinct patient populations than their metropolitan counterparts,

and they also encounter distinct challenges in practice. Regarding technological adoption, doctors are also categorised based on their age, experience, and the period of hours they prefer to spend learning the new technology. Moving to the hospitals who responded from northern region are Apollo hospital and AIIMS, eastern region is Mission Hospital, Narayana Hrudagalaya and from Southern region are from Rainbow children's hospital and Narayana group, also from western region MA (Mukhya Mantri Amratam) Center doctor.

Healthcare researchers or the industry personnel: Further moving to the third part of the schedule the data has been collected from the research institutes and healthcare industries. The interview from research institutes are been taken as researcher are the best to answer about the theoretical underpinning taken for this study. Also, the study on eHealth till now covered and further research in which part is need to be done. Coming to the eHealth industry they consists of the NGOs, government initiatives taken officials who are working for the betterment of eHealth adoption. The respondents are again divided in to zones, apart from western part (NGO and healthcare industry) rest all the interview are done face to face. The Southern part the Lead project development Officer from Benovyed healthcare is been interviewed. From the eastern zone Jadavpur University professor and IIT Dhanbad researcher who are doing research on eHealth are interviewed also research scientist from NICED research institute is been interviewed. IIT professor and associate professor doing research on health and UPHMIS employee is been interviewed from Northern part of India.

Table 3.17: The respondent Classification

Note: The names of participants and organisations are not disclosed due to agreed confidentiality.

Respondents	Respondents classification	Designation	Date of interview	Mode of interview	Total
Patients	All over India		July-November 2023	Face to face and Telephonic	10
Doctor	Hospital, Northern Part	Senior VP	September 2023	Face to face	7

Doctor	Hospital, Southern part	Group Chief information officer	August 2023	Face to face	
Doctor	Hospital, Northern part	Emergency Medicine	July 2023	Face to face	
Doctor	Hospital, Southern part	HOD (Neurology)	August 2023	Face to face	
Doctor	Hospital, Eastern part	Surgeon	October 2023	Face to face	
Doctor	Hospital, Eastern part	General practitioner	October 2023	Face to face	
Doctor	Hospital, Western part	General practitioner	August 2023	Telephonic	
Researcher	Healthcare Industry, Southern part	Lead project development Officer	August 2023	Face to face	9
Researcher	University, Eastern part	Professor	October 2023	Face to face	
Researcher	University, Eastern part	Dean academics	October 2023	Face to face	
Researcher	Research Institute, Eastern part	Scientist E	October 2023	Face to face	
Researcher	NGO, Western part	CEO & Founder	November 2023	Telephonic	
Researcher	Healthcare Industry, Northern part	Employee	July 2023	Face to face	
Researcher	University, Northern part	Associate Professor	September 2023	Face to face	
Researcher	University, Northern part	Professor	September 2023	Face to face	
Researcher	Healthcare Industry, Western part	Research Scientist	August 2023	Telephonic	

CHAPTER SUMMARY

In this chapter, an extensive discussion on the methodology applied to achieve the research objectives was presented. It outlined the data collection approach and the subsequent evaluation of this data using various methods. The chapter provided detailed explanations of the different analytical techniques utilized, including Fuzzy AHP, Sensitivity Analysis, DEMATEL, ISM, and Fuzzy MICMAC. The following chapter elaborates on the specific data collection methods and techniques, detailing the process of questionnaire development concerning eHealth adoption issues in India. Additionally, the results obtained from employing this methodology are thoroughly examined in the subsequent sections.

CHAPTER 4

RESULTS & DISCUSSIONS

OVERVIEW

In this chapter, the findings from the data analysis are presented, which involved the application of various statistical tools and techniques. The analysis proceeded in a specific order: Firstly, the Fuzzy Analytic Hierarchy Process (FAHP) was used to rank both eHealth adoption barriers and customer engagement barriers, followed by sensitivity analyses to assess the methodology's robustness. Secondly, the Decision Making Trial and Evaluation Laboratory (DEMATEL) method was employed to identify causal relationships among the barriers. Lastly, the Interpretive Structural Modeling (ISM) approach was utilized to understand the associations between different factors, along with a Fuzzy-MICMAC analysis to categorize these factors. This chapter focuses on addressing the initial three objectives outlined.

INTRODUCTION

The literature presents a diverse range of barriers to the deployment of eHealth in India, which are classified into eight categories, encompassing a total of thirty-seven sub-barriers. The findings indicate that barriers falling under the marketing category are particularly significant obstacles to the adoption of eHealth in the country. These marketing barriers are followed by others such as customer-related, administrative, organizational, regulatory, practitioner-related, and economic constraints.

Additionally, the policy mix, comprising both monetary and fiscal policies, plays a crucial role in driving growth and employment within the eHealth sector. In India, the HealthTech industry is experiencing rapid expansion, providing substantial value to consumers and enterprises alike. Projections suggest that the eHealth sector could reach a Gross Merchandise Value (GMV) of $9-12 billion by 2025 and $40 billion by 2030, presenting attractive opportunities for profitability. According to an analysis by Redseer, the Net Promoter Score (NPS) of India's eHealth sector increased by 47% in 2021, indicating a higher likelihood of customers

recommending eHealth platforms to others. Additionally, the survey reveals lower Customer Acquisition Costs (CAC), suggesting organic and profitable growth prospects for the sector. The performance of the eHealth industry is further characterized by features such as same-day deliveries and cross-selling, offering various growth pathways for players in the future.

RO1: To identify and evaluate the factors that affects the adoption of eHealth in India.

MARKETING BARRIERS (MB)

Marketing plays a crucial role in the successful implementation of eHealth initiatives in India. Among the various marketing barriers, customer engagement emerges as the most critical factor both locally and globally, across all categories and subcategories. Engaging and enrolling consumers or patients is essential to garner vital support for electronic health programs, facilitating their widespread adoption throughout the country. Therefore, a deeper understanding of marketing strategies is imperative to enhance customer engagement and ensure the effective dissemination of eHealth services (Alraja, 2022). Following customer engagement, customer loyalty ranks prominently in this category. Patient loyalty signifies an enduring emotional connection with the customer, resulting in their willingness to regularly engage with and utilize eHealth services. Leveraging eHealth loyalty as a by-product of a positive customer experience fosters trust and strengthens the bond between patients and healthcare services (Evers, 2006). Moreover, promoting the usage of eHealth services emerges as another significant marketing challenge in this category. The internet serves as a potent platform for cost-effective health promotion initiatives, offering vast potential for reaching and engaging with diverse audiences (Palmer, 2010). Overall, marketing barriers constitute a major obstacle to the implementation of eHealth in India, with two of the thirty-seven identified hurdles ranking among the top ten categories. Addressing these barriers is essential for overcoming implementation challenges and driving the widespread adoption of eHealth solutions across the country.

CUSTOMER-RELATED BARRIERS (CRB)

Customer-related barriers are identified as the second most critical barrier type, playing a pivotal role in the success of any service-oriented business. These barriers encompass various challenges, including the lack of data and system linkages, breakdowns in processes, misplaced focus, and neglect of essential components of the customer experience, all of which hinder the understanding of the customer journey (Ozair, 2016). Locally, customers' health consciousness emerges as the top-ranked barrier within this category, while globally, it ranks third. This underscores the significance of addressing customers' awareness of health-related issues and their impact on healthcare decision-making. Additionally, a lack of clarity about the benefits of eHealth services is identified as a prevalent challenge, underscoring the importance of effectively communicating the value proposition of such services to consumers. Furthermore, the lack of trust or confidence, as well as a lack of knowledge among health experts, are cited as notable barriers within this category. Trust is fundamental in healthcare interactions, and building confidence in eHealth solutions requires transparent communication and reliable service delivery. Moreover, the need for healthcare professionals and customers to adapt to new technologies presents a significant hurdle. As eHealth continues to evolve, ensuring adequate training and literacy in digital healthcare tools becomes essential for effective adoption and utilization (Mosadeghrad, 2014). Additionally, ethical considerations in the context of cultural norms and practices pose challenges for eHealth implementation. Addressing these ethical issues requires the development of guidelines and regulations to ensure ethical conduct among healthcare practitioners and developers (El-Sherif et al., 2022). Lastly, while literacy in eHealth and motivating elderly individuals to embrace digital healthcare have a lesser impact compared to other barriers, they remain important considerations in fostering inclusive and accessible eHealth services.

ADMINISTRATIVE BARRIERS (AB)

Administrative factors rank third among the barrier categories, underscoring their significant impact on eHealth implementation. For the successful integration of eHealth initiatives, the healthcare system must be structured to accommodate regulations from both federal and state governments. India has been actively promoting eHealth programs, both domestically and through collaborations with international partners. The National Digital Health Mission (NDHM), also known as the Pradhan Mantri Digital Health Mission, serves as a key initiative by the Indian government to advance digital healthcare services. Employee resistance emerges

as the primary administrative barrier, indicating challenges in garnering support from healthcare professionals for eHealth initiatives. This resistance may stem from various factors, including apprehensions about technological changes, concerns about job security, or perceived disruptions to established workflows. Additionally, a lack of technical staff is identified as a significant obstacle, highlighting the importance of having skilled personnel to support the implementation and maintenance of eHealth systems. An inflexible system is another notable administrative barrier, suggesting rigid structures or processes within the healthcare system that hinder the adoption of innovative eHealth solutions. Such inflexibility may arise from bureaucratic hurdles, outdated policies, or resistance to change from organizational stakeholders. Addressing these rigidities is essential for fostering a conducive environment for eHealth implementation and adaptation. Furthermore, the lack of healthcare worker training is identified as a barrier, albeit with a smaller impact compared to other factors. Adequate training and skill development among healthcare workers are crucial for effectively utilizing eHealth technologies and optimizing their benefits. Investing in training programs can enhance workforce readiness and competence in delivering healthcare services through digital platforms, thereby overcoming this barrier (Bhatia et al., 2018).

ORGANIZATIONAL BARRIERS (OB)

Organizational barriers rank as the fourth stumbling block within the barrier categories, indicating significant challenges in organizational structures and practices that impede eHealth implementation. In the local category, the highest-ranked barrier is the structural mismatch, followed by a lack of strategic planning. A structural mismatch refers to discrepancies between an organization's structure and its operational requirements, which can hinder the effective implementation of eHealth initiatives. Without alignment between organizational structure and operational needs, achieving success and demonstrating results in the digital healthcare market becomes challenging. Strategic planning is identified as another crucial barrier, emphasizing the importance of having a well-defined strategic plan with precise, measurable targets for eHealth implementation. A strategic plan provides a roadmap for guiding organizational efforts, setting clear objectives, and measuring progress towards achieving desired outcomes in the eHealth domain. Without strategic planning, organizations may struggle to effectively allocate resources, align initiatives with overarching goals, and assess the impact of eHealth

interventions. Additional barriers within the organizational category include unethical practices, a lack of insurance coverage and reimbursement mechanisms, and poor implementation management. Unethical practices can undermine organizational integrity and erode trust among stakeholders, potentially hindering the adoption and acceptance of eHealth solutions. Moreover, challenges related to insurance coverage and reimbursement can create financial barriers for organizations seeking to invest in eHealth infrastructure and services. Poor implementation management, characterized by ineffective leadership and management practices, can also impede eHealth initiatives. Inefficient management practices may lead to personnel turnover, budgetary constraints, and suboptimal performance outcomes, thereby hindering the successful implementation and sustainability of eHealth programs. Effective leadership and management are essential for fostering a supportive organizational culture, driving innovation, and maximizing the benefits of eHealth technologies (Sarwal et al., 2021).

REGULATORY BARRIERS (RB)

Regulatory barriers emerge as significant hurdles in the eHealth landscape, posing challenges to its adoption and expansion in the Indian market. Compliance costs and the potential for legal repercussions create barriers that deter eHealth initiatives from flourishing (Walden and Craig, 2003). The digital healthcare industry bears a disproportionate burden of compliance and licensure expenses, further exacerbating the challenges associated with regulatory compliance. A primary barrier within this category is the absence of standardized implementation protocols. Standardization entails the establishment of repeatable, harmonized, and documented procedures for eHealth deployment, which are essential for ensuring consistency and interoperability across diverse healthcare settings. The lack of universally accepted standards hampers the seamless integration and interoperability of eHealth solutions, hindering their widespread adoption and effectiveness. Additionally, the absence of comprehensive guidelines and federal regulations further compounds regulatory challenges in the eHealth domain. Clear and comprehensive guidelines are necessary to provide stakeholders with a framework for compliance and adherence to regulatory requirements. Similarly, the absence of robust federal regulations leaves gaps in regulatory oversight and enforcement, creating uncertainty and ambiguity in the regulatory landscape.In contrast, initiatives such as the Health Insurance Portability and Accountability Act (HIPAA) in the United States have sought to address regulatory challenges by establishing national standards for electronic healthcare operations and procedure codes. In India, the Digital Information Security in Healthcare Act (DISHA)

serves as a counterpart to HIPAA, aiming to enhance data security and privacy in the healthcare sector (Kapadia-Kundu, 2012). However, despite these efforts, regulatory barriers persist, underscoring the need for continued regulatory reform and standardization efforts to facilitate the growth of eHealth initiatives in India.

PRACTITIONER'S BARRIERS (PB)

The practitioner's barrier represents a significant obstacle to the adoption and implementation of eHealth initiatives. One of the primary challenges faced by healthcare practitioners is a lack of confidence in the effectiveness of technology, leading to skepticism regarding the legitimacy and efficacy of digital health solutions. This skepticism may stem from concerns about the reliability, accuracy, and usability of eHealth technologies, ultimately hindering their acceptance and adoption among practitioners (Gour and Srivastava, 2010). Furthermore, insufficient training and education of healthcare practitioners pose a significant barrier to the effective utilization of eHealth tools and technologies. Without adequate training and education on the use of digital health solutions, practitioners may lack the necessary skills and knowledge to effectively incorporate these technologies into their clinical practice. This lack of training can exacerbate existing skepticism and reluctance to adopt eHealth solutions, particularly among rural practitioners who may face additional challenges related to access to training resources and infrastructure. Moreover, the absence of a multi-state license presents a regulatory barrier that complicates the adoption of eHealth technologies for healthcare practitioners. Obtaining and maintaining licensing across multiple states entails significant administrative burdens, including compliance with varying regulatory requirements, medical education obligations, and associated financial costs. These challenges may deter practitioners from engaging in eHealth initiatives, particularly those operating across state boundaries, thus limiting the reach and impact of digital health services (Ajami and Arab-Chadegani, 2013). Overall, addressing these practitioner-related barriers requires targeted interventions aimed at building confidence in eHealth technologies, providing comprehensive training and education programs, and streamlining regulatory processes to facilitate multi-state practice and licensure. By overcoming these barriers, healthcare practitioners can better harness the potential of eHealth solutions to enhance patient care delivery and improve healthcare outcomes.

ECONOMIC BARRIERS (EB)

Economic obstacles represent significant challenges that hinder the progress of eHealth initiatives, encompassing factors such as a large population, outdated technology, and sluggish industrial expansion. Among the eight barrier categories identified, economic obstacles rank seventh in terms of their impact on eHealth implementation. Locally, the foremost economic barrier identified is the cost of staff training, which emerges as the second most significant barrier globally in this study. The expenses associated with training staff in eHealth systems, including employee benefits, salaries, and workload coverage, constitute major financial burdens for organizations operating in the eHealth sector (Rutledge et al., 2017). Additionally, the cost of software and equipment emerges as significant barriers to eHealth implementation. These expenses encompass the acquisition and maintenance costs of software solutions, as well as the procurement of essential equipment such as telemedicine technology and primary healthcare medical devices. Addressing these cost barriers is essential for facilitating the widespread adoption and implementation of eHealth solutions in India. To overcome these economic obstacles, concerted efforts are needed from both government and industry stakeholders. The Indian government should explore strategies to reduce the cost of software-based teleconferencing and per-patient-site expenses, thereby making eHealth technologies more accessible and affordable for healthcare providers and patients alike (Jarosławski and Saberwal, 2014). Additionally, investments in essential equipment and infrastructure, coupled with incentives for staff training and development, can help mitigate the economic challenges associated with eHealth implementation, ultimately fostering greater adoption and utilization of digital health solutions across the country.

TECHNICAL BARRIERS (TB)

Technical barriers are ranked as the least impactful among the eight barrier categories identified for the successful deployment of eHealth in India. These barriers primarily influence the appeal of eHealth initiatives to customers rather than directly impacting their implementation. The most significant technical barrier identified is the lack of system feedback, which hampers participation in eHealth efforts. To address this obstacle, it is essential to establish demand-driven health information exchange systems in India, supported by appropriate approaches and

standard measures. By ensuring effective system feedback, customer engagement in eHealth initiatives can be enhanced, thereby promoting their adoption and utilization (Parente, 2000). Other technical barriers include challenges related to health app efficacy, security issues, and limited internet access. Addressing these factors can contribute to the successful implementation of eHealth solutions in India by improving the functionality, reliability, and accessibility of digital health tools. However, barriers such as the lack of technical support, insufficient medical equipment, and privacy concerns are ranked lower in terms of their impact on eHealth implementation globally, indicating that they are less relevant obstacles in comparison to other categories of barriers.

SENSITIVITY ANALYSIS

In this study, sensitivity analysis was employed to assess the robustness of the methodology used, particularly in examining the significance of marketing barriers in influencing the adoption of eHealth in India. Marketing barriers emerged as the most crucial obstacle to eHealth adoption, prompting a sensitivity run to evaluate their impact on other barriers. The sensitivity analysis involved varying the values of marketing barriers from 0.1 to 0.9, as depicted in Tables 4.1, Table 4.2, and Fig 4.1. This variation allowed for an exploration of how changes in marketing barriers affected other barrier categories and the thirty-seven barriers grouped into eight barrier categories. Notably, the analysis revealed that marketing barriers exerted the highest impact on administrative barriers, while technological barriers were least affected by changes in marketing barriers.

For instance, when the value of marketing barriers (MB) was set to 0.1, EB3 (a specific administrative barrier) ranked first, followed by CRB1 (a customer-related barrier) in second place, B2 (a marketing barrier) in third place, and TB5 (a technical barrier) as the least impactful barrier. However, when the value of MB was increased to 0.2, MB2 (a different marketing barrier) claimed the top rank, with EB3 still ranking second, CRB1 in third place, and AB2 (another administrative barrier) rising to fourth place. Throughout the sensitivity analysis, MB2 consistently maintained its position as the most influential barrier, followed by EB3. Interestingly, barriers under the technology category consistently ranked as the least significant regardless of variations in marketing barriers. Consequently, it can be inferred that marketing barriers significantly shape the landscape of eHealth adoption in India, exerting a considerable influence on other barriers as well.

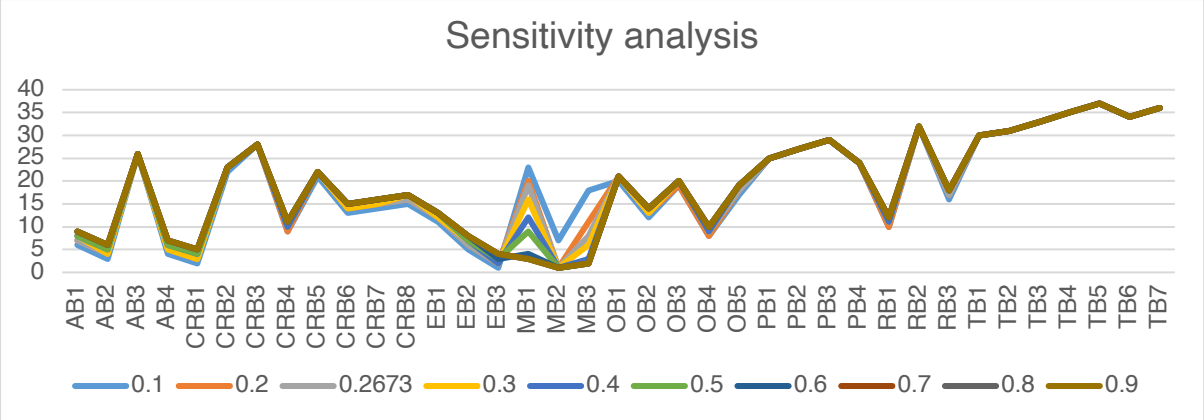


Figure 4.1: Sensitivity analysis

Table 4.1: Influence of marketing barriers on other barriers

CRB	0.3067	0.2726	0.2385	0.2044	0.1704	0.1363	0.1022	0.0681	0.0341	0.3067
RB	0.0864	0.0768	0.0672	0.0576	0.0480	0.0384	0.0288	0.0192	0.0096	0.0864
TB	0.0107	0.0096	0.0084	0.0072	0.0060	0.0048	0.0036	0.0024	0.0012	0.0107
OB	0.1746	0.1552	0.1358	0.1164	0.0970	0.0776	0.0582	0.0388	0.0194	0.1746
MB	0.1000	0.2000	0.3000	0.4000	0.5000	0.6000	0.7000	0.8000	0.9000	0.1000
PB	0.0251	0.0223	0.0195	0.0167	0.0139	0.0112	0.0084	0.0056	0.0028	0.0251
AB	0.2753	0.2447	0.2141	0.1835	0.1530	0.1224	0.0918	0.0612	0.0306	0.2753
EB	0.0211	0.0188	0.0164	0.0141	0.0117	0.0094	0.0070	0.0047	0.0023	0.0211
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 4.2: Ranking of barriers using sensitivity analysis when the value of marketing barrier varies

Factors	**Market-related barriers used for Sensitivity analysis.**									
	0.1	0.2	0.2673	0.3	0.4	0.5	0.6	0.7	0.8	0.9
AB1	6	7	7	8	8	8	9	9	9	9
AB2	3	4	4	4	5	5	6	6	6	6
AB3	26	26	26	26	26	26	26	26	26	26
AB4	4	5	5	5	6	6	7	7	7	7
CRB1	2	3	3	3	4	4	5	5	5	5
CRB2	22	23	23	23	23	23	23	23	23	23
CRB3	28	28	28	28	28	28	28	28	28	28
CRB4	9	9	10	10	10	11	11	11	11	11
CRB5	21	22	22	22	22	22	22	22	22	22
CRB6	13	14	14	14	15	15	15	15	15	15
CRB7	14	15	15	15	16	16	16	16	16	16
CRB8	15	16	16	17	17	17	17	17	17	17
EB1	11	12	12	12	13	13	13	13	13	13
EB2	5	6	6	7	7	7	8	8	8	8
EB3	1	2	2	2	2	3	3	4	4	4
MB1	23	20	19	16	12	9	4	3	3	3
MB2	7	1	1	1	1	1	1	1	1	1
MB3	18	11	8	6	3	2	2	2	2	2
OB1	20	21	21	21	21	21	21	21	21	21
OB2	12	13	13	13	14	14	14	14	14	14
OB3	19	19	20	20	20	20	20	20	20	20
OB4	8	8	9	9	9	10	10	10	10	10
OB5	17	18	18	19	19	19	19	19	19	19
PB1	25	25	25	25	25	25	25	25	25	25
PB2	27	27	27	27	27	27	27	27	27	27
PB3	29	29	29	29	29	29	29	29	29	29
PB4	24	24	24	24	24	24	24	24	24	24
RB1	10	10	11	11	11	12	12	12	12	12
RB2	32	32	32	32	32	32	32	32	32	32
RB3	16	17	17	18	18	18	18	18	18	18
TB1	30	30	30	30	30	30	30	30	30	30
TB2	31	31	31	31	31	31	31	31	31	31
TB3	33	33	33	33	33	33	33	33	33	33
TB4	35	35	35	35	35	35	35	35	35	35
TB5	37	37	37	37	37	37	37	37	37	37
TB6	34	34	34	34	34	34	34	34	34	34
TB7	36	36	36	36	36	36	36	36	36	36

RO2: To identify and evaluate the factors of customer engagement that effects the adoption of eHealth in India.

THE STUDY FINDINGS

Our findings through FAHP shows that for better adoption of eHealth in India the customer interaction part need to be more synchronized. Customer interaction (Relative rank: 1) are the main issues with the eHealth adoption in the case industry. Four of the top ten globally ranked sub-categories are in this. Across all categories, empowerment of customer is rated as the most important locally and globally. It is advised how to empower clients physically, medically, and socially through social customer relationship management (CRM). Based on the approach, the Clinic 2.0 social CRM prototype has been developed to assess the customer satisfaction levels before and after the suggested contact. The results of the tests showed a rapid improvement in satisfaction of almost (50%) as shown in Table 4.3. The literature findings are being taken from this study (Almunawar & Anshari, 2014). Thereafter, resolving issue (Global weight-16) and customer support service (Global weight-18) is highly recommended in better interaction and proper training is need to the customer support team. The customer support training sessions in the case industry have been increased from 2 session per week to 4 sessions per week which helped in customer to engage more.

Table 4.3: The mapped performance metrics of the case company

S. No.	Performance Matrix	Description	January 2022 (Before CE adoption)	January 2023 (After CE adoption)	Percentage Change
1.	**Customer relationship management (CRM)**	This technology is used to manage customer interactions for businesses, which will strengthen client relationships, simplify business operations, and boost profitability.	2 training sessions per year	8 training sessions per year	50% increase
2.	**Customer support training**	Customer service representatives have received training on how to better communicate with patients, know their services, resolve conflicts, and demonstrate empathy.	2 training sessions per week	4 training sessions per week	50% increase

3.	**Omnichannel approach**	There are now additional points of contact between patients and healthcare professionals because of omnichannel approaches. Emails, social media, and telemedicine appointments are just a few of the venues they can use to interact.	25 percent present	81 percent present	54% increase
4.	**Customer Complaints**	It represents the number of complaints patients have given regarding various services provided.	212 approximately per year	198 approximately per year	6.6% reduction.
5.	**Training to practitioners**	Doctors were trained in the newest technologies utilised for online patient visits and in understanding patient inquiries that can aid in diagnosis without a physical examination.	1 session per month	1 session per week	40% increase
6.	**Training to online department**	Dealing with advertisements, patient blogs, hiring of athletes, providing best surgeons.	2 training sessions per week	4 training sessions per week	50% increase
7.	**Daily target achievement rate**	It displays the percentage of the goal that was met for each working shift.	78%	82%	5.1% increase
8.	**Net operating profit**	It represents the company's net financial profit calculated after taking all costs into account.	12.1 % per annum	13.9 % per annum	15% increase
9.	**On time delivery**	It displays the proportion of timely patient deliveries of medications, medical equipment, and other services.	91 %	94 %	3.2% increase
10.	**Data security metrics**	It represents the occurrence of patient health profile been secured.	48 % per year	28% per year	31 % reduction

Customer involvement (Relative rank: 2) mainly consists of patient participation in healthcare-related services. It has been said that involvement becomes simpler after a positive customer interaction (Zaichkowsky, 1985). In this, four of the top ten sub-barriers are ranked globally. According to global rankings objective factor is located 1st locally and 2nd globally. This suggests that patients are more likely to identify the time savings for an activity when they opt to healthcare services digitally rather than in person. After this, customer intimacy (Relative rank: 3) increases word-of-mouth growth and customer loyalty, both of which significantly enhance the profitability of businesses and the allure of investments. Taking a look to its sub-

factors prioritization of patients (locally- 4th and globally 5th) and their retention (locally- 5th and globally 6th) are the two which helps to attract and maintain the customer loyalty.

The customer experience category (relative rank: 4) includes every effort a company makes to ensure happy, excellent customer experiences (Meyer & Schwager, 2007). The significance of the omnichannel approach is underscored by research findings indicating its impact on customer retention and value. Studies reveal that companies employing effective omnichannel customer engagement strategies retain an average of 89% of their customers, in stark contrast to the 33% retention rate observed among businesses employing mediocre tactics (Bhardwaj et al., 2021; Patrikar et al., 2020). Moreover, a study published in the Harvard Business Review highlighted that omnichannel customers exhibit significantly higher value compared to those engaged through single-channel approaches (Sopadjieva et al., 2017). So, the same concept has been strategized in the case study industry and the change of 54% increase is showed in target. The fifth-ranked category, customer satisfaction, has the least effect on successful eHealth rollout. Customers won't be satisfied and engage if the other drivers aren't taken care beforehand (Cobelli & Chiarini, 2020; Vukmir, 2006). This category is the least influential because all of its sub-categorise have the lowest global rank.

In the DEMATEL approach, the threshold value is determined as the average of all results obtained from the direct-indirect matrix. Any comparison between the total relation and the direct-indirect matrix, which exceeds the threshold value, suggests interactions between the two customer engagement (CE) drivers. Figure 4.2 depicts the relationship diagram for the main criteria.

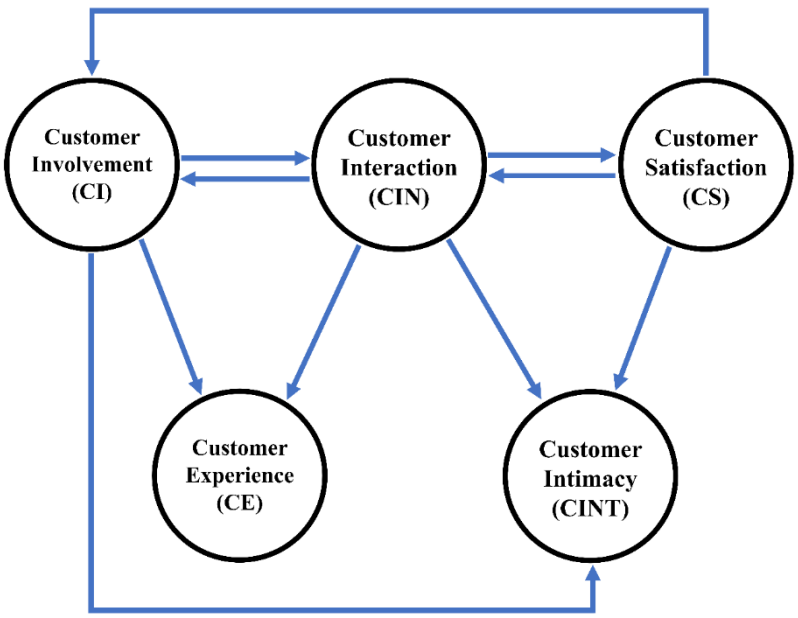


Fig 4.2: Relationship diagram for main criteria.

The findings showed that customer interaction, satisfaction, and involvement were the cause drivers, while intimacy and experience with the customer were determined to be the effect drivers. All other factors, including patient involvement and satisfaction, are developed with the help of interactions with patients. However, other cause factors completely determined the customer's experience and intimacy. Within the case company, it was discovered that the management was having trouble achieving successful results for the services they offered and close client relationships. Therefore, the management derived immediately from Fig. 4 that customer involvement and interaction have a significant impact on an organization's ability to adopt eHealth. This is in line with the findings of (Gruner & Homburg, 2000) who stressed the significance of involving customer relationship personnel in increasing eHealth adoption. By implementing the recommended framework, customer complaints were reduced by 6.6%, equivalent to 212-198 complaints per year.

Fig. 4.3 depicts the relationship diagram for the customer involvement driver. The findings showed that while time consumption, contextual factors, and frequency of website visits were effect drivers, interaction sessions, personal factor, and objective were cause drivers. The relationship diagram demonstrates that the patient and doctor's interaction with one another has reciprocal relationships with the other sub-drivers. Doctors should therefore receive the appropriate training in using new technology in order to make the sessions more interactive with the online patients. It was seen after adoption the increase of patients visit rise to 40%. Research conducted as part of a review of the literature confirmed the same notion, stating that doctors should also receive training as they are unfamiliar with digital services (Agarwal et al., 2020; George et al., 2007; Meher et al., 2009).

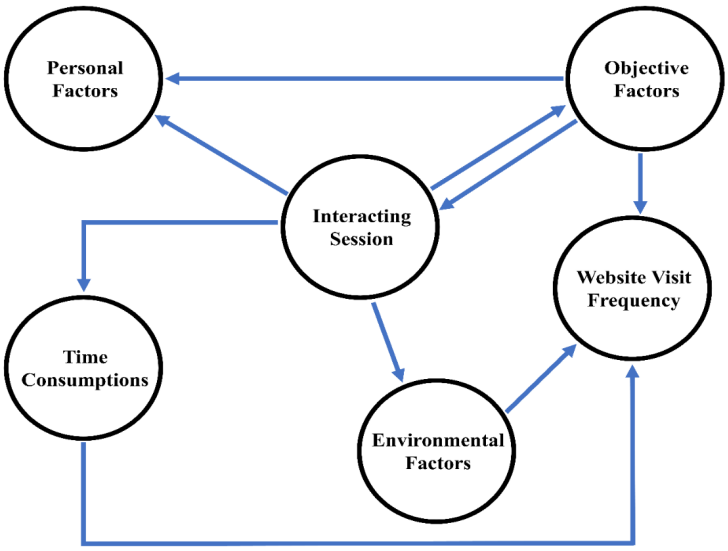


Fig. 4.3: Relationship diagram for the customer involvement driver

Fig 4.4 depicts the relationship diagram for the customer interaction driver. The findings reveal empowerment of customer, patient appreciation and issue resolving were the cause driver and inimical website, customer support service and addressing concern were the effect driver. The relationship diagram shows that all three sub-drivers are interrelated; therefore, if the patient feels valued and empowered and their problem are treated, this will be the main source for other factors. Patients are completely ignored in the case company's web advertisements, they are entirely for the company, app, and its services. The strategy taken to provide training to online department, the website now includes a patients' blogs, online enquiry profiles, and videos showing how to navigate the website. This strategy was taken from (Das et al., 2012; Pustokhina et al., 2020) and it revealed a rise of 35% of patient visit to website increased.

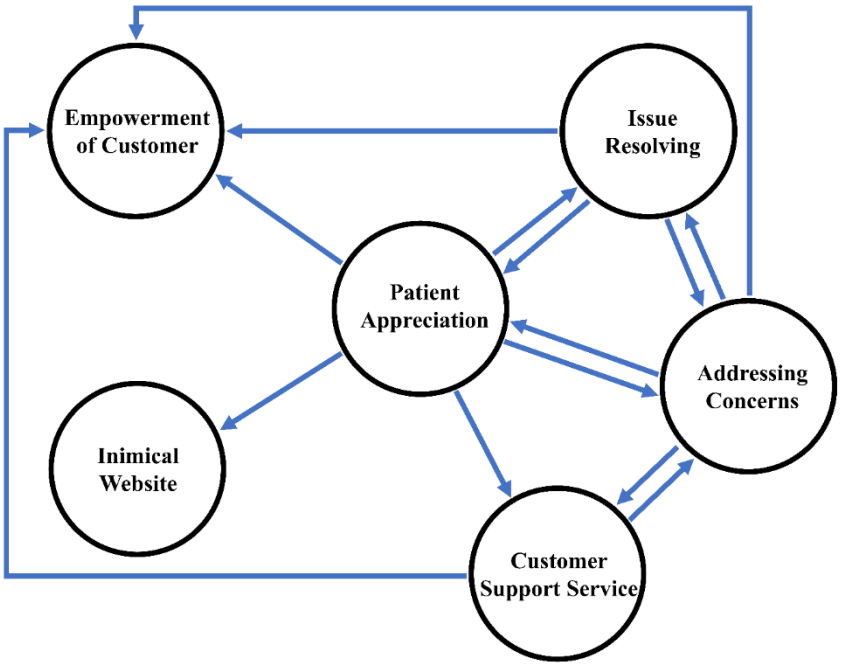


Fig 4.4: Relationship diagram for the customer interaction driver

Fig 4.5 depicts the relationship diagram for the customer intimacy driver. The findings reveal prioritization of customers and patient retention were the cause driver and easily adaptable, educating patient and word of mouth were the effect driver. As per Long et al. (2018), the importance of employee engagement in operational performance enhancement and the attainment of organizational objectives is underscored through the implementation of suitable employee evaluation methodologies. Additionally, by offering targeted training for the adoption of eHealth solutions and augmenting training initiatives, the framework recommended by them led to a 15% increase in net operating profits and facilitated enhancements in the company's daily target achievement rate.

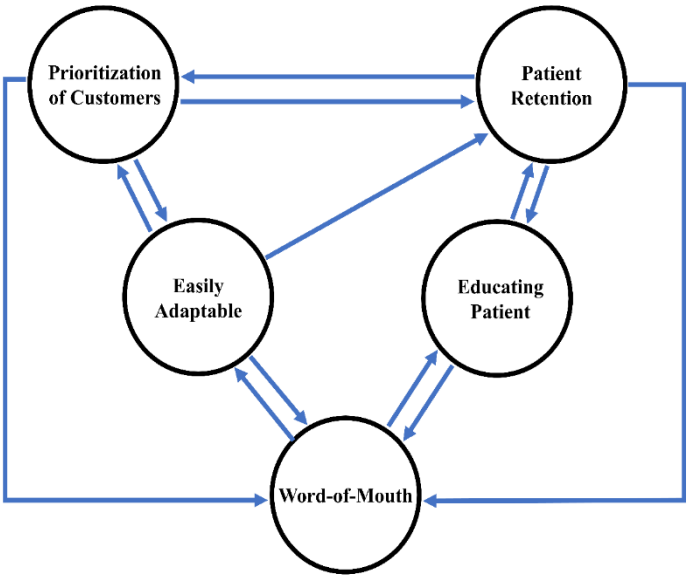


Fig 4.5: Relationship diagram for Customer Intimacy

Fig 4.6 depicts the relationship diagram for the customer experience driver. The findings reveal widespread adoption, proper engagement channels, product description and affordability are the cause drivers and patient personas, rate of resolution and commitment are the effect driver. This section strategy was previously mentioned when the organisation channelized its omnichannel approach in response to the FAHP results.

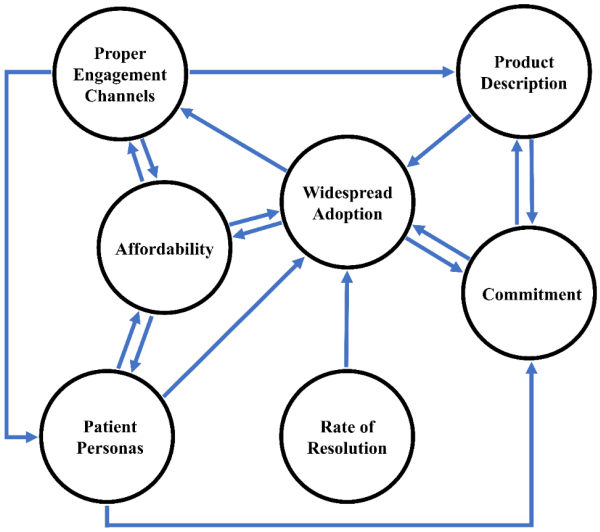


Fig 4.6: Relationship diagram for Customer Experience driver

Fig 4.7 depicts the relationship diagram for the customer satisfaction driver. The findings reveal accessibility, courteousness and integrity are the cause drivers and reliability, responsiveness and credibility are the effect drivers. There should be equal access to everyone, and every service provided. stated people with disabilities in a country should have accessibility to all the facilities provided by the Government. So, been a digital healthcare organisation it deals with online deliveries of medicines, in-home blood tests, installation of medical devices at home so that chronic patients don't have to visit their doctors and their reports can be easily visible to healthcare professionals. Fastest and timely delivery is utmost needed in the food and healthcare industries. Customer complaints about deliveries were discovered to be reduced inside the case company to 198 approximately per year that is, (6.6% reduction) and the rate of integrity issue was discovered to be lowered by 31%. This outcome aligns with the conclusions drawn by Henao et al. (2019), highlighting the importance of mapping delivery performance, comprehending customer expectations, and implementing appropriate evaluation techniques to enhance customer satisfaction.

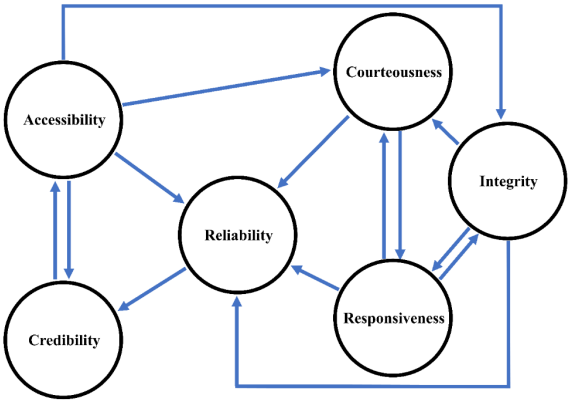


Fig 4.7: Relationship diagram for Customer Satisfaction driver

THE SENSITIVITY ANALYSIS

When CINB was set to 0.1, CIB5 took first place, followed by CIB1 in second place, CINTB5 in third place, and CEB5 in last place. Again, using CINB as its value of 0.2, the first rank was CIB5, followed by CIB1, CINTB5, and CEB5 in last. The least important barrier of all was still customer satisfaction. Hence, it can be concluded that the primary barrier to customer engagement in the adoption of eHealth in India is the customer interaction barrier. Figure 4.8 illustrates the sensitivity analysis graph.

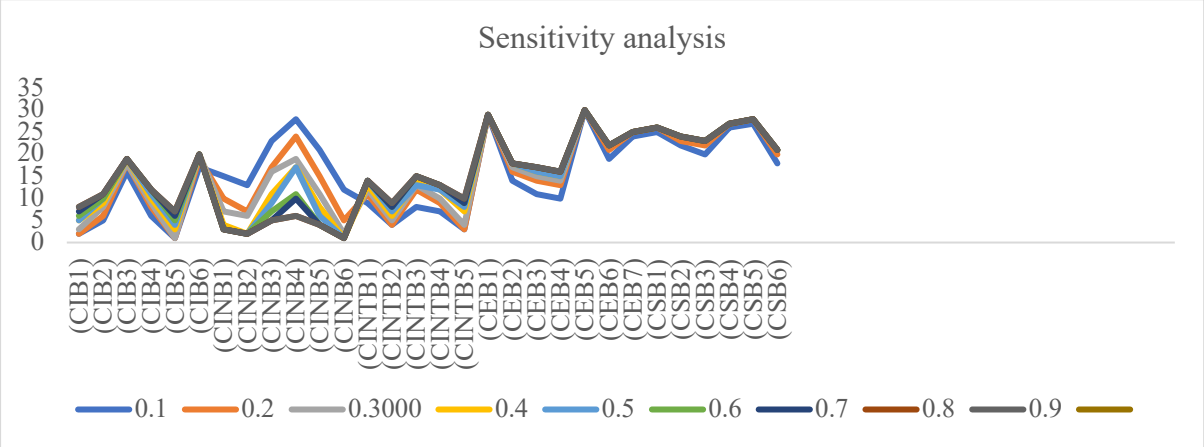


Figure 4.8: Sensitivity analysis

RO3: To understand the relationship between the factors of customer engagement affecting adoption of eHealth in India.

ISM INTERPRETATION

The structured model utilized in this study delineates thirty barriers to customer engagement in the adoption of eHealth, presenting them in a hierarchical framework across four levels. Within this model, the second sub-barrier of customer experience, CEB2, which pertains to the need for a product portfolio, occupies the fourth level. It exerts influence on two factors situated in

level III of the model: CINB4, related to the lack of customer support, and CEB7, associated with low first call resolution rates. Notably, other barriers in level III, such as CEB5 (Lack of commitment) and CINTB4 (Negative word-of-mouth), do not share a direct relationship with CEB2. Among the eleven identified barriers in level II, dependencies exist among factors like CIB4 (Lack of Personal factors), CIB6 (Lack of Situational factors), CSB5 (Inaccessibility), and others, indicating their interrelatedness. The first level encompasses fourteen barriers, including CIB1 (Activity Time), CINTB5 (Lack of Customer churn), CEB1 (Lack of Engagement Channels), and more, highlighting the breadth of factors influencing customer engagement.

The model underscores the significance of the need for a product portfolio, revealing its dependence on factors such as lack of customer support and low first call resolution rates as pivotal barriers to customer engagement in eHealth adoption in India. Enhancing engagement necessitates a healthcare system that is accessible and affordable to all citizens (Brock & Yu Zhou, 2012; Martens et al., 2019). Effective policies facilitate communication and issue resolution (Kumar et al., 2019; Phares et al., 2021; Sarbadhikari, 2019), fostering quicker and improved service delivery, thereby encouraging customer engagement in the digital healthcare domain. This underscores the influence of customer experience in shaping engagement within digital healthcare platforms (Meyer & Schwager, 2007; Sharma & Prashar, 2019; Sreejesh et al., 2022). For instance, Apollo Telehealth (Ganapathy, 2014; Ganapathy & Ravindra, 2009) stands as a prime example, offering accessible and high-quality digital healthcare services across rural and urban areas, facilitating engagement through simplified access and efficient customer service. Even amidst situational challenges like pandemics, maintaining transparency and integrity in healthcare services remains crucial for enhancing customer satisfaction.

FUZZY-MICMAC INTERPRETATION

The fuzzy MICMAC analysis was employed to stabilize the results and alleviate model uncertainties. The identified factors were categorized into four groups: "autonomous," "dependent," "linkage," and "independent" factors. Key findings of the study are as follows:

Quadrant - I, representing autonomous drivers, indicates barriers that have no connection with the system and do not influence the adoption process. In this study, no barriers fell into this category, underscoring the significance of all selected barriers.

Quadrant – II, encompasses factors with weak driving force but strong interdependence, connected through linkage factors. However, no barriers in this study were classified into this group.

Quadrant – III, comprises thirty barriers across various categories, such as customer involvement, interaction, intimacy, experience, and satisfaction. These factors exhibit both strong driving and dependence powers, indicating their critical importance and potential to impact other drivers.

Quadrant – IV, consists of factors with strong driving force but weak dependence, often referred to as "key drivers." None of the barriers in this study were classified into this category, suggesting their essential role in the eHealth market's entry level.

CHAPTER SUMMARY

This chapter provides a comprehensive overview of the methodology employed and the data analysis conducted to address the barriers and sub-barriers of eHealth adoption in India. Various techniques, including Fuzzy AHP, Sensitivity analysis, ISM, and Fuzzy MICMAC, were utilized to analyze the data and prioritize the identified barriers. Fuzzy AHP and sensitivity analysis were instrumental in categorizing and prioritizing the barriers and sub-barriers, while ISM and Fuzzy MICMAC analysis helped uncover the interrelationships between these barriers. The results obtained from these analyses were presented systematically to offer a clear understanding of the challenges associated with eHealth adoption in India. Moving forward, the subsequent chapter will focus on proposing strategies and solutions aimed at overcoming these identified issues.

CHAPTER 5

STRATEGIES AND SOLUTIONS TO OVERCOME THE BARRIER

OVERVIEW

The previous chapter was based on the identification and analysis of the barriers. However, just identification of the barriers is not sufficient. Hence, this chapter aims to present the strategies and solutions to overcome those barriers identified that influence the adoption of eHealth in India. The study opted for a qualitative design, prompting the need to deliberate on the factors to consider when selecting the appropriate qualitative methodology. The findings of this study will be organised based on the viewpoints of important respondents on data sharing interoperability. The topics highlighted during these interviews will be categorised into theme groups. The ATLAS.TI application programme have been used for conducting prioritization of the solutions.

INTRODUCTION

The qualitative data analysis process involves organizing descriptive data obtained from interviews, surveys, and observations and interpreting it to identify patterns and themes within the textual data. Challenges in this analysis include distilling large volumes of data, identifying significant patterns, and constructing a framework to communicate the essence of the data (Patton, 1990). Thematic analysis was selected as the analytical method, which some argue is fundamental to many other qualitative analyses (Boyatzis, 1998; Ryan & Bernard, 2000), while others view it as a standalone method (Braun & Clarke, 2006; Nowell et al., 2017). Thematic analysis aims to generate themes capturing phenomena, which are then interpreted (Daly et al., 1997; Ryan & Bernard, 2000), allowing for the identification, analysis, and reporting of themes within the data (Braun & Clarke, 2006). This aligns with the study's goal of elucidating barriers and proposing strategies for eHealth adoption in India. Thematic analysis involves a thorough

examination of qualitative data to identify recurring themes, making it suitable for exploring people's views, attitudes, experiences, and values (Sarfo, 2013). In this study, thematic analysis revealed that customer engagement is crucial for enhancing eHealth adoption in India. The data analysis aimed to explore awareness levels of digital healthcare, identify barriers to eHealth adoption, and propose solutions and strategies for improvement. While other qualitative approaches like grounded theory were considered, thematic analysis was chosen due to its suitability for identifying themes relevant to the study's focus on customer engagement in eHealth adoption in India (Willig, 2001; Hawker & Kerr, 2016). Grounded theory, although valuable for inducing theories from data, was deemed unsuitable for this study's goal of exploring strategies and solutions for customer engagement in eHealth adoption (Eyles & Smith, 1988).

STEPS IN THE THEMATIC ANALYSIS

Braun and Clarke (2006) outlined a six-step approach to conducting thematic analysis, emphasizing that these steps do not necessarily need to be followed in a strict linear sequence, as researchers may need to move back and forth between them. The steps used for thematic analysis in this study are as follows:

1. **Familiarization with the Data:** Initially, the researchers familiarized themselves with the data by repeatedly reading through it, gaining an understanding of the semantic meanings. General observations were noted to aid in later theme development.
2. **Coding:** Key analytic ideas within the data, potentially related to the questionnaire, were identified and labelled as codes. This process was iterative to ensure that important codes were not overlooked.
3. **Theme Generation:** Codes that related to similar concepts were grouped together to form themes. These themes aimed to capture patterns of meaning across the dataset.
4. **Reviewing Themes:** The identified themes were reviewed in relation to both the coded data and the dataset as a whole. A thematic map was utilized to organize the analysis and illustrate the relationships between the themes.
5. **Defining and Naming Themes:** Each theme was defined, named, and highlighted using different colors or other visual aids. Additionally, an analytic narrative was constructed to explain the findings within the data, their relevance to the questionnaire, and proposed strategies for implementation.

6. **Writing Up the Analysis:** Finally, the analysis was written up in the form of a report, detailing the findings, interpretations, and implications of the thematic analysis process.

RESULTS

Objective 4: To propose solution towards the improvement in customer engagement for the adoption of e-Health in India.

The aim of this chapter is to outline the themes identified through the thematic analysis process. These themes encompassed various aspects related to eHealth, including barriers, patient engagement, and potential solutions and adoption strategies. Overall, ten main themes emerged, each containing subthemes that provided insight into the meaning of eHealth and the challenges associated with its adoption. The primary objective of the study was to investigate whether barriers to customer engagement exist in the eHealth adoption process and, if so, to develop strategies and solutions to overcome them. Further qualitative discussion on these themes is provided within the results section to offer a comprehensive understanding of the findings.

There were ten main themes identified which were 1.eHealth, 2. New technology, 3. Barriers 4. Patient barriers 5. Practitioners barriers 6. Researchers barriers 7. Customer Engagement 8. Government initiatives 9. Potential solutions 10. Adoption strategies. There are total **173 codes** divided in each themes but some codes are used in two or more themes. Moreover, there are **327 quotations** each making this study unique and presenting the best strategies and solution for better customer engagement in eHealth adoption in India. Each themes with their sub-themes are discussed below in details.

Table 5.1: Themes with their respective codes

Main Themes	Codes
eHealth	Artificial Intelligence Delivering Care Digital Platform Digitization in healthcare

	Growth after pandemic Health Record Latest technology New trend Online care Online consultations Online healthcare Teleconsultations Telemedicine Virtual Consultations
New Technology	Data Security Data Storage Easy decisions Easy tracking Electronic medical record Forget Medical repots Good Experience Home diagnosis Lesser Time Low Mistake New Research area Past history correlation Patient preference change Radical transformation Tremendous Growth Fear of adoption Lack of engagement Lack of Patient appreciation Lack of Patient Centric Weak adoption User friendly app
Customer Engagement	Patient Experience Patient-doctor interaction Patient willingness Accessibility Patient training Patient are positive Social influence Economical Knowledge Empathy Patient follow-up Easy advice Good experience Involve actively Emotional connection

	Forget medical reports Authentic review Past history correlation
Barriers	Patient Awareness Patient literacy Technology barriers App usability Patient barriers Nurses training Government barriers Technical barriers Practitioners barriers Marketing barriers Infrastructure barriers Implementation issue Empathy Cultural issue More advancement needed Internet issue Process barriers Language barriers Economic barriers Older generation Guidance Risky propositions People in the process Regulatory barriers High chance of error Legal barrier Organisational barrier
Patient barriers	Patient awareness Patient literacy Rural patients Patient training App usability Data security Negative patients App for rural patients Change of perception Affordable Economical Knowledge Mentality barrier

	Physical Touch Privacy of patients Resistance to change Challenge to achieve Connectivity issue Fear of adoption
Practitioners barriers	Rural patient Doctor willingness Non-adoption from doctors Nurses training Weak adoption Data security Change of perception Training Economical Knowledge More advancement needed Physical Touch Resistance to change Connectivity issue Fear of adoption Mentality issue Robotic Surgery Post operation care Uncomfortable over video call
Researcher barriers	Research in broad ecosystem New research area Collaborated research Research in healthcare Change of perception Research within diseases Research institutes Fund for research
Government initiatives	Advanced technology Asha Workers Availability of 5g network Ayushman Bharat mission Collaborated research Demographic group Education campaigns eHealth policies Electronic medical record Fund for research Government schemes Grey areas

	Huge investment Implementing technology Inappropriate promotion National digital health mission Nurses training PM initiatives Policymakers Social media promotion Top down approach
Potential Solutions	Accessibility App for rural patients Better patient experience Billing system Electronic medical record Intuitive application Patient empowerment Patient training Voice recognition system
Adoption strategies	Adoption in leaps and bounds Advertisements Affordable Collaborated research Economic Development Education Campaign Government Schemes Improvement in services Patient Engagement PM Initiative Research Institutes Social media promotion Stakeholders Word of Mouth

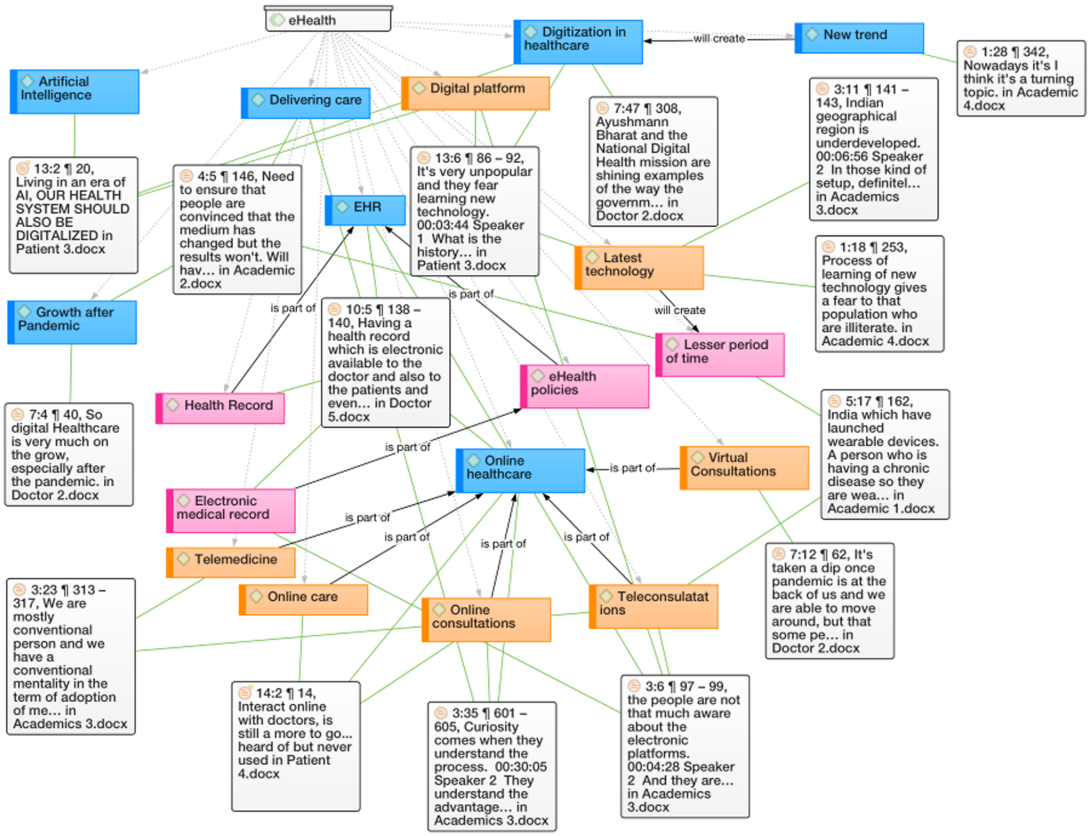
Consequently, we will divide up the themes and codes into groups based on how the codes arrived or how respondents from various groups answered the questions. The first theme is eHealth and the respondents were asked about it so that the basic idea can be derived.

THEME 1: eHEALTH

Table 5.2: eHealth questions for respondents

Respondents	Questions
Doctors	What do you think of India's digital healthcare system? How well do you understand electronic health or eHealth?
Patients	Share your views on India's healthcare system getting digital? How well do you understand electronic health or eHealth? How eHealth is different from primitive process of healthcare? To what extent do you use electronic health?
Academicians and industry professionals	What do you think of India's digital healthcare system? How well do you understand electronic health or eHealth?

The outcomes of the analysis with reference to the quotations can be explained by dividing the codes to positive and negative quotations from patients, doctors and researchers. A few of the representative quotations from the interview excerpts are:



Blue: *Positive quotations*
Orange: *Negative Quotations*
Pink: *Sub-code of each code.*

Figure 5.1: Codes for eHealth

POSITIVE CODES

Artificial Intelligence-

".....Living in an era of AI, our health system should also be digitalised...." ***– Lead project development officer (Academic 1)***

".... We are in the era of Internet and AI we should try to literate peoples in the term of Internet in the term of AI, in the term of technology……"- ***Patient 2***

It shows that Indians are accepting eHealth well and are eager for their nation to become digitally advanced. According to the academics and the patients, AI (Artificial Intelligence) is not a foreign concept to them, and they are pleased that it has been included into the Indian healthcare sector.

Delivering Care-

The vast, multifaceted field of "digital healthcare" studies how technology and healthcare delivery interact. It involves enhancing patient care, health outcomes, and the delivery of healthcare services through the use of digital tools, electronic platforms, and information technology. We learn from the conversation that patients want doctors to be kind and educate them about the entire procedure. Researchers have even been quoted as arguing that providing medicine at home equates to providing care at home.

"…. These you know that our country is crossed actually on 140 crores of population. So, in current situation that the government hospital is not able to provide the inadequate facilities. So, it's urgent need. Alternative healthcare facilities and E health is one of the best solutions. Yes, nowadays it's in fancier stage, but definitely we are working very hard on this topic. So, one by one, I think it would be the one of the best alternative solutions to the healthcare…." ***– Dean academics (academic 3)***

"…. doctors who are like who have started having this E health facilities so they should be very like courteous to the patients like patient doesn't know so they are the one who will make them aware that what's the help of it…." ***– Patient 3***

"…. Need to ensure that people are convinced that the medium has changed but the results won't. Will have the same kind of result…." ***– Patient 7***

"…. When I say top-down approach, the management of the hospital and the healthcare facility needs to get convinced that this is sustainable, you know way of delivering care and is all economical also right…." ***– Senior VP (Doctor 1)***

"...Now we know that the medicines all can also be delivered at home. So if there is a combination of that. And that could spread out the message. To larger audience that would be of beneficial and it would take time. But eventually if things catch up, people would definitely see the better…." – ***Professor (Academic 2)***

Digitization in healthcare-

"…absolutely benefit for the society because it helps the health care more accessible to every corner of the country…." – ***Dean Academics (Academics 3)***

"…From my understanding of digital health, it basically allows patients the access to healthcare facilities through the use of electronic and mobile…." ***– Associate Professor (Academic 7)***

As evidenced by the quotation, academics are generally supportive of the changes taking place in healthcare, and patients stand to gain from the fact that they may now utilise their mobile devices to consult with doctors while at home.

"…So if you want digitization in an organization, then you should have barriers to the minimum possible extent, then the barriers have to be sorted out first before the digitization happens, then all that time, money, effort, whatever the organizer is going to put will become right. So, we will have to ensure that everything is taken care of at the beginning before we start the digitization process…." ***– Surgeon (Doctor 5)***

"…With the continuous tapping on the mind, people have realized that there is going to be a huge change and eHealth or digitalization is going to be the part of life…." ***– HOD Neurology (Doctor 4)***

Even medical professionals are optimistic that our nation is about to undergo a significant transition, and citizens should be as well. Doctors, however, want to make sure that barriers are eliminated or careful consideration is given before making any modifications.

"…even in the presence of more situational factors, such as pandemics, the healthcare industry must demonstrate its honesty and openness in order to improve customer satisfaction…." – ***Patient 1***

Patients are optimistic, but they want the same transparency that existed before the epidemic, when healthcare suddenly became more digital and underwent significant changes.

Conversations with other patients also seemed to imply that the real procedure that is required is customer satisfaction.

New trend-

"…This kind of data about patients included their medical background, the kinds of medications or antibiotics they were using, and the medical conditions they were suffering from. Thus, such data is genuinely related to the patient's medical history together with other medical information such as their blood reports or other vitals reports. Those are significant statistics for any doctor to prescribe further medications…." ***– Scientist E (Academics 4)***

Healthcare is witnessing a new trend due to digitalization, as the figure illustrates. A good response and necessity for a nation to grow appears to be the answer to the interview question asked to scientist E of a research centre.

Online healthcare-

Online healthcare includes telemedicine, online care, online consultation, virtual consultation, and tele-consultation, as is seen from the figure. Since then, the nation has moved to an online environment due to COVID. Apps such as Practo, Sanjeevani, and Apollo entered the scene and are primarily used by educated people.

"…I would answer that after COVID-19 because patients had to continue receiving care from physicians and hospitals thorough electronically as they were unable to visit the hospital. The entire healthcare delivery system was shifted online…." ***– General Practitioner (Doctor 5)***

"…Yes, I do have a bit of an idea. Like it's more over like you know, you can talk to the doctors online through any digital platform. Since I've already tried an app called Practo…." ***-Patient 7***

"…Yeah, most of them are not, but yes, because people who are educated and, you know, meeting people around and have a social circle, they are aware…." ***- Patient 8***

Growth after pandemic-

"…So digital Healthcare is very much on the grow, especially after the pandemic, the majority of the chronic cases, which could be managed at home, care services, everybody has realized that such care can be provided from anywhere in the world, so that now, after the pandemic, I don't think that's a major barrier…." ***- Emergency Medicine (Doctor 3)***

"…Post Corona Electronic Health is now choice of the treatment for patients, but government is entering in all the ways they are not aligned petty consultations and they are not promoting…." ***– Senior VP (Doctor 1)***

"…It came into existence during the COVID or in the pandemic of COVID. It was very well established and were promoted by Government of India also…." ***– Healthcare Industry Founder (Academics 6)***

Following COVID, the roles of patients and medical personnel have changed as a result of healthcare digitization. The traditional patient position—one who waits to see a doctor until a symptom appears—is giving way to a more proactive, empowered role where patients want to be involved in their care. These "empowered patients," also known as e-patients, are knowledgeable about managing their health or diseases, have access to information and technologies, and use electronic devices to collect data.

NEGATIVE CODES

Digital Platform-

"…the people are not that much aware about the electronic platforms. And they are not much flexible to taken up these new ideas or new concept into their day-to-day life. As I mentioned that one of the main barriers is the adoption …." ***– NGO Founder (Academics 3)***

"…For, if you have some major kind of disease, then it is much better you visit a doctor for I think for normal cold cough fever I think you can use a doctor digitally…." ***- Patient 7***

"...It's very unpopular and people fear learning new technology. Indians are very rich in acquire any technology or to use any technology at first, but once they start they acquire faster than any other country...." ***- Patient 10***

"...The rural area have the lack of infrastructure, also I think the rural area and the urban area have a digital divide. Improvement of the health System of India will be done later. First, government should decrease the digital divide between urban and rural India...." ***- Patient 10***

Some respondents raised concerns about the unfavourable effects of India's healthcare system switching to electronic medical records. The founder of an NGO's comments indicate that both doctors and patients are fearful of adoption and are not very adaptable. The patient participants stated that they would rather see a doctor in person for significant illnesses because they are afraid of embracing new technology. They even acknowledged that the biggest area in need of development is the infrastructure barriers.

Latest technology-

"...less literacy population in India. That's the reason they are not learning on new technology and adopting it. Or that's the reason it's not getting implemented in India. Process of learning of new technology gives a fear to that population who are illiterate. People living in that rural villages electricity, knowledge barrier and language barrier is there...." ***– Research Scientist (Academic 9)***

"...I mentioned that India being a developing country, we need a good infrastructural support. To share those patients and disease related information the Indian geographical region needs to get developed. In those kind of setup, definitely infrastructural development as well as literacy of that particular program or awareness of that particular strategy needs to be there...." ***– Dean academics (Academics 3)***

"...People, background, culture and all those things might be different vary from country to country. So some of the aspects that are common to a country similar to ours, those things, those model can be like, seen and adopted and studied...." ***– Professor (Academic 2)***

"…And then when we enter the rural markets, I think that we would face a whole new set of challenges, you know language barrier. How those apps would be able to provide support in the local regional languages, definitely there is scope but my thinking and understanding at this point of time is that the urban market itself is still not fully tapped…." ***– Associate Professor (Academic 7)***

Upon perusing the remarks, experts largely express disapproval of the newest technology and have come to the conclusion that adoption and implementation will face challenges. They identified patient, linguistic, and infrastructure barriers as some of the obstacles.

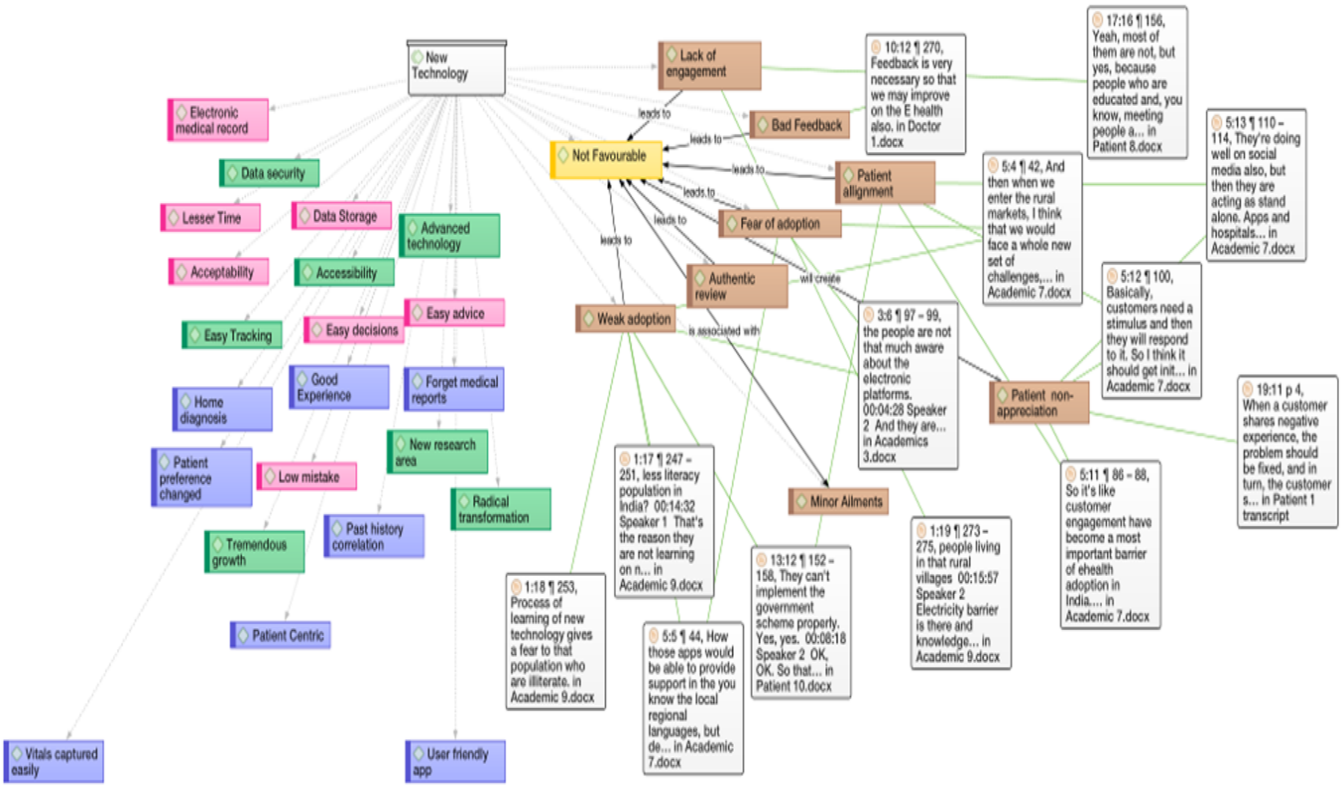
THEME 2: NEW TECHNOLOGY

When respondents were asked about the adoption of new technology in India there were both favourable and unfavourable responses. We will discuss both with the different quotations given. The negative codes came up from respondents are already discussed in the figure so we will look in to the favourable quotation regarding adopting of new technology.

Table 5.3: Respondents questions for technology

Respondents	Questions
Doctors	What is the practitioner`s attitude towards eHealth services in India? How practitioner`s appraise and evaluate a technology which is different from daily use ? How practitioner`s operationalise a new technology in practice by investing effort and resources ? What is your view point on the satisfaction level of the customer on using new technology for their health?
Patients	What can be the process of learning new technology so that enough population of India can adopt eHealth? What is your satisfaction level on using new technology for your health?
Academicians and industry professionals	How researchers are making sense of a new eHealth technology? How well eHealth research is been taken forward in India?

	What is your view point on the satisfaction level of the customer on using new technology for their health?



Pink box: *Doctors*
Green box: *Researchers*
Blue box: *Patients*
Right-side box: *Code with negative comments*

Figure 5.2: Codes for new technology

Academicians-

"...absolutely benefit for the society because it helps the health care more accessible to every corner of the country...." ***– Dean academics (Academics 3)***

"...Researchers who are doing research on the eHealth outside India. We should take help from them. We should work collaboratively with them...." ***- Professor (Academic 2)***

"…India which has launched wearable devices. A person who is having a chronic disease so they are using wearable devices which is implemented on the home itself and doctors can take their report. So, if it is just checking the vitals for that it can really save a lot of time and you know physical visit time and resource …." ***– Associate Professor (Academic 7)***

"…Of course, it is a very nascent stage right now. Most of the people like you can see myself have not adopted it, not used, so it does need more awareness…." ***– Lead project development officer (Academic 1)***

"…It's like same as practitioners, are also getting problem to engage to eHealth, to adapt a new technology and that should definitely be the case because healthcare practitioners are very busy people. So, they first of all, lack the time and obviously the motivation. Also, if there is a kind of again a motivation for them to shift to this new mode and invest some time and energy into it. Then I think that will catalyse the adoption…." ***– Research Scientist (Academic 9)***

Experts have concluded that the new technology is good for society and ought to be available to all citizens. One advantage that they strongly suggest is the use of recently introduced wearable technology, which allows chronic patients to manage their vital signs at home instead of needing to see a doctor frequently. The obstacles that they have identified include the need for increased awareness and the practitioner barrier to eHealth engagement. They even seek assistance from researchers working on eHealth issues who are based outside of India.

Patients-

"…The widespread adoption of health applications gives customer the high expectation of having an application that is both simple and intuitive in the palm of their hand. A welcome video explaining how to navigate the pages should be available while using a website. Everything on the website must be clear enough for both the general public and various demographic groups to understand…." ***- Patient 1***

"…When it comes to rural areas in India, there is still much research that needs to be done for the demographic group that is completely ignorant of eHealth policies of the government or perhaps they are unable to use eHealth apps, as well as the numerous difficulties they encounter when using it…." ***– Patient 7***

"…Despite the significant advancements made in the area of eHealth over the past 25 years, adoption and implementation issues still exist, and the benefits achieved are still not up to par…." ***– Patient 1***

The comments from the patients make it clear that digital apps must be easy to use and straightforward; in fact, a tutorial video on how to use an app can aid increase adoption. Since there are still obstacles in rural areas and they are not included in the Indian government's eHealth policy, they require greater attention.

Doctors-

"…That is, successful and you will see a drastic radical transformation in a way public healthcare works in this country…." ***– Surgeon (Doctor 5)***

"…With the continuous tapping on the mind, people have realized that there is going to be a huge change and E health or digitalization is going to be the part of life…." ***– HOD Neurology (Doctor 4)***

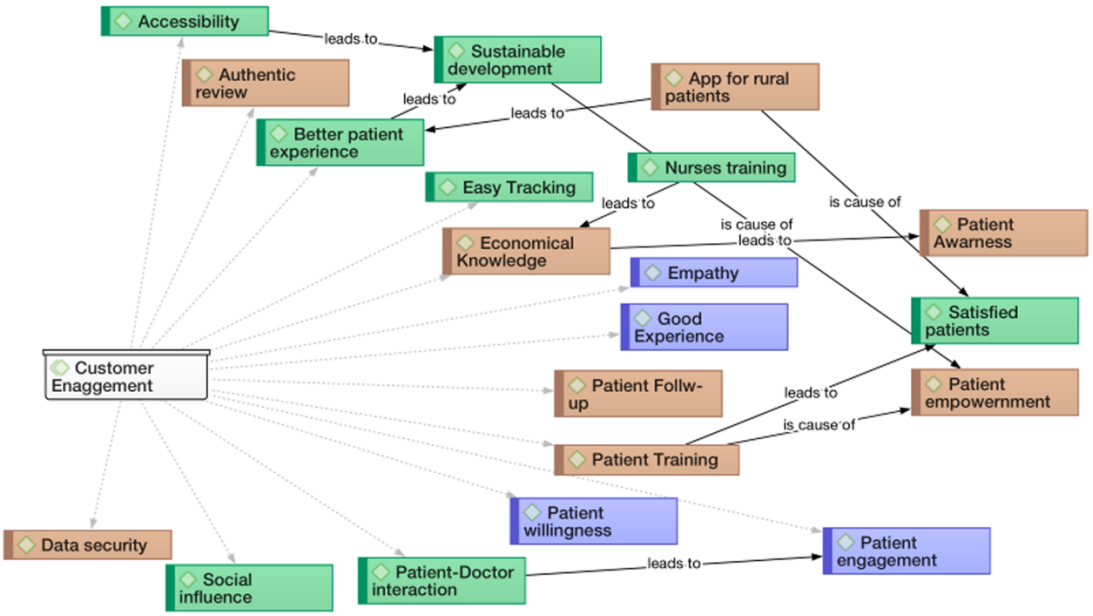
In the end, physicians have expressed great optimism about the digital revolution and are confident that consumers will embrace the changes.

THEME 3: CUSTOMER ENGAGEMENT

Table 5.4: Respondents questions for customer engagement

Respondents	Questions
Doctors	How important is customer engagement in eHealth?

	Why customer interaction are necessary for better customer engagement in eHealth? For engagement of customer what options can lead to customer involvement and intimacy according to practitioner`s perspective?
Patients	How are you engaging to electronic Health? What can be the issue that you couldn't engage to eHealth?
Academicians and industry professionals	How important is customer engagement in eHealth?



Green box: *Doctors*
Brown box: *Researchers*
Blue box: *Patients*

Figure 5.3: Codes for customer engagement

Doctors-

"…Global adoption of electronic health could have social advantages, such as making it easier for doctors and other medical personnel to access patient records when they're far away from their patients…." – ***Senior VP (Doctor 1)***

"…Curiosity comes when they understand the process. They understand the advantage of it. So, people should be aware. Government can also take their strategy to make the common people aware about the advantage…." ***– Emergency Medicine (Doctor 3)***

"…doctors who are like started having this E health facilities so they should be like courteous to the patients like patient doesn't know so they are the one who will make them aware that what is the help of it. Need to ensure that people are convinced that the medium has changed but the results won't. Will have the same kind of result…."- ***General Practitioner (Doctor 6)***

Regarding patient involvement, physicians believe that patients ought to be interested in the newest technology and, if so, will be able to comprehend the procedure and its benefits. Additionally, doctors bear the responsibility of educating patients about new technologies and raising awareness of them.

Patients-

"…I don't want to discuss these things in public, whether it may be a sexual disease or anything else. So, people may suffer with it, but they don't want to disclose it with their networks or anybody else in the public. So, for such kind of diseases, yes, what I think is these apps or electronic considerations will be very beneficial for them until these things are provided, the rural and urban areas…."- **Patient 4**

"…You know, I think people who are already aware, like me, why would they waste their time? But I think if there is a way in which we can predict like whether the reviews are true or not, things like that, I think that will be more beneficial for us and there should be some transparency…."- **Patient 8**

"…People must actively interact with and use these platforms in order to realise the potential advantages of electronic health (eHealth), such as increased accessibility and cost effectiveness. Before utilising any new technology, patients should receive proper instruction, and when it comes to their health, this is absolutely essential…." **- Patient 1**

"…even in the presence of more situational factors, such as pandemics, the healthcare industry must demonstrate its honesty and openness in order to improve customer satisfaction. Global adoption of electronic health could have social advantages, such as making it easier for doctors and other medical personnel to access patient records when they're far away from their patients…."- **Patient 3**

After interacting with the responders who must primarily participate in the computerised delivery of healthcare, they had rather diverse perspectives. Sub-themes included knowledge of the process, communication with other patients receiving the services, and possible benefits including lower costs and greater accessibility. One of the most novel ideas expressed by patients is that they believe electronic health can greatly benefit those with sexually transmitted diseases that, because to the prevalent taboo against open discussion in Indian society, result in a higher death rate—and that these patients can more effectively communicate with their physicians.

Academicians-

"…the people are not that much aware about the electronic platforms.
And they are not much flexible to taken up these new ideas or new concept into their day-to-day life. There is two main Person who actually involved in this process, one is the customer or patients. Another is the service provider or doctors. So, to make these particular things successful. The involvement of these two sectors 2 persons. Is equally important…." **– Dean academics (Academics 3)**

"…if we can give more research on E health in future years, then definitely we can able to develop such robust platform that enables the patient to access this healthcare system of India more easily. Government wants this strategy to be implemented very well, very strategically in our social settings. We are equally responsible to make this successful. If we can adopt this kind of strategy, very welcoming way…." – **Healthcare Industry Founder (Academics 6)**

"…customer engagement is very important, until and unless the parties who are involved in this kind of platform are enough engaged or not enough. Occupied or not adapted to that particular E health strategy, definitely this will not possible to make eHealth research to be successfully India…." **– Professor (Academics 2)**

"…So, we're talking about barriers only when patients used to visit doctors.
they feel a touch and that's the reason patients used to get connected to the doctors. No touch feeling from the doctors…." **– Research Scientist (Academic 9)**

"…in foreign countries there is a system of electronic health records wherein what happens is that every patient has a unique ID like for example we have aadhaar card. So, our entire health information should be linked to that ID irrespective of which hospital I go to. So, whenever I go to a new hospital, I don't have to explain everything from the scratch, and it should all be integrated…." **– Associate Professor (Academic 7)**

"…I've come across studies where people you know there are empathy chat bots for design to help people with mental health problems because people who suffer from anxiety, from depression, from loneliness. So there a lot of experimental studies which were done and then people were made to interact with those. Chat bots to provide that social support, to provide empathy. And it was interesting that. The responses were not negative, so people responded. Favourably so it can be done…." – **Scientist E (Academic 4)**

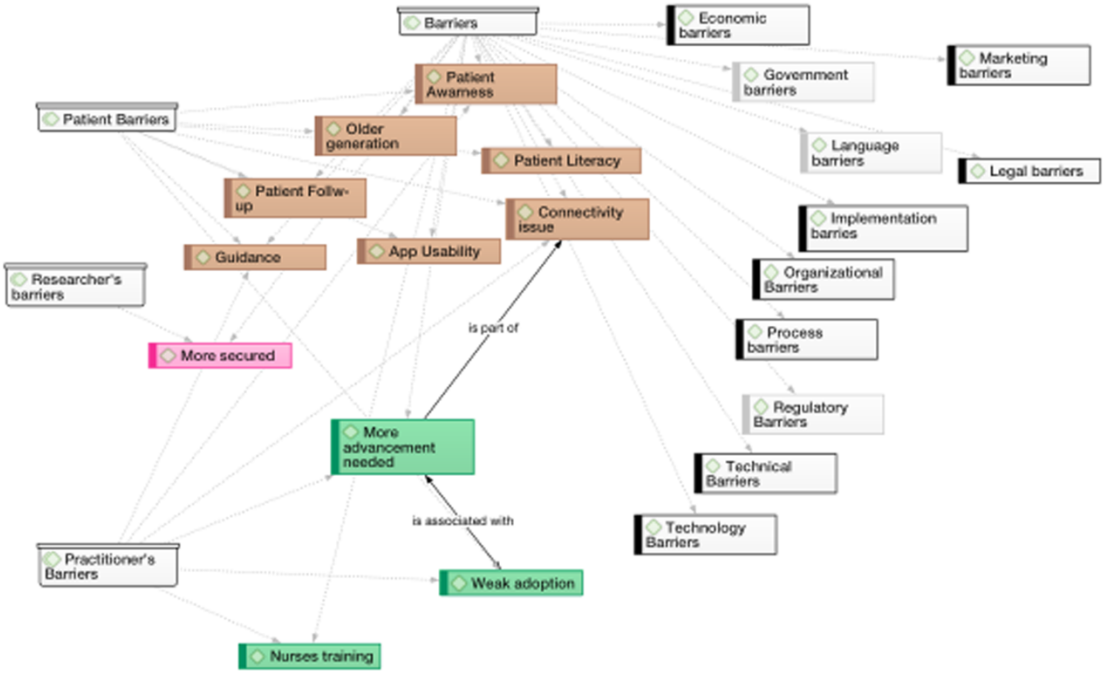
Academicians believe that if research is conducted more effectively and research institutes receive appropriate funding, society may benefit and adoption may occur more effectively. They recommended that, in order to maximise benefits, each citizen be issued with a unique health card. Empathy chatbots can help even those with mental health issues at home; the results of this research are encouraging.

THEME 4: BARRIERS

Table 5.5: Respondents questions for barriers

Respondents	Questions
Doctors	What are the most prominent barriers to eHealth adoption in India? Share me your ideas regarding regulatory and organizational barriers? How helpful is technical infrastructure for better adoption of eHealth in India ?

	What can be the administrative and economic barriers in eHealth adoption?
Patients	What problems are you facing while using eHealth?
Academicians and industry professionals	What are the most prominent barriers to eHealth adoption in India? Share me your ideas regarding regulatory and organizational barriers? How helpful is technical infrastructure for better adoption of eHealth in India? What can be the administrative and economic barriers in eHealth adoption?



Left Side:
Brown: *Patients barriers*
Pink: *Researchers barriers*
Green: *Practitioner barriers*
Right side:
Other identified barriers

Figure 5.4: Codes for the barriers

"...Doctors are very bad at adopting technology, especially the older generation where they have been born, brought up and used pen and paper, getting them to use technology is very difficult, but that I'm happy to say you that this also has changed...." ***- Surgeon (Doctor 5)***

"…Yes, yes, barriers are there like infrastructure it is the most important values to the mobile healthcare. The digital infrastructure and now awareness, privacy and security. So, data security is one of the major factors that so government or policymakers should be taken care of…." – ***Research Scientist (Academic 9)***

"…Have taken years of studying and research and all that to get into that position where they can treat the patients. Now adding this extra layer of technology might be challenged for some of them…." - ***Professor (Academic 2)***

"…Infrastructural barrier is one of the key barriers I would say, in portability, challenge is the regulatory, policy or government policies. It is not only the technology, but it is the people, process and technology…." – ***Associate Professor (Academic 7)***

"…People, background, culture and all those things might be different vary from country to country. So, some of the aspects that are common to a country similar to ours, those things, those models can be like, seen and adopted and studied …." ***– Professor (Academic 2)***

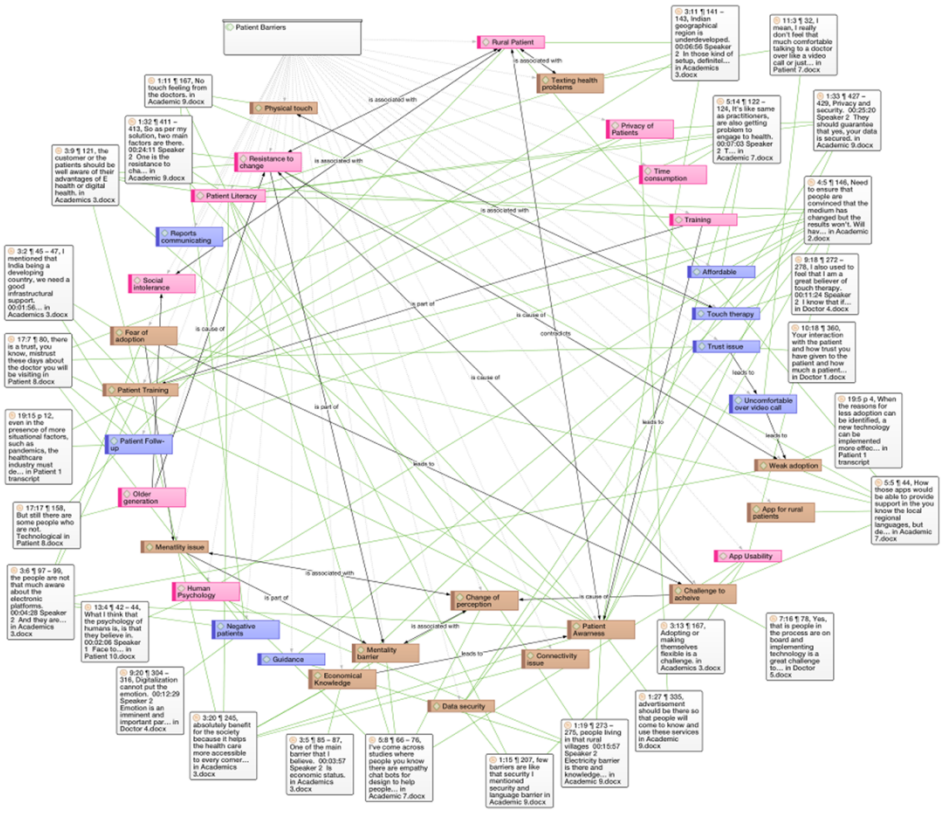
"…Technology also the connectivity and maybe rural area did not cover 100% so talking about technical infrastructure barriers will be there…." - ***Patient 5***

The image presents a division of the detected barriers into three categories: patient, researcher, and practitioner barriers. The barriers are further classified based on the responses supplied by the respondents. Thus, physicians primarily discuss the necessity for nurses to receive the training necessary for improved process development and also note that adoption is still lacking. Researchers need more infrastructural advancement and are more concerned about the security of patient data. Patient obstacles include things like knowledge of electronic health, patients' literacy in rural locations, and connectivity problems in rural areas, which result in difficulties related to technical infrastructure.

THEME 5: PATIENT BARRIERS

Table 5.6: Respondents questions for patient barriers

Respondents	Questions
Doctors	What according to you customer related barriers can be? What can be the potential barriers to customer engagement in eHealth adoption in India?
Patients	Does word of mouth anyhow help you to engage to eHealth platforms? Why do you think accessibility can be a problem to adopt eHealth technology?
Academicians and industry professionals	What according to you customer related barriers can be? What can be the potential barriers to customer engagement in eHealth adoption in India? Why customer interaction are necessary for better customer engagement in eHealth? For customer engagement what options can lead to customer involvement and intimacy?



Pink: *Code from the researcher*
Brown: *Code from patient*
Blue: *Code from doctor*

Figure 5.5: Code for patient barriers

As seen in the image, 32 hurdles were highlighted in total after the interview was completed and the quotations were categorised. Thirteen of the thirty-two hurdles came from patients, eight from physicians, and ten from researchers. Thus, it's clear that patient hurdles are greater when it comes to eHealth adoption in India. In general, patients demand better explanations of the procedure, precise answers to their questions, and relief from their apprehension of utilising new technologies. Physicians and academicians are more concerned about patient data security and privacy.

"...Everything on the website must be clear enough for both the general public and various demographic groups to understand...." ***- Patient 1***

"...When a customer shares negative experience, the problem should be fixed, and in turn, the customer should be thanked for helping to improve the service...." ***- Patient 5***

"…In rural areas, especially in Himalayan state. The infrastructure of health system is not so good. It is very low. So, in the Himalayan state and rural areas, people face severe health issues…." ***- Patient 10***

"…I mean, I really don't feel that much comfortable talking to a doctor over like a video call or just simply just texting them and telling my problems…." ***- Patient 7***

*"…We are mostly conventional person and we have a conventional mentality in the term of adoption of medical system. Like we mostly believe that if we can go to the doctors, in the Operation theatre and the surgery are done directly by the doctors, the patients become more trusted towards that system…."****- Patient 9***

"…Privacy and security. They should guarantee that yes, your data is secured. And you know, it should be patient centric. Because if it is not some people will not use nowadays, there are people who are not much educated. See literacy level is, you know, in India somehow difficult people doesn't know the language…." ***– Research Scientist (Academic 9)***

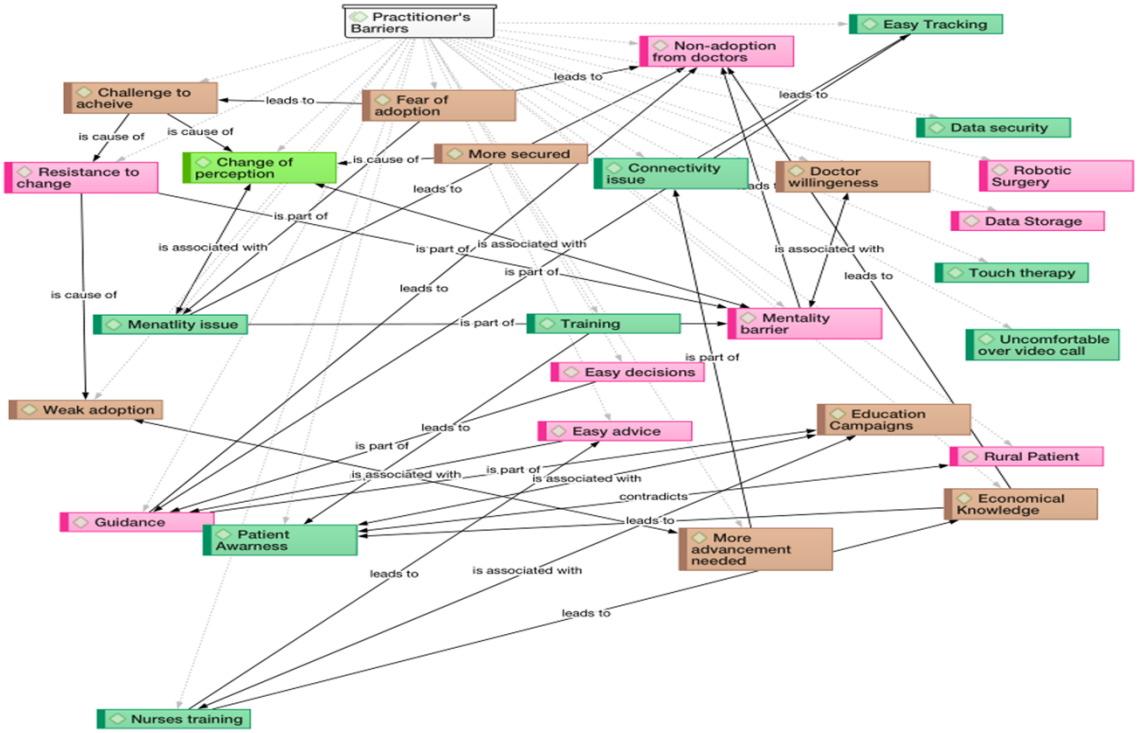
"…the patients should be well aware of the advantages of eHealth or digital health, people are not that much aware about the electronic platforms. And they are not much flexible to taken up these new ideas or new concept into their day-to-day life…." ***- Dean academics (Academics 3)***

"…Privacy of the patient's data is very, very important. …." ***– Senior VP (Doctor 1)***

Theme 6: Practitioner's barriers

Table 5.7: Respondents questions for practitioner's barriers

Respondents	Questions
Doctors	What are the barriers practitioner`s are facing in eHealth adoption?
Patients	Why do you think you couldn't connect to practitioner`s easily in eHealth?
Academicians and industry professionals	What are the barriers practitioners are facing in eHealth adoption?



Green: *Doctor*

Pink: *Researcher*

Brown: *Patient*

Light Green: *Most identified code from doctors*

Figure 5.6: Codes for practitioner's barriers

Due to their existing lack of training, the majority of medical professionals are not aware of the practical, ethical, or legal ramifications of using modern telecommunications technologies. Although rural practitioners are less likely to support new technology, they are more experienced with it. They worry that they may lose patients because a patient in a rural area can see a doctor in a metropolis that seems to be quite a distance away. According to the law, a physician or other organisation must apply for a licence before handling a patient's data. The biggest barrier is faith in the effectiveness of technology. Medical professionals often lack knowledge about procedures for securely removing patient files from computer hard drives or encrypting email correspondence to safeguard patient privacy. Although legislative protections for patients and practitioners are still evolving, federal guidelines aimed at ensuring the secure transfer and privacy of medical information are currently under development.

"…the doctor should be more flexible in the adaptation of this particular strategy. there are certain populations of the Doctor who are pretty old school mean minded. They mostly believe on the conventional processes…." ***– Dean academics (Academics 3)***

"…Adopting or making themselves flexible is a challenge …." ***- NGO Founder (Academics 5)***

"…Have taken years of studying and research and all that to get into that position where they can treat the patients. Now adding this extra layer of technology might be challenged for some of them. …." ***- Professor (Academic 2)***

"…So, the doctors first of all, lack the time and obviously the motivation. Also, if there is a kind of motivation for them to shift to this new mode and invest some time and energy into it. Then I think that will catalyse the adoption. …." ***– Associate Professor (Academic 7)***

"…Is not well organized from the point of view of doctors but, they are willing, but they are also not well organized to this…." ***-Emergency Medicine (Doctor 3)***

"…I also used to feel that I am a great believer of touch therapy. I know that if I keep one hand on the shoulder of my patient. 50% of his or her disease will get cure.
Yes, but it's one way of seeing the things. …." ***– HOD Neurology (Doctor 4)***

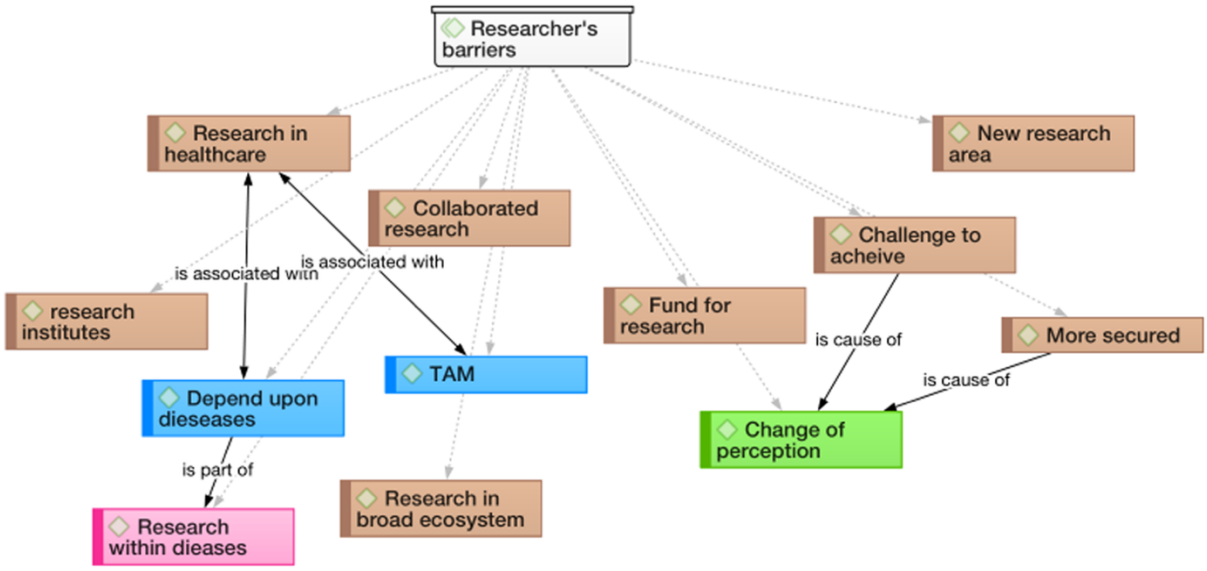
"…I think the private sector is still lagging behind in this and every doctor, every staff has to be prepared. It's going to be absolutely digital. …." ***– General practitioner (Doctor 4)***

THEME 7: RESEARCHER BARRIERS

Table 5.8: Respondent questions for researcher barriers

Respondents	Questions
Doctors	
Patients	

Academicians and industry professionals	How researchers are appraising and evaluating a technology which is different from daily use? How researchers operationalize a new technology in practice by investing effort and resources?



Brown: *Main identified code*

Green: *Cause code*

Blue: *Associated code*

Pink: *Part of code*

Figure 5.7: Codes for researcher barriers

The image provides a clear picture of the obstacles that the researchers have identified as standing in the way of the study being done in India. Diseases should be the focus of electronic healthcare research, and the technological acceptance model should be followed. Research collaboration should be pursued across disciplines and globally. They also described this as a fresh field of study and a novel concept.

"...I believe that there are some researches going on. But more directed and strategic research in these themes or in this area is highly required in a country like India. even I think that E

health connecting with various diseases like cancer or maybe thalassemia and research should be done on it also…."- ***Dean academics (Academics 3)***

"…like the fund or something, the researcher is not getting up to that limit. So maybe the research is not up to the point. That's the reason there is a non-adoption and non-implementation of eHealth in India. …." ***-Research Scientist (Academics 9)***

"…the research is needed in every ground for to make the Indian government understand what are the barriers. So that they would know what help Indian government can do to the researchers. if I say about the health field there are different types of people with different expertise at different area and each of them can potentially contributes. …." ***– Professor (Academic 2)***

"…Government can create a common platform for all the multidisciplinary people. Can come interact with each other, share their ideas regarding eHealth, and create a common platform where they can do research by joining hands. That gives you a best fruit out of it. People, background, culture and all those things might be different vary from country to country. So some of the aspects that are common to a country similar to ours, those things, those model can be seen and adopted and studied. …."- ***Scientist E (Academics 4)***

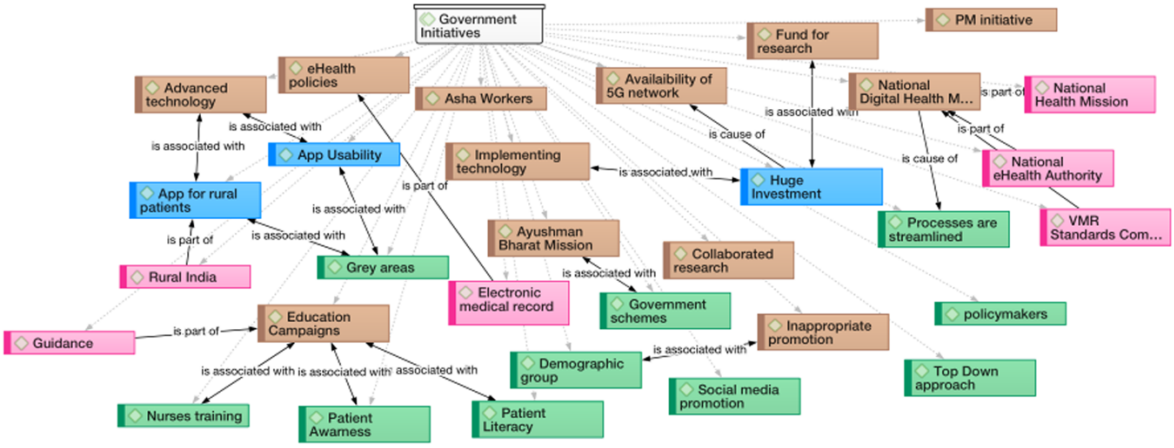
"…we have to take help for our research from the other countries who are doing research on health and gets that things implemented in our India or it's like we can work collaboratively with other countries and do something betterment for our country. I think we can successfully look at those cases…."- ***Associate Professor (Academic 7)***

"…we should learn it from different countries or we should work collaboratively with other countries and do something new for Indian eHealth adoption. I think both of them are going to be beneficial. We can learn from them and we can adapt some of their technologies or whatever they are doing. The way they are doing it and also, we can collaborate with them also so as to facilitate. …." ***– Professor (Academic 8)***

THEME 8: GOVERNMENT INITIATIVES

Table 5.9: Respondent question for government initiatives

Respondents	Questions
Doctors	Do you have any insight of the strategies the Indian government has implemented to date to encourage the adoption of eHealth in India ?
Patients	Do you have any insight of the strategies and solutions the Indian government has implemented to date to encourage the adoption of eHealth in India?
Academicians and industry professionals	Do you have any insight of the strategies the Indian government has implemented to date to encourage the adoption of eHealth in India?



Brown: *Initiative already taken*

Pink: *Initiatives recommended by Doctors*

Blue: *Initiatives Suggested by Researchers*

Green: *Initiatives Suggested by Patients*

Figure 5.8: Codes for government initiatives

The scope of e-Health is vast, encompassing various economic models, which poses challenges in its governance. A significant obstacle arises from the absence of comprehensive government regulations and legal frameworks, hindering the development and implementation of effective e-health strategies. Additionally, challenges such as the lack of national information standards and code sets, limited financing options, physician apprehensions, and interoperability issues further complicate the establishment of clear eHealth guidelines. Despite the initiation of the National Digital Health Mission (NDHM) by the Indian government in 2020 to modernize the healthcare system, there remains a lack of empirical research addressing why eHealth adoption in India remains limited despite these efforts. Therefore, there is a critical need to identify, classify, and prioritize the key factors acting as barriers to eHealth adoption in India.

"…actually, government is trying to implement the number of projects have been started and taken care by the women like NPR…."- ***Research Scientist (Academic 9)***

"…It could have been a problem before, but I don't think now is any issue in the infrastructure front space in the rural areas also. Like 70-80% of the country is connected with 5G network. …."- ***Surgeon (Doctor 5)***

"…Very achievable at this point in time for the nation and especially with the government initiatives of Ayushman Bharat Mission. So, Ayushmann Bharat and the National Digital Health mission are shining examples of the way the government wants to digitize the Indian healthcare, both public and private…."- ***Lead project development officer (Academic 1)***

"…we are supposed to fill up the records of the nursing staff and also doctors, it has become compulsory. Our payments through the Ayushmann were stopped because our health record was not complete. So, Indian government is much quicker. …." **– *NGO Founder (Academic 5)***

"…The Ayushman Bharat Digital Mission. It mainly aims to create the framework required to support the nation's integrated digital health infrastructure. …." ***Patient 1***

"...if you are registered in this EHR system then you Will be given say 5% discount. Because it has been considered in all these studies, that reward is better than punishment. ...." ***-HOD Neurology (Doctor 4)***

"...people are using awareness there should be education campaigns to adopt the services or public private partnership. ...." ***– Research Scientist (Academic 9)***

"...I think the focus on the utilization has grown very well and majority of the hospitals everywhere all across the country are investing significant amounts of money. ...." ***– Surgeon (Doctor 5)***

"...Are times when you misplace the reports or the pages, or sometimes you cannot explain the doctor. But if you have already done your tests and everything has been submitted in electronic health record it becomes easier for the doctor and you don't have to go through that whole procedure again of taking the test. So, I think that is much better. ...." ***- Patient 7***

"...The Ayushman Bharat Digital Mission. It mainly aims to create the framework required to support the nation's integrated digital health infrastructure. So, the entire NHA National Authority has a lot of work, which is being done. ...."- ***Surgeon (Doctor 5)***

"...Actually, nurses also have some advanced technology to follow up like, the patient records, vitals, and all the reports. They need to be more advanced so that they can call the doctors and inform immediately. ...." – ***General Practitioner (Doctor 7)***

However, despite all of the advancements made by the Indian government, there are still gaps in the country's adoption and application of eHealth. Larger-scale government projects are malfunctioning, and Asha workers who are employed are being underpaid, which is a work-related carelessness. Therefore, for improved acceptance and implementation of eHealth in India, proper government engagement is required.

"...The state wise also governments have initiated some projects, but actually in the larger scale, if you ask me, it's not succeeded...." ***– Research Scientist (Academic 9)***

"…Despite the significant advancements made in the area of eHealth over the past 25 years, adoption and implementation issues still exist, and the benefits achieved are still not up to par. Global adoption of electronic health could have social advantages, such as making it easier for doctors and other medical personnel to access patient records when they're far away from their patients…." ***– Scientist E (Academic 4)***

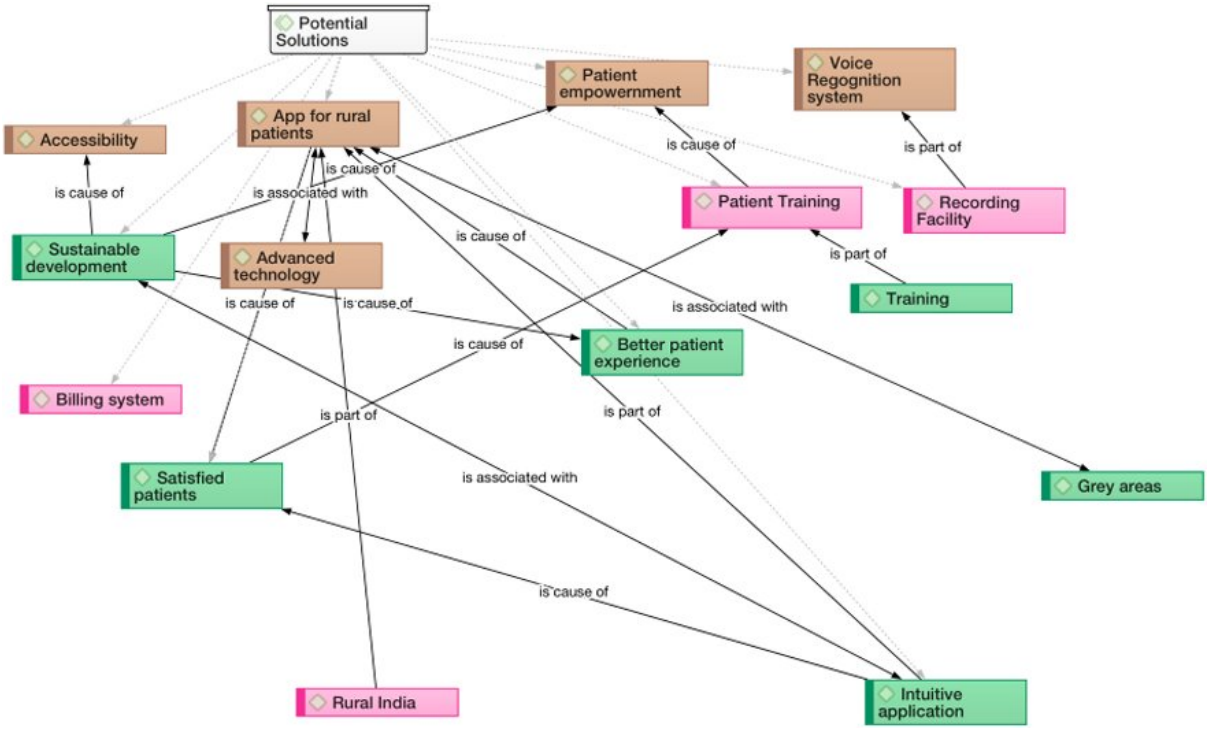
"…Asha workers are recruited but Government is pending payment for the work done. …." ***– Emergency Medicine (Doctor 3)***

"…The eHealth ecosystem in India is also developed and promoted by National eHealth Authority (NeHA) from 2015. Despite this, there is a lack of proper engagement in the eHealth field in India. …." ***– Senior VP (Doctor 1)***

THEME 9: POTENTIAL SOLUTIONS

Table 5.10: Respondent questions for potential Solutions

Respondents	Questions
Doctors	What would be the potential solution for improving patient engagement in eHealth?
Patients	What other strategies and solutions can be used to implement and adopt eHealth in India?
Academicians and industry professionals	What potential solution are there for improving patient engagement in eHealth research?



Brown: *Solutions provided by practitioners*

Pink: *Solutions from researchers*

Green: *Solutions from patients*

Figure 5.9: Codes for potential solutions

Solution 1: Accessibility

"…absolutely benefit for the society because it helps the health care more accessible to every corner of the country. Also, message from existing patients will definitely create an impact. So, if they say something positive about some platform that directly impacts the mind of a patient. …." ***- Dean academics (Academics 3)***

"…Now we know that the medicines all can also be delivered at home. So, if this message can be spread out to larger audience that would be of beneficial and it would take time. But

eventually if things catch up, people would definitely see the better. ….” ***- Professor (Academic 2)***

Customers will participate in the digital market if they receive faster and better service. Yes, this has a significant impact on how customers in digital healthcare are treated and governed. Customers want to build a relationship with the company when they use a service, so it's important to be open with communication and have the capacity to spot chances for new products or services that customers would find helpful and take advantage of them before they even notice it. Additionally, everyone benefits from accessibility research and development.

Solution 2: App for rural patient

“…For the rural patient we have one more app which send reports directly to them….”- ***General practitioner (Doctor 7)***

“…I think the eHealth can help a lot to the villagers, because nowadays everybody is having mobile even in the interior areas of the villages. India, including the hill areas every place, is having excess of Internet. ….” ***- Senior VP (Doctor 1)***

In order to save patients from having to drive great distances to get their reports or show them to the doctor, some hospitals are exclusively employing the programme for patients who live in remote areas. In order to make the applications easier to grasp, they are also offered in their native languages. Therefore, it is suggested that every hospital in India implement this kind of effort.

Solution 3: Patient Empowerment

“…Curiosity comes when they understand the process. They understand the advantage of it. So, people should be aware. Government can also take their strategy to make the common people aware about the advantage….” ***- Dean academics (Academics 3)***

Patients from both urban and rural areas should receive education about the benefits and applications of electronic health. The majority of the time, urban people are educated and dread embracing certain types of healthcare facilities, while rural people are unaware of their existence. Therefore, the best way to achieve improved adoption is through patient empowerment.

Solution 4: Voice Recognition system

"...May be, doctors or other healthcare workers can just speak and system can write it will be very useful. Maybe, voice recognition is a good thing. So, advancement can save our time. ...." ***- General practitioner (Doctor 7)***

Some hospitals use electronic health records, which allow patients' data to be preserved and accessed from anywhere at any time. However, doctors discover that saving every piece of data takes a lot of time, therefore they recommended that if this programme included a voice recognition system, it would save even more time.

Solution 5: Electronic medical record

"...Having a health record which is electronic available to the doctor and also to the patients and even any hospital they visit next time any chronic disease. So, they will be knowing from last one or two years what doctors they have seen and what reports they have got. ...." ***- Senior VP (Doctor 1)***

Since clinicians will have access to patient data, including diagnoses, allergies, test results, and prescriptions, EMR implementation is necessary. Secure electronic communication between patients and physicians will benefit from this. Patients will also benefit from having access to illness management tools, health information resources, and medical records.

Solution 6: Advanced Technology

"...A welcome video explaining how to navigate the pages should be available while using a website. Everything on the website must be clear enough for both the general public and various demographic groups to understand. ...." ***- Patient 1***

The patient suggests that for better acceptance, technology should be more advanced. It is not sufficient to only provide apps; appropriate usage instructions is also required. Therefore, a

brief video explaining the options and process should always play when a patient accesses an EMR or health application.

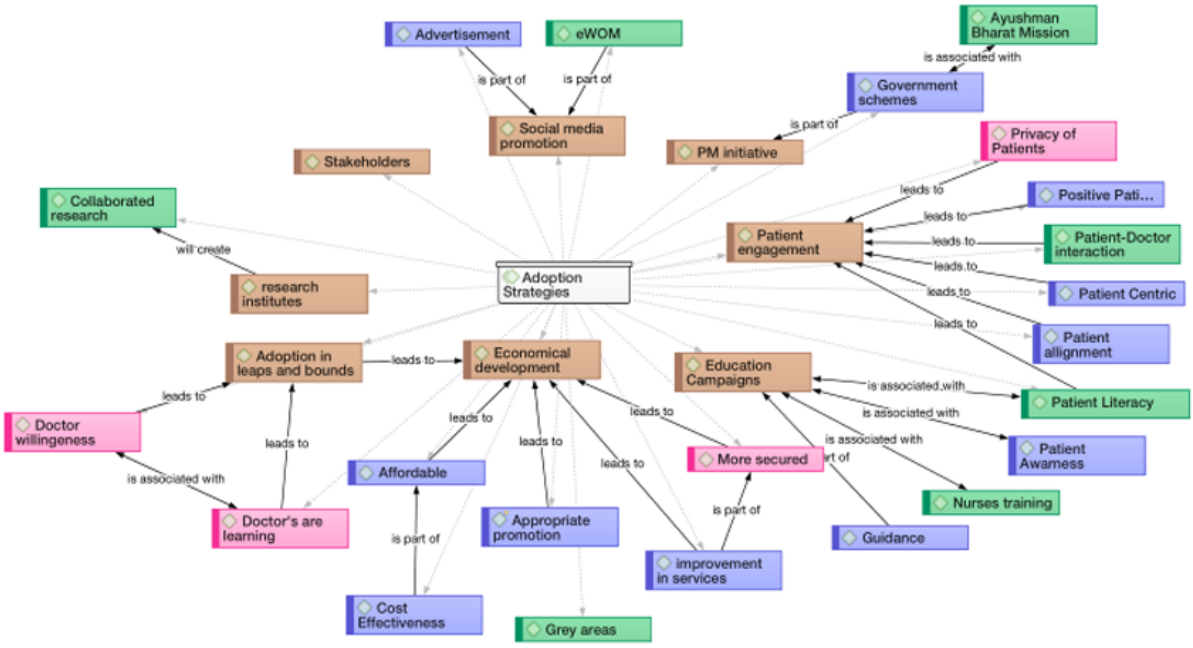
Brown: *Ultimate solution need to be taken*

Figure 5.10: Potential solution for eHealth adoption

THEME 10: ADOPTION STRATEGIES

Table 5.11: Respondents question for adoption strategies

Respondents	**Questions**
Doctors	What other strategies can be used to implement eHealth in India? What other strategies can be used to adopt eHealth in India?
Patients	What other strategies and solutions can be used to implement and adopt eHealth in India?
Academicians and industry professionals	What other strategies can be used to implement and adopt eHealth in India?



Brown: *Ultimate strategies need to be taken*

Green: *Strategies proposed by researchers*

Blue: *Strategies suggested by patients*

Pink: *Strategies recommended by doctors*

Figure 5.11: Adoption strategies for eHealth adoption

Strategy1: Social media promotion

"…So as per my solution, two main factors are there. One is the resistance to change and the second one is what we call social influence. …." ***- Professor (Academic 9)***

"…Users sharing their screenshots of interaction and creating so many discussions on social media and looking at how many sign ups were there so definitely Word of mouth is one of the main important factors that becomes a mean process of advertisement…." ***- Scientist E (Academics 3)***

"…So, word of mouth is definitely very important, especially word of mouth is important in small communities. But if you have to talk about the population of 160 crores, then word of mouth is not going to help you too much. …." ***- HOD Neurology (Doctor 4)***

"...A good word-of-mouth reputation is crucial for better adoption. ...." ***-Patient 1***

"...So once there will be reservations initially for the patients, if a patient gets fine with robotic surgery, then there is a thing in medical science that is word of mouth, he will tell 10 more patients to go to it. ...." ***- Senior VP (Doctor 1)***

Social media platforms offer valuable opportunities to promote healthy habits and enhance public awareness of health-related issues. Health organizations and activists can leverage various content formats such as videos, infographics, and instructional materials to disseminate information and raise awareness about health topics. Through social media, it is possible to engage with audiences, encourage behavior change, and provide support for adopting healthier lifestyles. By sharing informative and engaging content, social media can play a crucial role in empowering individuals to make informed decisions about their health and well-being. Social media platforms provide a means for healthcare practitioners to interact with the general public. Providing common health queries with answers eases people's minds and prevents them from self-diagnosing. The World Health Organisation, for instance, created a chatbot for Facebook Messenger.

Strategy 2: PM Initiative

"...The primary objective of the government must be like electronic medical record, if you don't have any medical history recorded then you are not able to identify some of the diseases which is in long term or exempted from medical benefits. ...." ***-Patient 4***

"...First of all, focusing on the infrastructure. Secondly, communicating the benefits and you know incentivizing hospitals to come on eHealth platforms and to communicate the benefits to their patients maybe bring a huge difference. ...." ***- Associate Professor (Academic 7)***

We have examined every tactic and solution available for improving the uptake and application of eHealth in India. The precise obstacles have been determined. Now that government funding is available, more research can be conducted. It's also necessary to take care of the infrastructure setup for grey zones. It is also essential that the current plan be implemented everywhere, something that the government alone is capable of doing. The National Digital

Health Mission will put into practice the fundamental and standard digital building blocks needed for healthcare and make them available to the public and commercial ecosystems as digital public goods.

Strategy 3: Patient Engagement

"...I believe that customer engagement is one of the important factors that need to be addressed for a better adaptation of eHealth Unit. ...." ***- Dean academics (Academics 3)***

"...When a customer shares negative experience, the problem should be fixed, and in turn, the customer should be thanked for helping to improve the service. ...." ***-Patient 1***

"...customer engagement is very important, until unless the parties who are involved are not enough engaged or occupied to that particular eHealth strategy definitely this will not be possible to make eHealth research to be successful in India. ...." ***- Emergency Medicine (Academics 3)***

Effective patient engagement in a country can empower individuals to better self-manage their illnesses, participate in activities that promote overall functioning and prevent health decline, and actively engage in making treatment and diagnostic decisions. So, for better engagement of patient they should be satisfied with the services provided also have proper knowledge of the changing technology in healthcare.

Strategy 4: Education Campaign

"...Before utilising any new technology, patients should receive proper instruction, and when it comes to their health, this is absolutely essential. ...." ***-Patient 1***

"...people are using awareness there should be education campaigns to adopt the services or public private partnership. ...." ***- Research Scientist (Academic 9)***

"...Convey the message to the mass. You know, to the masses through campaigns to rural areas for better adoption...." ***-Patient 8***

The campaign's objective is to make adjustments and establish a transparent, open, and encouraging environment for both staff and patients. Practical test campaigns should be

conducted, primarily in rural regions, and leaflet distribution in the local language can also be a beneficial measure. Even those who responded acknowledged that raising public awareness can only be accomplished through the appropriate eHealth campaign channels.

Strategy 5: Research Institute

"…When it comes to rural areas in India, there is still much research that needs to be done for the demographic group that is completely ignorant of eHealth policies of the government or perhaps they are unable to use eHealth apps, as well as the numerous difficulties they encounter when using it. …." ***- Patient 1***

"…Researchers should get enough funds, or maybe enough help from the Government of India. Should engage more and more research. Institutes or research Centres for this kind of research. The budding researcher to work on this area by providing them in a fund support and necessary…." ***- Research Scientist (Academic 9)***

"…if we can give more research on eHealth in future years, then definitely we can able to develop such robust platform that enables the patient to access this healthcare system of India more easily. …."- ***Dean academics (Academics 3)***

Future studies aimed at improving the policies should be conducted in addition to current research on eHealth policies. Research institutes in India should receive the funding they need from the government since scientists are confident that with proper facilities, they will generate new ideas for implementing electronic health.

Strategy 6: Adoption in leaps and bounds

"…the doctor should be more flexible in the adaptation of this particular strategy. …." ***-Group Chief information officer (Doctor 2)***

"…In India, I think it's quite important, especially amongst the doctor, because doctors' community is huge in every city. …." ***- Lead project development Officer (Doctor 8)***

After identifying obstacles, implementing a number of techniques, and drafting new laws, it is now time to implement the precise answer for increased uptake. Therefore, there is no need to

squander time because digitization of healthcare is genuinely necessary for a country to develop and become more diverse. As a result, adoption should be now done rapidly, or in fast progress.

CHAPTER SUMMARY

The methods and approaches that the Indian government should employ to improve eHealth acceptance and implementation in India were covered in this chapter. Customer engagement was identified in the study as one of the obstacles to the adoption of eHealth, and as a result, six strategies and solutions for improving eHealth facilities were developed through a qualitative investigation. The study's conclusion and a roadmap for further research are provided in the next chapter.

CHAPTER 6

RECOMMENDATION, CONCLUSION AND FUTURE RESEARCH

OVERVIEW

This section provides a comprehensive overview of the research conducted in this study. It thoroughly summarizes the main findings and conclusions drawn from the investigation. The chapter also highlights the contributions of the study to the existing literature, as well as proposed solutions derived from the study's findings. Additionally, it discusses the challenges encountered during the review process and outlines potential areas for future research.

INTRODUCTION

This section provides a comprehensive summary of the findings and results obtained through detailed analysis of interview data for this research study. Despite an increased focus on eHealth in the healthcare industry over the years in India, the adoption of innovations in information technology has been relatively slow compared to other service industries. The aim of the study was to identify barriers to the adoption of eHealth in India based on existing literature. Through a literature review and expert interviews, thirty-seven barriers were identified and categorized into eight main categories: customer-related hurdles, regulatory barriers, technical barriers, organizational barriers, practitioner barriers, marketing barriers, administrative barriers, and economic barriers. Using a multi-criteria decision-making technique, the study classified and prioritized these obstacles, with marketing and customer-related barriers emerging as the most significant hindrances to eHealth adoption in India, while economic and technical barriers were found to be the least significant. Key barriers such as customer engagement, staff training costs, health consciousness, employee resistance, and privacy concerns were highlighted across different barrier categories. The study contributes to understanding the identification, categorization, and prioritization of eHealth obstacles in India, emphasizing the need for coordinated efforts to address these barriers and promote optimal development in the health environment. The findings underscore the importance of

government intervention in addressing barriers such as marketing and customer-related challenges through policy initiatives aimed at promoting eHealth literacy and addressing cultural ethical issues.

While previous research has focused on the barriers to eHealth adoption, this study will go a step further by categorising and dividing the most significant barrier. We originally carried out a thorough literature review to investigate the CE drivers mentioned in the literature in accordance with the research objectives. In order to examine the framework's components (drivers), a digital healthcare organisation in India was taken into consideration. It was decided to use the FAHP-DEMATEL approach after assembling an expert panel from within the case company. The FAHP approach helped to calculate the CE driver weights and the input of it is used for the DEMATEL approach. Finding the causes and effects of each of the CE drivers was made easier by the DEMATEL approach studies, which also offered insights into the relationships between the drivers via relationship diagrams. The research results revealed that the customer involvement, interaction and satisfaction were the causal drivers whereas, customer experience and intimacy were documented to be the effect drivers. The customer interaction driver’s considerable influence over the other drivers was demonstrated by the fact that its influence intensity was higher than the threshold value of the other drivers. After the case organisation had used the suggested CE framework for a year, the performance of the organisation was mapped. There was a significant increase in the percentage of customer relationship management, customer support training, omnichannel approach, training of practitioners and online department, target achievement rate, net operating profit and delivery timing. Both customer complaints and data security metrics significantly decreased. An expert panel made up of members of the case organisation and patients provided feedback that served as the foundation for this research. However, to obtain a more comprehensive list of CE drivers and strengthen the study's validity, we carried out a large-scale survey. To calculate the interrelationships between the selected components and evaluate the factor weights, the FAHP-DEMATEL approach was used to achieve a distinctive equilibrium.

The pandemic has introduced India and the rest of the world with plethora of opportunities to accelerate technological advances in healthcare industry. With a strong effort from the government, India's rapid advancement in this sector have proven beneficial to the advancement of the country. Given India's enormous diversity and size, the sector has enormous potential for the future. Extending the notion of the proverb "Health is Wealth," we

can state with certainty that investing in technology will be a wise decision. Patient- centered care is regarded as one of the foundations of a high-performing and quality health-care system. It is a crucial component of several initiatives aimed at changing care and improve population health. Healthcare services in India continue to be unequally distributed. The availability of medical and health - care services in rural India, in specific, is unreliable. So, the absence of a well-organized healthcare system, traditional beliefs persisted, often posing a life threatening risk to patients who are often unaware of potential diseases and cures. The Ministry of Health and Family Welfare (MoHFW) has taken steps to support digital healthcare in empowering citizens through the dissemination of crucial information, prolong the delivery of healthcare services, and expand the public health care system to every region of the nation.

Customer Interaction barrier ranks the highest which indicates that there should be proper two way communication between the patient and the healthcare personnel. There is a chain of process found in this study that is required while engaging, beginning with customer interaction. If there is proper interaction, there will be high chances of involvement, progressing to higher intimacy. Furthermore, if all three of these elements work properly, the percentage of customer experience will be higher, resulting in a healthier and more satisfied customer base. So, in general, all five categories are acting sequentially and individually to improve customer engagement. India has advanced significantly in extending the economy's digitization under the direction of Prime Minister Narendra Modi in order to tap into the nation's overall entrepreneurial potential. Prime Minister Narendra Modi emphasised the value and potential of telemedicine in India by saying, "Our Country is already receiving several counselling sessions without heading to the hospital" . This is, once again, a good sign. So, can we think of business models that would assist further eHealth from across world?". One of the first actions the Modi administration took to act as a promoting, regulating, and standards-setting organisation in the health sector was the establishment of the National eHealth Authority (NeHA) in 2015. NeHA's mission is to facilitate the organisation, management, and delivery of effective, people-centred health services to all in a productive, cost-effective, and consistent way. Despite efforts by organizations like NeHA to develop and promote the eHealth ecosystem in India, there remains a significant lack of engagement in this field. This study aims to assist the Government of India (GoI) in developing more effective customer-oriented processes and organized systems by identifying and addressing the various barriers and sub-barriers that hinder eHealth adoption in the country.

IMPLICATION OF THE STUDY'S FINDING

In the following aspects, this study was a valuable addition to the field of customer engagement for both eHealth researchers and companies:

- For the purpose of creating the CE framework for a digital healthcare company, the authors of this research used an FAHP-DEMATEL-ISM technique. From the literature, it was discovered that many researchers generated CE driver weights but did not evaluate the interrelationships between the drivers. This study estimated the driver weights as well as evaluated how different drivers affected one another.

- Through this study, researchers will be able to collect a large, driver-based data set that they may use to develop CE-specific frameworks for their businesses. By analysing the relationships between CE drivers, the framework created by this research can assist firm executives in strategizing their plans for successfully implementing CE.

- Researchers involved in this study first evaluated both the barriers that had been described by different authors. The contrasting findings of the frameworks created within the existing frameworks will encourage fresh study within academia and help them create better CE frameworks that can be utilized to support leaders of SMEs and major corporations.

- In this study a digital healthcare company used the CE framework. These results showed increases in organisational performance across 10 key performance measures. Similar businesses can effectively use the study's findings to their operations.

- Many CE models were reported in the literature, although they tended to be more theoretical and frequently lacked supporting real-world data. However, this study was created and put to the test in a particular business. The framework that has been built can now is more efficient and can be applied more broadly and effectively.

- Furthermore, because SMEs have a significant impact on the economies of all nations, it is anticipated that the outputs of the framework would give policymakers guidance for creating regulations relating to discounts and subsidies for adoption of eHealth.

MITIGATION STRATEGIES

This study involved participants from hospitals and research organizations across different regions of India. The majority of these participants expressed several key sentiments: (a) healthcare professionals should approach patients with gratitude; (b) patients should be commended for embracing new technology; and (c) patients should be empowered to adapt to changes in healthcare practices. Now, let's delve into the strategies recommended by experts for addressing barriers:

Customer Involvement (CIB)- This suggests that when individuals opt for digital medical services over traditional face-to-face interactions, they tend to appreciate the time-saving aspect of the activity (Ossebaard & van Gemert-Pijnen, 2016; Huba & Zhang, 2012). However, the barrier related to personal factors requires thorough investigation at present. Individual factors and eHealth literacy could impact a person's health behaviors, emphasizing the need for India to accelerate its pace of technological development (Arcury et al., 2020a). From a barrier perspective, effective customer involvement encourages engagement with services, potentially leading to higher levels of client satisfaction (Alnawas & Aburub, 2016; Gruner & Homburg, 2000; Jun & Yi, 2020).

Customer Interaction (CINB)- Through the implementation of social customer relationship management (CRM), it is proposed and discussed how to empower customers on three distinct levels: personal, medical, and social. Utilizing this model, a social CRM prototype named Clinic 2.0 was developed to assess changes in customer satisfaction levels pre- and post-implementation. The results of testing indicated a significant increase in satisfaction, highlighting the importance of empowering users when engaging with eHealth services (Almunawar & Anshari, 2014). However, mere appreciation may not suffice if the website lacks transparency (Li et al., 2021). Meaningful customer interaction, addressing common pain points, and enhancing frequent customer journeys can foster better engagement (Lunn et al.,

2019). While having a well-designed website is essential, ensuring robust 24/7 customer support in the digital healthcare industry is crucial for effectively addressing patient concerns.

Customer Intimacy (CINTB)- Before enacting policies, it's crucial to grasp the concept of "customer-centric," which revolves around fulfilling customer needs (Dhingra & Dabas, 2020). The customer churn rate is influenced by three primary factors: average subscription length, customer lifetime value (CLV), and customer acquisition cost (V. Agarwal et al., 2022). However, even with these considerations, comprehensive training in the provided services or positive word-of-mouth recommendations can further aid customers in engaging with a platform.

Customer Experience (CEB)- To maintain a better persona, it's essential to consider three key elements: characteristics, influencers, and workflows (Salminen et al., 2022). These components help in understanding customers, their motivations, and how to effectively support them in using services. However, without the provision of the right product portfolio and access to support staff capable of achieving high call resolution rates, engagement channels may struggle to function effectively (Lee et al., 2019). The omnichannel approach is emphasized in this context. Research indicates that brands employing successful omnichannel customer engagement strategies retain an average of 89% of their customers, compared to just 33% for organizations with less effective approaches (Bhardwaj et al., 2021; Patrikar et al., 2020). Furthermore, a study published in the Harvard Business Review found that omnichannel customers tend to be significantly more valuable (Sopadjieva et al., 2017).

Customer Satisfaction (CSB)- The primary challenge to address is the lack of credibility, as people are unlikely to trust services they perceive as lacking credibility (R. Bhatia & Taneja, 2019). Convincing individuals becomes difficult when credibility is lacking, hindering innovation, leadership, and problem-solving abilities (Bellekens et al., 2016). Accessibility is also crucial, as everyone, including those with disabilities, should have equal access to services, promoting inclusivity and usability (Mshali et al., 2015). Finally, maintaining politeness when interacting with patients is essential (Management Association, 2020).

MANAGERIAL IMPLICATIONS

In summary, the discussion section highlights the key findings and conclusions drawn from the analysis of eHealth barriers in India. The study identified thirty-seven barriers grouped into eight categories, with marketing-related barriers emerging as the most significant hindrances to eHealth adoption. These barriers include challenges in promotion, customer engagement, and loyalty. Customer-related barriers, such as health consciousness and literacy in eHealth, were also deemed important. Interestingly, economic barriers were found to be the least significant among all categories. This comprehensive examination of eHealth barriers in India contributes valuable insights into the challenges faced in the adoption of eHealth technologies. Despite the global recognition of eHealth and its potential benefits, significant barriers persist, highlighting the need for targeted strategies to address these challenges.

This study fills a crucial gap in understanding the obstacles to eHealth adoption in India and provides a framework for categorizing and prioritizing these barriers. By shedding light on these challenges, policymakers, healthcare professionals, and stakeholders can develop more effective strategies to overcome barriers and promote the widespread adoption of eHealth technologies in India.

According to the second research gap the another point one has to focus is that studies considered are mainly the most broader concept that is, digital health and the most narrow concept mHealth. But, this study deals with the most prominent concept that is, eHealth which includes both mHealth and telemedicine and even the newer concept which arrived in India is EHR (Electronic Health Record). To be more objective, an adoption can be possible if it's been looked in to recent concept which is been failed and considering all its sub-sets.

The third research gap addressed in this study focuses on the significance of patient engagement in eHealth adoption, a perspective often overlooked in previous research. While existing studies have primarily examined non-adoption due to technological and infrastructural constraints, this study seeks to emphasize the critical role of customer engagement barriers in influencing eHealth adoption in India. To address this research gap, the study followed a structured approach, comprising three phases: identification of factors through literature review, expert opinion to select key factors, and application of interpretive structural modeling to analyze the relationships between these factors. Through fuzzy-MICMAC analysis, the

factors were categorized into independent, dependent, autonomous, and linkage categories, providing a comprehensive understanding of their interrelations. The findings of the study reveal a model that illustrates the intricate relationships between various barriers hindering eHealth adoption in India. Among the significant obstacles identified are the need for a product portfolio, lack of customer support, and low first call resolution rate. By elucidating these hierarchical relationships, the study offers valuable insights for academics and practitioners interested in India's healthcare market and its strategic expansion. Overall, this study contributes a novel perspective to the existing body of knowledge by highlighting the importance of customer engagement barriers in eHealth adoption. The insights generated are instrumental in informing strategies to enhance the implementation of eHealth services and foster greater adoption among Indian citizens.

The fourth research gap talks about the dearth of empirical studies done for eHealth in India there are many review which have been found for eHealth implementation in India so this thesis have done qualitative work on the eHealth adoption in India. Fifthly, this study not only identify the barriers for eHealth adoption and their barriers are also been categorize to further steps, the government initiatives taken till now is shown as well as the most promising part which has been identified is the solution and strategies to the better adoption of eHealth in India. The diverse responses obtained from professionals were meticulously analyzed to gain insight into their perspectives and reactions to several key questions, including obstacles encountered, potential benefits for both themselves and patients. As, mentioned there was no study till now which identified the best solution for the adoption but this thesis will work towards the improvement of adoption of eHealth in India suggesting which was the fifth research gap identified through review of literature.

The analysis will now focus on evaluating the extent to which the research questions were adequately addressed and whether this thesis effectively contributed to enhancing understanding of these questions. The first three objective of the study are well defined as can be seen by the above explanation of the research gap. The ultimate strategy and solutions which was main motive of the study are analysed through the qualitative study as mentioned below:

Voice Recognition system:

The most significant discovery made by this study is the necessity for technological improvement to advance implementation. Some hospitals have already started implementing eHealth, whereby apps are used to collect patient data for later use. However, because this requires more time, doctors are finding it challenging to store or change data. Doctors have advised that the best course of action is to install a voice recognition system so that patients may quickly record their reports by voice. It will process more quickly and easily.

App for rural patients:

Considering the cultural nuances prevalent in healthcare delivery in India, it's imperative to ensure that eHealth solutions are culturally sensitive and tailored to cater to diverse patient populations' needs and preferences. This involves providing multilingual support, integrating culturally relevant content, and respecting cultural beliefs regarding healthcare. Additionally, efforts should focus on developing user-friendly interfaces, delivering personalized health information and resources, and encouraging patient involvement and feedback in the refinement of eHealth services.

Patient training:

Patients must be educated about the importance of privacy and security when using eHealth platforms. This includes safeguarding personal health information, setting strong passwords, and recognizing potential security threats like phishing scams. Patients should learn how to input and update their health information accurately within the eHealth system. This may include recording symptoms, medications, vital signs, and other relevant data. Continuous training ensures that patients remain informed and proficient in utilizing eHealth platforms effectively. Access to support resources and regular updates on new features or changes further empower patients to navigate these platforms with confidence.

Accessibility:

eHealth services in India aim to be both accessible and affordable for patients across various regions and income brackets. Achieving this goal entails creating economical solutions, utilizing mobile technology, and collaborating with governmental bodies and non-governmental organizations to extend services to remote and underserved areas. The physicians

in this survey stated that electronic medical records (EMRs) allow authorised healthcare providers to access patient data from any location with an internet connection. This makes it easier for healthcare practitioners to provide continuity of care because they can easily access vital information such as lab results, medication lists, and medical histories—even if the patient is seeing a different doctor or is in a different hospital.

Patient Empowerment:

Patients should be aware of additional resources available through the eHealth platform, such as educational materials, support groups, or community forums. They should know how to provide feedback about their experiences with the eHealth system and report any issues or concerns they encounter. Lastly, efforts should be directed towards engaging and educating patients about the advantages of eHealth services, potentially through implementing patient portals, delivering online resources, and fostering support for digital health literacy.

Electronic medical record:

The results of this study indicate that although EMR is being used in India, it should be used more prominently, as suggested by all of the respondents. Patient portals are a common feature of EMR systems, giving patients access to their own health data, facilitating communication between them and their doctors, appointment scheduling, prescription refill requests, and self-management capabilities. This encourages empowerment and involvement from the patient. One further finding from this study is that by enabling the safe transfer and storage of sensitive patient data, electronic medical records (EMRs) assist healthcare organisations in adhering to legal standards such those set forth by the Health Insurance Portability and Accountability Act.

Training to doctor:

Doctors require enough training and facilities to enable them to perform better, in addition to patients and other service providers. The interview revealed that physicians' ignorance of the new technology can result in improper application. They have to be trained in the use of telemedicine platforms, electronic medical records, and other digital health resources. Training

patients and healthcare providers is essential for the successful implementation of eHealth initiatives.

Funds for research:

The most outstanding feature of the study was disclosed by the researchers during the interview sessions. They claimed that eHealth research has the potential to significantly affect global health, especially in low-resource countries like India where access to traditional healthcare services is limited. Funders can contribute to addressing global health concerns and improving health outcomes for underprivileged groups countrywide by funding research on scalable and sustainable eHealth solutions. Even with widespread adoption, electronic medical records (EMRs) provide strong data analysis capabilities that enable healthcare organisations to track quality metrics, spot population health trends, and produce reports for regulatory compliance and performance improvement programmes. All of these capabilities will pave the way for more effective and valuable eHealth research. Encouraging innovation, improving evidence-based practice, tackling healthcare difficulties, optimising implementation, guaranteeing data security and privacy, fostering workforce development, and boosting global health impact all depend on financing for eHealth research.

Other than this, the more strategies which came up in this study is about technology advancement to support eHealth services, encompassing dependable internet connectivity, secure data storage systems, and access to essential hardware and software. Even many of the service providers suggested that conducting usability testing and gathering feedback from users can inform iterative improvements to the platform. According to eHealth industry, mainly in India, policymakers also has a vital role for improvements in eHealth. They should establish clear guidelines covering telemedicine, data privacy, and interoperability standards, ensuring patient safety and ethical technology use.

LIMITATIONS OF THE STUDY

- The findings of this study have provided several insights and their implementation in other industry will definitely add value, through there are certain limitations of this study.

- This research employs a quantitative analysis of data specifically gathered within the Indian context. Consequently, each constraint identified, encompassing consumer, regulatory, technological, organizational, practitioner, marketing, administrative, and economic barriers, is tailored to the Indian setting. Therefore, the conclusions derived from this study are limited in their applicability to other nations, as they are context-dependent and may not be generalizable beyond India.

- In this study, a group of forty researchers and doctors from Indian universities and hospitals engaged in a brainstorming session to identify and interconnect inhibiting factors. Given the subjective nature of brainstorming, the outcomes regarding variables and their relationships may vary depending on the domain expertise or position of the participants. Therefore, the findings of this study should be interpreted with consideration of the subjective nature of the brainstorming process and the diversity of perspectives among participants.

SCOPE FOR FUTURE RESEARCH

Future research endeavors could expand both the scope and methodology utilized in this study. Additional multi-criteria decision-making methods, such as AHP, PROMETHEE, NWHF-MAUT, and NWHF-CRITIC, could be employed to validate or challenge the findings obtained. Furthermore, further qualitative research could be conducted to delve deeper into the identified sub-barriers. Additionally, conducting additional quantitative research could aid in determining cause-and-effect relationships among the identified sub-barriers within similar or different

industries. Replicating the study in other countries with diverse political, social, institutional, technical, and economic contexts compared to India could provide valuable insights.

- Building upon the findings of the study, several recommendations for future research have emerged. It is imperative for future studies to pinpoint the specific variations in key challenges for each mode of eHealth, encompassing mHealth, Telemedicine, and Electronic Health Records (EHR). Further exploration into these distinct areas can provide a more nuanced understanding of the barriers and facilitate tailored solutions for each mode of eHealth implementation.

- The study's CE framework was created and evaluated for an Indian organisation that provides digital healthcare. The CE framework can, however, be applied in other industrial sectors in other nations by altering the initial inputs with the aid of sector specialists.

- Future research can reinforce and expand the set of performance drivers used in this study, and it can also be utilize more deeper and broadly across other businesses.

- It is possible to create the framework using different hierarchical methodologies, but doing so would prevent you from knowing the threshold values for each group of components, which are crucial to identifying in order to forecast the success of any framework.

- It is advised that researchers and business executives who wish to apply this framework in other developed nations, particularly in those like the United States, Germany, and others, consult with local eHealth domain experts to determine the modifications that need to be made to the framework's inputs in order to achieve results that are specific to those nations.

- The FAHP-DEMATEL approach was employed by the researchers for this study, but other researchers may choose to improve on the findings presented in this publication by using additional tools, such as multi-criteria decision-making approaches. Researchers may want to utilise total interpretive structural modelling (TISM),

analytical network methods and fuzzy cognitive mapping, , etc. to better visualise the suggested and tried framework used in this study in order to uncover the structural comparisons.

- The current collection of drivers was examined by concentrating on digital healthcare companies specifically, but the CE drivers set should be tested in a variety of other industries, including the food sector, the manufacturing sector, and others. Through the use of a single case study, the established CE framework was validated.
- Through the created CE framework, the researchers can conduct numerous case studies in various sub-domains of the digital healthcare industry such as m-health, telemedicine etc., to enhance the application insights.

Future studies can build to concentrate on the issues with customer empowerment that are related to the eHealth adoption in India. Future research can apply the approach and scope of this study to the high-risk and high-impact industries like finance and pharmaceuticals. This will demonstrate how industry-specific rankings and barriers differ. This study can also be repeated in various sectors and nations to determine the applicability of these barriers there. As a result, the findings will be easier to generalise. Furthermore, the identification and prioritization of eHealth barriers in India can serve as a valuable reference for other countries grappling with similar challenges, prompting them to review their own issues and enact necessary legislative reforms. In essence, overcoming obstacles in the digital health sector is crucial for paving the way towards a promising future for eHealth and effectively tackling the complexities of healthcare delivery, particularly in vast countries like India. Future research endeavors should extend beyond merely identifying barriers to exploring innovative social approaches that position digital health adoption as the optimal choice.

CHAPTER SUMMARY

This doctoral study has employed a qualitative approach to investigate the barriers to eHealth adoption in India, with a particular focus on customer engagement. Utilizing methods such as FAHP, DEMATEL, and ISM, we prioritized, weighted, and delineated the relationships among these barriers. The identification of barriers to customer engagement was initially derived from a literature review and subsequently validated by experts. Additionally, a qualitative study

using ATLAS.ti was conducted, exploring the perspectives of three key stakeholders: patients, doctors, and practitioners. Through this comprehensive approach, potential solutions and adoption strategies were identified, all of which are directly linked to addressing customer engagement as the most significant barrier. These findings have the potential to streamline implementation processes and enhance the uptake of electronic health products and services, thereby positively impacting the well-being of citizens and shaping the future operation of health systems in India.

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PUBLICATIONS

- **A FUZZY ANALYTIC HIERARCHY PROCESS-BASED ANALYSIS FOR PRIORITIZATION OF BARRIERS TO THE ADOPTION OF EHEALTH IN INDIA**

July 23, 2022

Das, D., & Sengar, A. (2022). A fuzzy analytic hierarchy process-based analysis for prioritization of barriers to the adoption of eHealth in India. International Journal of Medical Informatics, 165, 104830.

https://doi.org/10.1016/j.ijmedinf.2022.104830

(Scopus Q1 and ABDC-A)

- **ANALYSIS OF FACTORS INHIBITING THE CUSTOMER ENGAGEMENT OF EHEALTH IN INDIA: MODELING THE BARRIERS USING ISM-FUZZY MICMAC ANALYSIS**

28 August 2023

Das, D., & Sengar, A. (2023). Analysis of factors inhibiting the customer engagement of eHealth in India: Modeling the barriers using ISM-Fuzzy MICMAC analysis. International Journal of Medical Informatics, 178, 105199.

https://doi.org/10.1016/j.ijmedinf.2023.105199

(Scopus Q1 and ABDC-A)

- **STRATEGIES AND SOLUTIONS TOWARDS THE IMPLEMENTATION OF EHEALTH IN INDIA: A LITERATURE REVIEW**

International Conference on Business, Digitalization, and Sustainability (ICBDS-2023)

17 July 2023

Received the best presentation award.

- **DEVELOPMENT OF A CUSTOMER ENGAGEMENT FRAMEWORK TO ENHANCE EHEALTH ADOPTION WITHIN INDIAN DIGITAL HEALTHCARE INDUSTRY**

PAN IIM Conference 2024 (Accepted 11th Jan 2024 and presented on 22nd Dec 2024).

Appendix- A

Interview Guide (Practitioners)

1) **What do you think of India's digital healthcare system?**
2) **How well do you understand electronic health or eHealth?**
3) **What is the practitioner`s attitude towards eHealth services in India?**
4) **What are the barriers practitioner`s are facing in eHealth adoption?**
5) **What according to you customer related barriers can be?**
6) **What are the most prominent barriers to eHealth adoption in India?**
7) **Share me your ideas regarding regulatory and organizational barriers?**
8) **How helpful is technical infrastructure for better adoption of eHealth in India ?**
9) **What can be the administrative and economic barriers in eHealth adoption?**
10) **How important is customer engagement in eHealth?**
11) **What can be the potential barriers to customer engagement in eHealth adoption in India?**
12) **Why customer interaction are necessary for better customer engagement in eHealth?**
13) **For engagement of customer what options can lead to customer involvement and intimacy according to practitioner`s perspective?**
14) **How practitioner`s appraise and evaluate a technology which is different from daily use ?**
15) **What is your view point on the satisfaction level of the customer on using new technology for their health?**
16) **How practitioner`s operationalise a new technology in practice by investing effort and resources ?**
17) **Do you have any insight of the strategies the Indian government has implemented to date to encourage the adoption of eHealth in India ?**
18) **What other strategies can be used to implement eHealth in India?**
19) **What other strategies can be used to adopt eHealth in India?**
20) **What would be the potential solution for improving patient engagement in eHealth?**

Appendix- B

Interview Guide (Patient)

1) **Share your views on India's healthcare system getting digital?**
2) **How well do you understand electronic health or eHealth?**
3) **How eHealth is different from primitive process of healthcare?**
4) **To what extent do you use electronic health?**
5) **How are you engaging to electronic Health?**
6) **What can be the issue that you couldn't engage to eHealth?**
7) **What problems are you facing while using eHealth?**
8) **What is your thought on using eHealth could result in the misuse of your medical data?**
9) **Why do you think you couldn't connect to practitioner`s easily in eHealth?**
10) **What can be the process of learning new technology so that enough population of India can adopt eHealth?**
11) **What is your satisfaction level on using new technology for your health?**
12) **Does word of mouth anyhow help you to engage to eHealth platforms?**
13) **Why do you think accessibility can be a problem to adopt eHealth technology?**
14) **Do you have any insight of the strategies and solutions the Indian government has implemented to date to encourage the adoption of eHealth in India?**
15) **What other strategies and solutions can be used to implement and adopt eHealth in India?**

Appendix- C

Interview Guide (Academician)

1) **What do you think of India's digital healthcare system?**
2) **How well do you understand electronic health or eHealth?**
3) **How researchers are making sense of a new eHealth technology?**
4) **How well eHealth research is been taken forward in India?**
5) **What are the most prominent barriers to eHealth adoption in India?**
6) **What according to you customer related barriers can be?**
7) **What are the barriers practitioner`s are facing in eHealth adoption?**
8) **Share me your ideas regarding regulatory and organizational barriers?**
9) **How helpful is technical infrastructure for better adoption of eHealth in India?**
10) **What can be the administrative and economic barriers in eHealth adoption?**
11) **How important is customer engagement in eHealth?**
12) **What can be the potential barriers to customer engagement in eHealth adoption in India?**
13) **Why customer interaction are necessary for better customer engagement in eHealth?**
14) **For customer engagement what options can lead to customer involvement and intimacy?**
15) **What is your view point on the satisfaction level of the customer on using new technology for their health?**
16) **How researchers are appraising and evaluating a technology which is different from daily use?**
17) **How researchers operationalise a new technology in practice by investing effort and resources?**
18) **Do you have any insight of the strategies the Indian government has implemented to date to encourage the adoption of eHealth in India?**
19) **What other strategies can be used to implement and adopt eHealth in India?**
20) **What potential solution are there for improving patient engagement in eHealth research?**

BRIEF BACKGROUND

Strategic and innovative marketing manager with over 7 years of professional experience and now as a researcher in the marketing domain for 2 years, I leverage quantitative and qualitative data to learn factors that influence the adoption of eHealth in India. In 2014 I started my job career and worked in multinational companies both in India and abroad translated business vision into marketing initiatives that improve performance, profitability, growth, and employee engagement. My research journey got started in the year **2021**, since then I published **ABDC-A** category manuscripts, collaborated with a diverse group of colleagues across the University and other top-tier Universities in India to conduct health services research and promotes interdisciplinary collaborations. On collaborative research teams, I specialize in the different methodology used in data analysis and processes involved with implementing interventions that translate research into practice and strive to encourage researchers, especially in eHealth domain. I am an energetic teacher and experience taking UG and PG classes of management courses.

My current research area investigates the effects and constraints to the adoption of eHealth in the healthcare sector in India, providing a fresh perspective on eHealth. This study highlights what obstacles healthcare organizations should consider while dealing with eHealth and what could hinder the healthcare sector's growth. As a result, it's worth looking into what the real impacts of the eHealth implementation have been so far, as well as what challenges have developed. The goal is to look into the consequences and roadblocks from the standpoint of customer engagement as one of the barriers.

Sincerely,

Dikhita

PLAGIARISM REPORT

ORIGINALITY REPORT

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