Impact of Health Applications on The Indian Health Insurance companies

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This thesis investigates how mobile health applications can create business development in terms of business model innovation/ customer value creation for Indian health insurance companies. Recent years have noted the increasing prevalence of smartphones and an expansion of their user base across all age ranges. A growing amount of health-related mobile applications is flooding the application market and the digitization of the health sector processes rapidly with digital offerings becoming more and more popular. Firstly, a literature review is conducted to gather relevant important information and to build a theoretical background on the concepts of mobile health applications, big data, the business model concept and app-enabled business value creation. In order to filter out the role of health applications for Indian health insurance companies, knowledgable employees of health insurance companies are asked to participate in a selfadministered online survey around health application offering of their company. The results of the online survey are thus analyzed using an exploratory factor analysis and are then evaluated descriptively. Based on the findings a model is created that shows the underlying business value of mobile health applications. The overall finding of this thesis is that there are correlations between health applications and three main factors. Firstly, health apps can possibly influence customer retention and customer relationships. Second, health apps hold an underlying potential of aiding in the prevention of widespread diseases, early detection of diseases, treatment of diseases and offering targeted customer offers. And thirdly, there are big data possibilities such as detecting trends about the collectivity of insurants and the provision of targeted offers based on customer knowledge.

Keywords	Mobile health app, Indian health insurance, Big data.

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1 Introduction

1.1 Health Apps Development

The terms “healthcare mobile app development” and “mHealth apps” have emerged not so long ago. In fact, both were introduced to the public in response to the global digitalization of almost every aspect of our lives, including such vital spheres as health and wellness. So, no wonder that mobile apps in healthcare are in demand today not only among patients, but also among physicians (medical mobile,2017).

First and foremost, it’s very convenient to have your smartphone working for your health. Your mobile device can track a state of health and signal if something goes not according to the plan. In addition, mHealth apps allow doctors to refer to the medical history of their patients remotely. Thus, they can urgently provide some advice or feedback. All this makes the mHealth apps market an irresistible opportunity for medical business owners to drastically expand their market niche and provide better service to patients.

Mobile health apps offer exciting opportunities in the healthcare industry, offering providers the ability to expand patient care beyond the limits of the clinic. Yet even though wearables and health app usage has doubled over the past two years, and health apps continue to dominate app stores, developers still struggle to build apps that plug in to the needs of a regulation-centred industry in meaningful ways. Thankfully, the industry is responding. When identifying the apps best-suited to their organization’s needs, healthcare stakeholders should look for apps that possess the following features,

1. Minimal Data Collection

Patient data collection requires scrutiny of industry regulations. The FDA recommends that mobile health apps collect data only if the data is integral to a product or service. Additionally, a well-developed app must be able to secure, transmit, store and eventually delete the data.

2. Limited Access and Permissions

In an era of smartphones and apps that access everything from locations to contacts, many consumers don’t question why an app would need to pull certain information. A responsibly designed app will use trusted user interface as much as possible, as opposed to direct API access, and use those trusted components only when it makes sense, to minimize unnecessary data collection.

3. Secure Authentication

Healthcare records and information are valuable to patients, healthcare professionals and, unfortunately, hackers, so using authentication as a method of improving application-level security should be a primary concern during development. From the beginning, developers and owners should invest in designing, implementing and testing app authentication. If the risk of illegitimate access is high, options such as multifactor authentication should be considered.

4. Compatibility

Mobile platforms differ by API, security features and permissions. A well-built app should be developed only after researching these differences, and it should adapt codes as needed to protect user data. These questions become more complex when third-party service providers are introduced. Responsible developers work to ensure data is protected, and they communicate their expectations and requirements to any entity they're working with.

5. Application-level Security

Well-developed mobile health apps are built by companies that prioritize security from the ground up. At the minimum, one person is responsible for data security, if not an entire team. Engineers behind the app should have experience in secure coding practices or be trained as needed. Data security should be a priority at every stage in the app's lifecycle, from design to development to launch, all the way to post-market. Since healthcare threats are always evolving, security measures will need to do the same.

6. Resources for Security Improvements

Security is a concern across the board, so naturally, multiple resources for improving application-level security exist. These come in the form of software libraries, software development kits (SDKs), cross-platform toolkits and free tools that can be used to improve encryption, navigate pre- and post-launch testing, check password strengths, test interfaces and reverse engineer programming code.

7. Clear Communication

A well-designed app talks to its users in a clear, simple way. In healthcare, it's especially important to avoid jargon as much as possible. Developers should acquire clear consent before gathering any information, both during installation and at any point afterward, and the app must include an easily accessible privacy policy.

8. Compliance with Regulations

For mobile health app developers, this can be especially challenging, since laws ranging from the FDA's Federal Food, Drug & Cosmetic Act could apply to all, or parts, of an app.

The collection of financial data, the data of young children (under 13) and even state laws will be factors in developing an app that is compliant with the proper legal environments. (Megan Williams,2017)

1.2 Evolution of Health App in India

Healthcare has become one of India's largest sectors - both in terms of revenue and employment. Healthcare comprises hospitals, medical devices, clinical trials, outsourcing, telemedicine, medical tourism, health insurance and medical equipment. The Indian healthcare sector is growing at a brisk pace due to its strengthening coverage, services and increasing expenditure by public as well private players. Healthcare in Indian delivery system is categorised into two major components - public and private. The Government, i.e. public healthcare system comprises limited secondary and tertiary care institutions in key cities and focuses on providing basic healthcare facilities in the form of primary healthcare centres (PHCs) in rural areas. The private sector provides majority of secondary, tertiary and quaternary care institutions with a major concentration in metros, tier I and tier II cities.

India's competitive advantage lies in its large pool of well-trained medical professionals. India is also cost competitive compared to its peers in Asia and Western countries. The cost of surgery in India is about one-tenth of that in the US or Western Europe.

India's mobile app market grew sharply last year, outpacing the US, and ranked number one in terms of Google Play downloads, highlighting the vibrancy of the country's mobile ecosystem. Indians downloaded over 6 billion apps in 2016, up from 3.5 billion in 2015. That 71% growth was significantly higher than the overall 15% growth in app downloads around the world (livemint,2017)

Technology is changing the dynamics of the healthcare industry which is growing at a rapid pace of 17 percent per year to expand to $160 billion by 2017. Health mobile applications have become a key tool of taking the care to the hands of people. The healthcare industry must keep pace with modern technology. Healthcare services need a technology integration to bring accountability and efficiency in the system. By 2020, the Indian healthcare market is estimated to grow to over $280 billion and the start-ups are ready to make their own contributions. "Technology is solving the huge accessibility gap. At the click of the fingers, through the mobile app and web-based video and text chat sessions, people get in touch with ePsyClinicians'' (idianexpress,2016).

1.3 Research Objective

Recent years have been subject to growing digitalization, all types of information are accessible every time of the day, from everywhere and just at the fingertips. Growing network sophistication including high speed internet access data transfer along with more powerful mobile devices are shaping new ways of access, delivery and management of data (World Health Organization, 2011). The digitization of the health care system progresses at a very high speed and digital offerings in the health sector are becoming increasingly popular. Ever more users are and will be tracking their personal health with and without the use of connected devices on their smartphones in mobile health applications. This creation of masses of highly detailed and rich data provides an enormous source of potentially useful business insights if they are to be analysed. Simultaneously, medical insurance companies in India are increasingly facing tough competition among each other and further difficulties such as growing costs stemming especially from ambulatory treatment, inpatient care and psychiatric hospitals (pwc, 2013). Other very large expenses for medical insurance companies next to inpatient treatment are doctor's fees and pharmaceuticals. Attributable for the growing costs in Indian inpatient care, and pharmaceuticals are the changing demographics in in terms of an aging population and a decreasing amount of young people in the population (Pwc, 2013). In today's economy, chronic diseases are a growing concern which is why a lot of preventative action is needed in the areas of obesity and smoking (Handel, 2011). It becomes apparent that the "current model for healthcare service delivery faces enormous challenges posed by an aging population and the prevalence of chronic diseases" (Triantafyllidis et al., 2015, p. 1). A very critical aspect for the future of health insurance companies, especially government aided health insurance companies is thus being to be able to stay competitive in the market and accordingly achieving a reduction in costs. A potential source of cost reduction can come from active and healthy insurance members as a healthy lifestyle is said to decrease the chances of chronic diseases, a cost intensive circumstance (Warburton, Nicol & Bredin, 2006). Since private health insurance companies are calculating their insurance premium based on age and health of the individual, data from health applications can provide useful insights in terms of all of their customers. To remain competitive, it can additionally be very important for health insurance companies to concentrate on customer acquisition, customer retention and customer service. Quite some research has been conducted in the area of Social Media Analytics and in how far Big Data from Social Media can be used to create useful insights about customers. The results show that technological developments such as Social Media can aid in

strengthening customer retention through increased transparency, using social networks for acquiring new customers and cost reductions (pwc, 2011). The new environment of mobile devices, mobile health applications and connected devices and wearables opens up a whole new field of research. A study of Vital Wave Consulting (2009) in the developing world has indicated the positive effect of the use of mobile technology in particular smart phone-based applications on the “effectiveness of health care delivery “(Liu et al. 2011). The role of health applications is still a very young research area and therefore, the relationship between health applications and business development are not fully understood which the Impact of health applications within business development is why can be presented as a gap in scientific literature. Derived from the introductory chapter and the research gap the following research question arises: How can the use of health applications enable business development in terms of business model innovation/customer value creation in Indian Health Insurance Companies? Throughout the thesis, the following sub-questions will be addressed:

• What are Health Applications and what data is generated by them?
• How can Data from Mobile Applications be useful for Health Insurance Companies?
• How do how do mobile health-related applications relate to business model innovation?
• What possibilities for Health Insurance Companies exist from Health Applications?
• What are possible limitations of the use of Data from Mobile Applications?

1.4 Research Approach

To answer the research question „How can the use of Mobile health applications enable business development in terms of business model innovation/customer value creation in Health Insurance Companies? “both a literature review and an empirical study is conducted. The first part of the thesis consists of a literature review for providing a theoretical background that is necessary to identify the use of Health Applications for Health Insurance Companies. A literature review is used to understand and learn what is already known in the area of concern and what has been studied before (Babbie, 2010). Moreover, a literature review can be used to show gaps in the literature indicating the importance of further analysis. The topic of this thesis is a very recent and new topic, resulting in only a small amount of scientific literature that is concerned with the impact of mobile health applications especially for Indian health insurance companies. The criterion for selecting literature for the literature review is thus a focus on academic papers which were mostly found using online search engines for academic literature. An additional way of finding literature was by applying ‘reference harvesting’. In the second part

of the thesis, an empirical study is carried out to analyse the impact of health applications for Indian medical insurance companies. Chapter four discusses in detail the methodical aspects of the empirical research of this thesis.

1.5 Thesis Structure

The first chapter is an introduction to the topic of the master thesis by providing background information concerning relevant background information, the research objective followed by the research question as well as an explanation of the research approach. Within chapter 2, the medical insurance sector in India will be introduced. Chapter 3 discusses important theoretical information which is necessary for answering the research question. The fourth chapter explains the methodology for the second part of the thesis, the empirical research. The chapter is used to introduce the research type and design, sampling, data collection and data analysis as well as the reliability and validity of results. The fifth chapter will present the results of the survey which are then thoroughly discussed in chapter six. The sixth chapter will also give recommendations to health insurance apps as to how health-related applications can generate possible business developments. The last chapter of this research merges all insights together and also discusses limitations of the study, gives suggestions for further research and discusses theoretical and practical implications.

2 Industry Background

The Indian healthcare industry is expected to reach US$ 280 billion by 2020 on the back of increasing demand for specialized and quality healthcare facilities. Further, the hospital services market, which represents one of the most important segments of the Indian healthcare industry, is expected to be worth US$ 81.2 billion by 2018. Health insurance is the fastest growing segment in the nonlife insurance sector in India. The health insurance market share as a percentage of the total nonlife insurance industry has more than doubled from roughly 11% in the 2005-2006 period to 27% in the 2014-2015 period.1 Growth has been significant in the last five years following the advent of standalone health insurers and various government-sponsored health insurance schemes. The compound annual growth rate (CAGR) has been 24.6% for health

insurance during the past 10 years (2005-2006 to 2014-2015). The high CAGR of the health segment has led to a noticeable rise in its share in the nonlife premiums(Milliman,2017)

Naturally, health insurance has emerged as one of the financing options to overcome some of the problems of our system. In simple terms, health insurance can be defined as a contract where an individual or group purchases in advance health coverage by paying a fee called “premium”. Health insurance refers to a wide variety of policies. These range from policies that cover the cost of doctors and hospitals to those that meet a specific need, such as paying for long term care. Even disability insurance, which replaces lost income if you cannot work because of illness or accident, is considered health insurance, even though it is not specifically for medical expenses. Health insurance is very well established in many countries, but in India it still remains an untapped market. Less than 15% of India’s 1.1 billion people are covered through health insurance. And most of it covers only government employees. At any given point of time, 40 to 50 million people are on medication for major sickness and share of public financing in total health care is just about 1% of GDP. Over 80% of health financing is private financing, much of which is out of pocket payments and not by any pre-payment schemes. Given the health financing and demand scenario, health insurance has a wider scope in present day situation in India. However, it requires careful and significant efforts to tap Indian health insurance market with proper understanding and training.

The health insurance industry in India has had much dialogue on claims cost containment through provider networking and prevention of fraud, but dialogue around the potential savings through administrative efficiencies and costs often fails to get its due attention. The potential for administrative savings, as observed in other markets, should warrant a focused approach to a review of administrative functions. For example, the U.S. Healthcare Efficiency Index estimates that if the entire US healthcare system (a $2.5 trillion industry) moved from a paper-based and phone-based system to an electronic one, it could save $30 billion a year. Out of these, electronic payment through direct deposit instead of printing paper checks could save an estimated $11 billion every year.6 There are already successful examples within Indian health insurance of certain best practices—member updates through Short Message Service (SMS) gateways, provider portals for empanelment, tele underwriting, standardised medical underwriting, risk scoring for decision making and fraud and abuse trigger systems are all used by many insurers in India. But so much more needs to be done. All these initiatives complement standardisation and process efficiencies. However, they often remain internal developments with no formal methods to evaluate impact or savings. Understanding the current

costs and productivity of each administrative function relative to the market would help develop a baseline and influence informed decision making for planning, monitoring and evaluating investments in process efficiency or information technology (IT).

3 Theoretical Background

3.1 Health Applications

Mobile-health applications can be classified as a subset of electronic-health (eHealth) applications. Electronic-health applications are described as applications which offer the tools and communication channels which are used in professional healthcare settings, enabling the practice of electronic health (Liu et al, 2011). E-Health has been said to be a key part of enabling a patient oriented, efficient and economical future for the health insurance system (Knöppler et al., 2016). M-Health can be characterized as an overall term for the “areas of networking, mobile computing, medical sensors and other communications technologies within healthcare “(Liu et at. 2011, p. 2022). In line with the research question, this paper will however only focus on mobile health applications that are targeted for private use on smart phones and/or tablet computers and are targeted for both healthy people as well as patients. Mobile applications that are designed around user health and fitness are booming. In fact, a review of the literature by Riley et al. (2011) have worked out four main fields of health behaviour areas, namely (1) smoking cessation, (2) weight loss, diet and physical activity, (3) treatment adherence and (4) chronic disease management where mobile technology has been used. Fiordelli et al. (2013) have also conducted a literature review to explore the impact and outcomes of mobile devices on health. They filtered out that the main area within the literature they observed is chronic conditions such as diabetes which is followed by prevention and well-being and acute conditions. Moreover, seven non-mutually exclusive mobile features could be identified within Fiordelli et al.’s (2013) research, namely text messaging, voice messaging, video messaging, multimedia messaging, ad hoc developed features for certain conditions, external sensors and native applications. The fact that mobile devices, especially mobile phones are “personal, intelligent, connected, and always with people “provides a large advantage within their use in health care (Fiordelli, Divani and Schulz, 2013). Moreover, the literature suggests that there are certain features that constitute the field of mobile health monitoring applications. Triantafyllidis et al. (2015) for instance have presented three areas within personalized health status monitoring,

videolike mobile phone sensing, self-reporting and social sharing of health information. The first area, mobile phone sensing describes the ability to sense health data through the mobile phones internal and / or external sensors (Triantafyllidis et al. 2015). Modern smartphones are equipped with high technology features which enables the accessibility and generation of a variety of different data. Klasnja and Pratt (2012) describe that all large smartphone platforms such as iOS, Android and Windows Phone allow applications access to the phones hardware features such as the camera, microphone, accelerometers and the global positioning system (short GPS) through APIs. Via wireless technologies, such as Bluetooth, mobile applications can be additionally interconnected to external sensors that can measure further variables such as blood sugar level, blood oxygen level, heart rate, body temperature and many more (Gouidoux et al. 2014). Using these possibilities, and of course the Internet or Bluetooth, has allowed for the development of different types of m-Health applications suitable for different needs in different situations (Fiordelli et al. 2013, Triantafyllidis et al. 2015). The second area, self-reporting is concerned with the manual gathering and registering of health data such as symptoms, problems, dietary or physical behaviour and test results which are currently difficult to sense through sensors (Triantafyllidis et al. 2015). This presents another advantage of mobile health application in that they enable and improve self-management which empowers the patients and allows them to actively engage in their medical path at low cost and right at the fingertips while at the same time increasing their quality of living by elevating mobility and independence (Lasierra et al., 2013). According to Klein et al. (2014) patient involvement as described above can improve patient adherence to the recommended therapy and can ultimately improve the patient's overall health status. For this kind of approach to work successfully over the long run, it is however critical that mobile applications are also designed around changing a patient's perception of their disease as well as motivations and thinking to overcome the barriers that inhibit long-acting behavioural changes (Klein et al., 2014; Oinas-Kukkonen, 2013). 9 Thirdly, social sharing describes the sharing of personal health information with an online social network, doctors or other online communities. This online sharing of health data has proven to be effective in educating patients about their condition as well as promoting a change in health behaviour by for instance discussing experiences, suggesting new ideas and providing emotional support (Triantafyllidis et al., 2015; Laranjo et al., 2015). Building on the aforementioned information a variety of health applications have been designed. The following sections will provide a taxonomy of popular mobile health applications based around the design of the application. However, it has been noted by Triantafyllidis et al. (2015) that an

application that integrates the three main areas is likely to be more accurate as applications that only integrate one of the three features.

3.1.1 Logbook of Health-related Data

The first category of mobile health apps can be declassified under the idea of self-monitoring and can be seen as a logbook or journal in which the user records health and fitness related data such as physiological states and symptoms (Klasnja & Pratt, 2012). Tracking health information is said to have a positive influence on adopting „healthy "behaviours while at the same time decreasing the frequency of behaviour patterns that are undesired (Kopp, 1988). Moreover, Klasnja and Pratt (2012) claim that studies have shown that self-monitoring can overall positively affect a user's health. Many applications are targeted around the tracking of physical activity or daily diet. However, it is important to note that it has been proven that the provision of tailored feedback and nutritional information can increase effectiveness in terms of adherence and health benefits (Klein et al., 2014). MyFitnessPal and Life sum are examples of health applications that help users in tracking their daily calorie intake. These apps are further providing additional information concerning micro nutritional information for each meal. RunTastic is an application that can be used to track the level of physical activity including running, hiking and biking. Often times applications can display the data in a way that unveils rends over time such as he Apple Application 'Health 'which portrays results graphically to enable a quick comparison to the prior time period. Furthermore, is the 'Health' App useful to track a large variety of other personal health-related data such as body fat percentage, body temperature, heart rate, weight, blood sugar levels and respiratory frequency. Other health applications that fit within this category are applications that can be used to document water intake and other lifestyle behaviour and patterns that are regarded as healthy.

3.1.2 Health and Fitness Communities

Studies have found that a social network can have a positive impact on an individual's lifestyle and health-related choices (Consolvo, Everett, Smith and Landay, 2006). Consolvo et al. (2006) describe three types of social influences that affect the way that users are motivated, in particular social pressure, social support as well as being able to communicate about the data that is shared with peers. A lot of health applications are thus build around this positive influence of networks and communities and create an open environment where people that share the same health-related interest can communicate, motivate one another and exchange progress photos and tips. Freeletics, Weight

Watchers and Pump Up are examples within this mobile health application group where users can share progress and motivate each other.

3.1.3 Informative Health Apps

A third category within the sector of mobile health applications are applications that are targeting at informing the user about health-related topics or medical conditions. As the purpose is informative in nature, this kind of application will not generate customer-centric data which can be further analysed and processed.

3.1.4 Reminders

Mobile Reminder Applications are utilizing the push intervention method to remind the user of certain events which can be for instance the intake of time-dependent medications and thus increasing the adherence to a medication schedule (Klasnja & Pratt, 2012). Other forms of reminder applications are apps that remind the user of adopting health beneficial behaviours such as water intake and reapplication of sunscreen depending on skin type and user location. Many other health applications also incorporate a reminding feature into their software which reminds users to regularly log for example their glucose levels for diabetes patients or nutritional consumption for individuals that are interested in their calorie intake (Klasnja & Pratt, 2012). Reminding applications can have a positive effect on adherence and lifestyle adaption but can also increase motivation (Curioso et al. 2012; Dennison, Morrison, Conway & Yardley, 2013). On the other side, obtrusive and very frequent reminders can build up aversion and dislike among users (Dennison et al., 2013). Furthermore, it has been shown that generic reminders without specific medical advice are less efficient compared to reminders that are patient specific and at best even based on user data that is collected through sensors (Klein et al., 2014).

3.2 Big Data and Big Data Analytics

The topic of Big Data has already been shortly introduced in the introductory chapter of this paper however to answer the research question it is useful to enlighten this topic further. The term Big Data is most commonly used to indicate a massive amount of raw data which cannot be handled without the use of specific processing and analysing tools. Raw data for Big Data Analytics can come from a variety of different sources such as Social Media usage, the Internet of Things such as wearable fitness trackers or the use of mobile applications on smart phones or tablet computers. For the scope of this

research a focus is however laid on Big Data resulting from the use of mobile health applications also in combination with wearables or connected devices.

3.2.1 Classification of Big Data

According to Russom (2011), Big Data can be explained by three main characteristics which are Volume, Variety and Velocity. Volume represents the quantity of data. The increasing usage of different mediums such as health related applications as well as the digitalization of existing health care data is accountable for a growing volume of Big Data in the health care sector (Feldman, Martin & Skotnes, 2012). Data variety describes the nature of the data can be sub-classified into structured data, unstructured data or semi-structured data and data velocity can be explained as the speed of data with the sub-categories of batch, near time, real time and in streams. (Russom, 2011). Another advocate of the idea that Big data does not solely evolve around the size are Boyd and Crawford (2012) who define Big Data as an interplay of technology (maximizing computation power and algorithmic accuracy), analysis (drawing on large data sets to identify patterns) and mythology (the widespread belief that large data sets offer a higher form of intelligence) (p.663).

3.2.2 Collection of Big Data

One form of data can come from the build-in camera which almost all smartphones of today are equipped with. The camera feature can be accessed by mobile applications and can thus aid in collecting data that is connected to the user's health and physique (Klasnja & Pratt, 2012). Furthermore, through the access of applications to the mobile devices hardware features, geographic data can be used within applications which can provide insights about the user's covered distance and movement (Klasnja & Pratt, 2012). Another facet that constitutes to Big Data from Health Applications are connected devices or Wearables. The positive aspect of these devices is that they can automatically insert the generated data into the mobile application which can have a positive 12 effect on the adherence to the desired schedule or plan and reduce the possibility of errors from manual entering of the data (Klasnja & Pratt, 2012). In relation to the aforementioned source of Data an additional source of data from mobile health apps are data which is entered by establishing information exchange through personal area networking such as Bluetooth. M-Health Applications can integrate data from devices that are equipped with personal area network capabilities such as "scales, blood pressure monitors, glucose meters, portable electrocardiograms […] and gym equipment "(Klasnja & Pratt, 2012, p. 186). Data from mobile applications and wearables provides a quite different data set than data that is generated through Web 1.0 and Web 2.0 capabilities

(Chen et al, 2012). Mobile and sensor-based data requires the needed analytical skills to analyse “highly mobile, location-aware, person-centred and context-relevant data “.

3.2.3 Analysis of Big Data

Since Big Data is to a large extent defined by the volume and the complexity of the data sets, data is analysed using data processing tools to make sense of the data and generate useful insights about customers. Data Analytics describes the technologies that are based on data mining and statistical analysis (Chen et al., 2012). Data from mobile applications and wearables require specific techniques that are able to process the complex data sets. Next to these technological capabilities an area of growing importance are also organizational skills which can build the foundation to successfully analyse big data (Fania & Miller, 2012). Researchers further argue towards the need for Data Scientists, professionals that have been trained to explore Big Data to find underlying business insights (Davenport & Patil, 2012). Compared to traditional analysts, Data Scientists can cope with the complex, unstructured and non-numeric data sets by applying for example machine learning tools.

3.3 Diffusion of Innovation Theory and health apps

Rogers’ Innovation Diffusion Theory is the most popular theories for studying adoption of IT (Rogers EM,2004). According to this theory, innovation is an idea, process, or a technology that is perceived as new or unfamiliar to individuals within an area or social system. Innovation should be understood as a technology, process or idea perceived by individuals in a social system or a particular area as unfamiliar or new. On the other hand, diffusion refers to the flow of information about the innovation from one individual to another within the social system. These studies demonstrated that Rogers’ innovation theory is useful for conceptualization of technology adoption in the context of Health App. Although the DOI theory proposes many constructs to explain how a new idea, service or technology spreads in a given population, the constructs that are most germane to this study are the first three attributes of an innovation and the characteristics associated with the adopter categories as they relate to the rate of adoption of a particular innovation. In his book, Rogers summarizes previous innovation research studies and identified five perceived characteristics that make an innovation desirable to adopt within a social system. The rate of adoption for an innovation is more rapid if members of a social system perceive it to be better than what the innovation is intended to replace (perceived relative advantage); is consistent with their values, experiences and needs as potential

adopters (perceived compatibility); is not overly complicated to understand or use (perceived complexity); lends itself to be used without a significant commitment in time, 21 effort or expense (perceived trialability); and possesses benefits that are readily identified by the user and others (perceived observability) (Rogers, 2003). of an innovation, the more likely they are to adopt. (Rogers, 2003, p.16)

To fully inform and provide for an ease of reference, key terms related to the Diffusion of Innovations (DOI) theory as defined by Everett Rogers are provided below.

1. Compatibility: The degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An idea that is incompatible with the values and norms of a social system will not be adopted as rapidly. (Rogers, 2003, p. 15)

2. Complexity: The degree to which an innovation is perceived as difficult to understand and use. New ideas that are simpler to understand are adopted more rapidly than innovations that require the adopter to develop new skills and understandings. (Rogers, 2003, p. 16)

3. Diffusion: The process by which an innovation is communicated through certain channels over time among the members of a social system. (Rogers, 2003, p. 11)

4. Innovation: An idea, practice, or object that is perceived as new by an individual or another unit of adoption. It presents an individual or organization with a new alternative to solve problems. (Rogers, 2003, p. 12)

5. Innovativeness: The degree to which an individual (or other unit of adoption) is relatively earlier in adopting new ideas than other members of a system. (Rogers, 2003, p. 267)

6. Preventive Innovation: New idea that an individual adopts now in order to lower the probability of some unwanted future event. (Rogers, 2003, p. 265) 24

7. Rate of Adoption: The relative speed with which an innovation is adopted by members of a social system. (Rogers, 2003, p. 265)

8. Relative Advantage: The degree to which an innovation is perceived as better than the idea it supersedes. The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption will be. (Rogers, 2003, p.15)

9. Trialability: The degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on an instalment plan will generally be adopted more quickly than innovations that are not divisible. (Rogers, 2003, p.16)

10. Observability: The degree to which the results of an innovation are visible to others. The easier it is for individuals to see the results.

3.4 The Business Model Concept

Technology and new science by itself are not direct success factors for the creation of economic business outcomes or for the creation of customer value (Chesbrough, 2010). New technologies such as mobile applications and the analysis of the data generated from mobile applications have to be incorporated throughout all parts of a business (Johnson, Whittington & Scholes, 2011) This is where the concept of the business model comes into play. Since the introduction of the business model in 1975 the concept has especially in recent years created a lot of buzz (Bouwman, et al., 13 2012). Scientific literature reveals that there are a variety of different definitions of the term, therefore some of these definitions will now be presented. Teece, (2010) states that a business model "articulates the logic and provides data and other evidence that demonstrates how a business creates and delivers value to customers "(p.173). Within another definition the business model is described as a "system of interdependent activities that transcends the focal firms and spans its boundaries "(Zott & Amit, 2010; p. 216). Even though the definitions differ in wording the essential message is that the business model describes how a specific organization "creates, delivers and captures value "(Osterwalder &Pigneur, 2010). A critical aspect is the understanding of the positioning of the business model with regard to business strategy. The literature is drifting apart over this aspect in the way that some researchers are seeing no differentiation between business models and business strategy (Margretta, 2002; Al Morris, Schindehutte & Allen, 2005; and Burkhart, Krumeich, Werth & Loos, 2011). On the other hand, researchers are arguing that business models are the connecting link between business strategy and business processes indicating an interrelation between the three concepts (Al-Debei & Alison, 2010 and Osterwalder, Pigneur and Tucci, 2005). Within this view, the business strategy can be regarded as being at the highest level, concerning strategic aspects such as the organizational vision, goals and objectives whereas the business model reflects these strategic plans and business processes are concerned with the implementation of the strategic planning.

3.4.1 The Business Model Framework

The study within this thesis build upon the well-known business model framework of Osterwalder et al (2005). Other models exist, however the framework of Osterwalder et al. (2005) is constructed on the basis of the most mentioned and most studied

components of other models which indicates that all relevant aspects are combined within business model framework of Osterwalder et al. (2005). Using a synthesizing approach Osterwalder et al. (2005) concluded nine building blocks of the business model relating to 4 different pillars. Table 1 presents the nine building blocks in combination with the belonging pillars of Osterwalder et al.'s (2005) business model.

Pillar	Building Block	Short Description
Product	Value Proposition	Gives an overall view of a company's bundle of products and services.
Customer interface	Target Customer	Describes the segments of customers a company wants to offer value to.
	Distribution channel	Describes the various means of the company to get in touch with its customers.
	Relationship	Explains the kind of links a company establishes between itself and its different customer segments.
Infrastructure management	Value Configuration	Describes the arrangement of activities and resources.
	Core Competency	Outlines the competencies necessary to execute the company's business model.
	Partner Network	Portrays the network of cooperative agreements with other companies necessary to efficiently offer and customize value.
Financial Aspects	Cost Structure	Sums up the monetary consequences of the means employed in the business model.
	Revenue Model	Describes the way a company makes money through a variety of revenue flows.

Table 1: Osterwalder et al.'s (2005) nine business model building blocks.

3.4.2 Business Model Innovation

Academic literature implies that in order to create the most potential of a new technology it is relevant to find a way to incorporate the new technology into the business model as soon as possible as the technology cannot be used to its full capacity without a clear and fitting business model (Chesbrough, 2010). This results in the need to improve or to innovate the current business model to harness the new technology. New advances in the area of mobile devices, mobile applications, the Internet of Things, data collection and data analysis are a potential source of business model innovation. Business model innovation can be defined as re-innovating the current business model in such a way that improves the way of value creation, value delivery and capturing of value (Osterwalder, 2010). Another definition comes from Souto (2015) who highlights that business

Pillar Building Block Short Description Product Value Proposition Gives an overall view of a company's bundle of products and services. Customer interface Target Customer Describes the segments of customers a company wants to offer value to. Distribution channel Describes the various means of the company to get in touch with its customers. Relationship Explains the kind of links a company establishes between itself and its different customer segments. Infrastructure management Value Configuration Describes the arrangement of activities and resources. Core Competency Outlines the competencies necessary to execute the company's business model. Partner Network Portrays the network of cooperative agreements with other companies necessary to efficiently offer and customize value. Financial Aspects Cost Structure Sums up the monetary consequences of the means employed in the business model. Revenue Model Describes the way a company makes money through a variety of revenue flows. 15 model innovations can be explained as "a new configuration of what is done in the company and how it is done, in order to provide a new value proposition to customers ". A downside of business model innovation is discussed by Chesbrough (2010) who claims that business model innovation can however be an extremely hard task and often includes a serial of trial and error runs. Osterwalder et al. (2005) further indicate that the business model is subject to a variety of different forces. These forces are classified into five subgroups, namely the social environment, the legal environment, competitive forces, customer demand and technological change. The force of technological change is especially important for the outline of this research as the potential of using data from mobile devices which is a technological development will be evaluated. Moreover, business model innovation on the basis of technology developments is discussed as the predominant type of business model innovation (Osterwalder, 2004; Teece, 2010).

3.5 App-enabled Business Value Creation

Previous sections have discussed the competitiveness of the Indian health insurance market. Within such an environment it is important to remain competitive by creating and providing value to customers. Mobile applications are able to achieve this need in that they offer new possibilities of value creation such as ensuring a firm's competitive advantage. (Ehrenhard, Wijnhoven, van den Broek & Zinck Stagno, 2017). An important aspect to note is that mobile applications alone do not create business value but rather

they create the interface through which consumers access a mobile service which can possibly present business value (Ehrenhard et al., 2017). However, in order to best exploit the potential of mobile apps it is crucial that the application is well developed and realized otherwise it can get lost in the large amount of other applications that are offered on the market (Ehrenhard et al., 2017). Based on the Dynamic Capabilities Perspective and the Net Enabled Business Innovation Cycle Ehrenhard et al. (2017) have created a framework, the App-enabled business innovation cycle, short ABIC. The Dynamic Capabilities Perspective was first defined by Teece, Pisano and Shuen (1997) and describes the ability to constantly reconfigure internal and external resources and competences to create competitive advantage. The Net Enabled Business Innovation Cycle (NEBIC) by Wheeler (2002) is" an applied dynamic capabilities theory for measuring, predicting, and understanding a firm's ability to create customer value through the business use of digital networks "(p. 125). According to Wheeler (2002) emerging technologies hold the potential to lead to economic opportunities that make for growth in terms of business innovation for the purpose of creating customer value. An overview of the app-enabled business innovation cycle of Ehrenhard et al. (2017) can be found in Figure 1. Ehrenhard et al.'s (2017) framework focusses on value creation processes in the context of app-enabled start-ups. The value creation cycle is characterized through four capabilities,
(1) choosing emerging/enabling technologies, (2) matching with economic opportunities, (3) executing business innovation for growth and (4) assessing customer value, which are interlinked through learning processes in order to strengthen each of the capabilities. Each of the capabilities is linked to specific routines. The choosing capability includes routines that help in choosing emerging/enabling technologies. These routines cover choosing platforms for a certain functionality, choosing dominant platforms and choosing a platform that is compatible across all other platforms. The matching capability covers routines that include the continuous search for new and improved solutions, looking for novelties between enabling platforms and finding efficiencies by combining platforms. Automation of the value proposition, creation of flexibility and organizational agility as well as funding and monetization are routines of executing capabilities. Lastly, the assessing capabilities includes assessing (potential) customer value through customer interaction, customer review and customer analytics. It is also advisable to include customers early on in the process to increase product success and consequently business value.

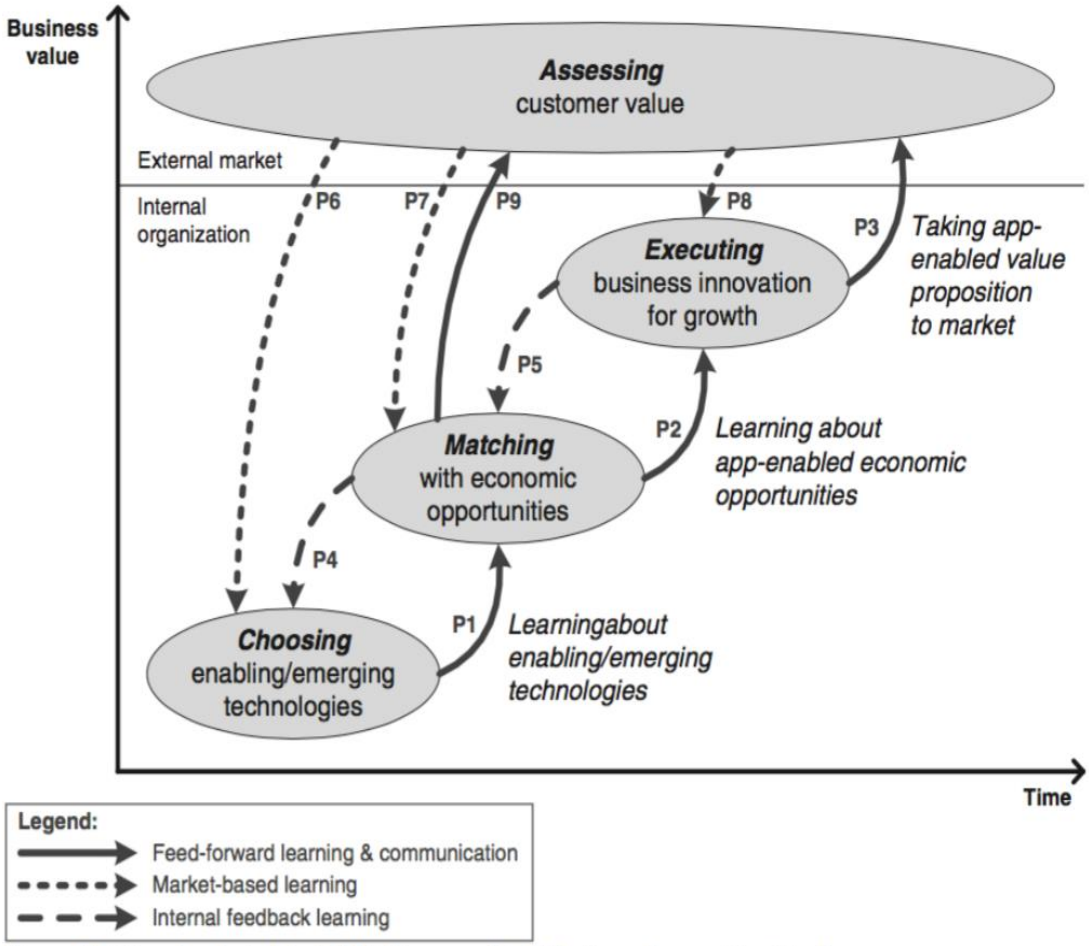


Figure 1: Ehrenhard et al.'s (2017) App-enabled Business Innovation Cycle.

The authors present four types of app-enabled business value, namely (1) strategic value, (2) informational value, (3) automation value and, lastly, (4) infrastructural value. Strategic value is connected to transformational processes such as growth of sales, improved customer satisfaction or improved competitive capability. Informational value is associated with decision and control processes and involves the ability of IT to" collect, store, process, and distribute information (Ehrenhard et al. (2017, p. 29). Automation value is linked to operational process improvements by substituting labour with IT such as the communication with customers and decreasing delivery costs. And finally, infrastructural value is related to the IT-enabled supporting processes such as hardware, software, IT staff and maintenance of customer databases. Based on the case study data, the authors have linked the four capabilities with the four types of business value and worked out eleven app-enabled business value indicators. Table 2 displays the outcomes.

Capability	Choosing enabling platform ecosystems leads to	Matching enabling platforms to economic opportunities leads to	Executing business innovation for growth leads to	Assessing customer value leads to
Type of business value	Infrastructural value	Strategic value	(1) Automational value (2) Strategic value	Informational value
Business value indicators	• Reduced IT cost • Mitigation of privacy risks • Reduced distribution cost	• Improved product and/or service innovation • Strenghtened competitive capability	• (1) Reduced delivery cost • (1) Reduced transaction cost • (2) Supporting business growth • (2) Improved customer service and satisfaction	• Improved decision making • Improved market responsiveness

Table 2: From Ehrenhard et al. (2017) Business value indicators and dimensions from data linked to capabilities

3.6 Possibilities of Mobile Health Application

Consumers increased mobile health application usage potentially offers a variety of positive aspects to health insurance companies. The first positive aspect of data generated from Health Application usage is concerned with cost-effectiveness especially when the data is generated from in-house mobile applications. Klasnja and Pratt (2012) discuss that the main use of mobile applications by users is to track and monitor personal health-related data to create self-awareness of behaviour patterns. The following subsections discuss how data from mobile health applications can provide advantages in terms of customer acquisition, customer retention and cost reduction.

3.6.1 Cost reduction

In section 2.1 a few of the main areas of government aided health insurance companies were introduced. In order to classify the role and potential of mobile health applications for health insurance companies the possibilities are explained within three of the main benefits offered by private health insurance. Again, a large cost factor for health insurance companies are inpatient treatment, doctors' fees and ambulant treatment. The first

benefit is concerned with the prevention of diseases. Mobile health applications can be used as a motivational initiative to comply with the suggested number of preventative check-ups such as prophylactic measures (Handel, 2011). Complying to the suggested preventive check-ups can reduce the unnoticed development of severe diseases which is directly linked to the second main aspect, in particular early disease detection. Devices that track a user's bio-signals can notice sudden changes and can serve as an early warning system for potentially critical health complications (Li & Guo, 2016). Lastly, for the treatment of diseases. Data analysis can filter out which treatments are more efficient than others for a certain illness, which side effects are increasingly common for certain medications and other important information which can thus yield to a large cost reduction as it can be acted correctly much faster based upon the quicker insights. Common widespread diseases in today's economy are for instance obesity and diabetes (Bradway, Arsand & Grøttland (2015). Handel (2011) describes that self-management practices and programs can trigger customers to keep working towards their fitness goals and learning new skills which will lead to long-term health and thus will eventually reduce costs of health insurance companies as these patients are potentially less likely to suffer from diseases that are provoked by obesity.

3.6.2 Customer retention and customer acquisition

Mobile health applications could potentially be useful within the retention and acquisition of customers in terms of analysing a customer's lifestyle to evaluate whether the customer pursues a healthy lifestyle including exercise, diet and nutrition and other factors. For government health insurance organizations, the majority of offerings is fixed by law which leaves only little room for differentiation. However as explained in section 2.1, health insurance providers are able to offer additional services. Offering users that are active and regularly provide proof of their active lifestyle and behaviour through mobile application usage additional perks could potentially result in the acquisition of new customers as well as retaining current customers. Another important aspect in the area of customer retention and customer acquisition is customer intimacy. Treacy and Wiersema (1993) discuss three value strategies, in particular operational excellence, customer intimacy and product leadership and argue that companies that have taken over superior positions within their industries have a narrower business focus and concentrate on excelling at one of these value disciplines while at the same time reaching at least industry standards within the other two value disciplines. Operational excellence is about the supply of reliable and convenient products or services while leading the market in terms of pricing. Customer Intimacy is about precisely defining the targeted customer segment and offering a suited product or service, thus understanding its customers' needs and

preferences. Lastly, the third value discipline, product leadership, is concerned with market leadership in terms of consistently supplying state-of-the-art products and services to customers. A very important aspect within customer intimacy is in-depth customer knowledge as well as the ability to quickly respond to customer needs which has a great positive effect on customer loyalty (Treacy & Wiersema, 1993). Another characteristic of a customer intimacy strategy is the long-term view in terms of the customers lifetime value to the company and long-term relationships with the customer which can yield potential benefits for the company. Weinmann (2013) for instance claims that „deeper, longer-lasting customer relationships can mean greater revenue, higher customer lifetime value, lower relative customer acquisitions costs through lower churn and greater share of wallet ". However, in order to build customer intimacy a certain level of trust and commitment is needed as a study shows that the level of commitment and interaction is influenced by the level of trust they have towards the service provider (Ponder, Holloway & Hansen, 2016). Yet customer trust does not automatically lead to loyal customers, rather this conversion requires intimacy building processes such as interactive communication as well as social bonds (Ponder et al., 2016) 20 In light of the digital revolution the economy is currently undergoing, Weinmann (2013) further argues that the era of Big Data augments customer intimacy towards collective intimacy, where as he states each relationship between a company and its customer is deepened by insights which are derived from all relationships. For insurance companies the collection and analysis of a multitude of data can potentially uncover underlying patterns and trends which can provide guidance in multiple cases such as individual as well as collective risk screening.

3.7 Limitations of Mobile Application Data

Next to the various possibilities coming from the use of customer data generated from mobile health apps for the health care sector quite a lot of negative concerns and challenges are discussed by researchers. By far the largest challenge is concerned with the topic of data security and privacy of sensitive customer data. Assuring the non-identifiability of health data is a very important factor which when being disregarded can act as a limiting factor in terms of technology acceptance (Nikayin, Heikkilä, de Reuver & Solaimani, 2014). In a focus group study, Dennison et al. (2013) have found that users have concerns about what happens to their data without their specific permission as well as discomfort about the possible privacy intrusion of context sensing features. It is furthermore argued that customers are having mixed opinions in that they understand that detailed individual information about them can be useful in a variety of ways and allows

firms to offer matching solutions, yet consumers are concerned about firms exploiting their personal data in unwanted ways (Akcura & Srinivasan, 2005). User acceptance is thus said to be an enabling factor when it comes to the potential analysis of customer health data as user acceptance is only achieved when data protection is functioning at a high standard. This is especially of interest in consideration with cyber-hacking or cyber-crime which is an increasing area of concern especially as technology and hackers are evolving to become more sophisticated (Fania & Miller, 2012). Ethical considerations are also a very challenging factor. The principle of granting supposedly fit and healthy customers a lower insurance premium or other benefits raises tremendous ethical concerns. The idea of this concept can be argued as being built upon the assumption that people with a certain level of weekly activity and with certain physical measurements are not the result of increasing health insurance costs. On the other hand, this automatically signifies that people that are analyzed as being rather unhealthy are forcing up health insurance costs. Directly related to this is the fact that this would count as discrimination against a large group of potential customers which would have rather counter-effective results especially in light of the extreme competitive health insurance market. A negative aspect that is in particular of relevance for self-reporting type of health applications is that users need to stay active in inserting their data and using the application to provide data for analysis. Those patients that perceive smartphone usage per se as difficult might be prone to be less consistent with their submission of health information Triantafyllidis et al., 2015). Epstein, Siegel and Silberman (2008) furthermore discuss three main elements that are required for the principle of self-monitoring. These factors are motivation, attentiveness, curiosity and habits of mind. Another negative aspect is accuracy. Automatic pedometers for instance can falsely measure the steps that have been taken which in turn does not portray an accurate health behaviour to the user and thus leads to false data analysis outputs. Furthermore, can mis calibrated devices or wearables lead to false data which can potentially have negative influence on the analysis of the data (Klasnja & Pratt, 2012). Low involvement of professionals in app development and low-quality assuring measurements or certifications are further fuelling the discussion of the quality of medical applications (Hussain et al. 2015). Lastly, the literature discusses the issue of trustworthiness of health information. Especially those pieces of information that are shared among online communities and on social media are seen as critical as this information is rarely verified by professionals and can thus lead to misinterpretations and dangerous outcomes (Triantafyllidis et al., 2015).

3.8 Empirical Findings

3.8.1 Business Model Configuration

Based on the qualitative comparative analysis by Rumble and Mangematin (2015), the significant results on antecedents for the multi-sidedness based on the four configurations 48 elements of multi-sided, tailored engagement, repeated payments and networked structure versus to those of single sided markets are presented below. Client Involvement Foremost, Rumble and Mangematin (2015) found that client involvement is different between multi-sided and single-sided models. For instance, with the use of an event based social media platform case, clients and early adopters of this multi-sided networked models helped establish and scale the venture by promoting it among their peers, in order for both users (event seekers) and paying customers (event organizers), benefited from increasing returns on adoption. In addition, a brokerage firm that profiles job seekers, mentioned the significances of clients' involvement is to allow them to adopt their business model according to the clients' expectation. This firm's clients took an active interest in its development and had expectations about how it should be structured. Interviewees from firms that adopted multi-sided networked models in Rumble and Mangematin (2015) study, repeatedly reported that clients anticipated benefiting from the new ventures and sought to (a) scale the firm to reap those benefits, or (b) tailor the firm's offerings around their needs. In contrast, respondents from firms with single-sided, hierarchical models repeatedly stated that, although their clients were involved, that involvement was in response to firm-led initiatives to convince them to take part. The aim of these initiatives was to benefit the firms, rather than to convince the clients of the mutual benefits to be had. Regardless of the finding that both multi-sided networked models and the single-sided hierarchical model to involve their clients. Clients were often convinced that they would benefit from the firm's establishment and expansion from the multi sided networked perspective. Clients not only assisted in the expansion where they could, but also sought to influence the business model so that it was more suited to their needs. On the other hand, clients of firms with single-sided hierarchical models were not as convinced that they would benefit from firms' new models. Firms that actively tried to engage prospective clients were often met with indifference, while prospective clients appeared to be more willing to walk away than to try to influence the development of firm models. Feedback With regards to feedback, (Rumble and Mangematin, 2015) observed that multi-sided networked business model's clients' feedback differs from those of single-sided models. The kind of feedback obtained from the single-sided models based on the value proposition involved that of products while on the other side of multi-sided

models it involved services. But also based on their further research, the multi-sided networked models showed that they received feedback about the structure of their business such as commenting and rating on what to be improved while with other businesses providing the basis for their business system. Regarding the second and the third question under investigation by (Rumble and Mangematin, 2015), which are: whether multi-sided business model associate with the use of tools to enhance design, creativity and visualization and if these models are accompanied with external activities. Their findings reveal that, multi-sided models were not designed according to the cases they researched but they have been copied due to the founder's experience in particular industries where they have been involved in. Furthermore, Casadesus-Masanell and Zhu (2011) contribute to the literature on innovation and imitation. Based on their findings, scholars have looked at how new products or processes can be imitated by their competitors (Benoit 1985; Gallini 1992; Pepall and Richards 1994; Ethiraj, Levinthal, and Roy, 2008) and whether firms should disclose or license their innovations (Hill 1992; Gans, Murray, and Stern 2008; Mukherjee and Stern 2009). They argue that, while mechanisms such as patents, trademarks and commercial secrets exist to prevent competitors from appropriating returns from product innovations, they are not generally applicable to business model innovations. Therefore, they suggest that, before an entrant decide to reveal 50 their business model, firms should take into account the competitive effects associated with it. Thus, in their study, they assume firms can imitate each other's business models once they are revealed. Entrants should realize that incumbents will react to innovations in two main ways: they can keep their business model intact and adjust its tactical variables (such as price); or they can adopt a new business model so as to change their value creation and capture logic. The new business model may be a replica of the innovator's, or alternatively a new hybrid that combines some of its elements with others from the incumbent's original model in a mixed business model.

3.8.2 Multi-sided General Findings

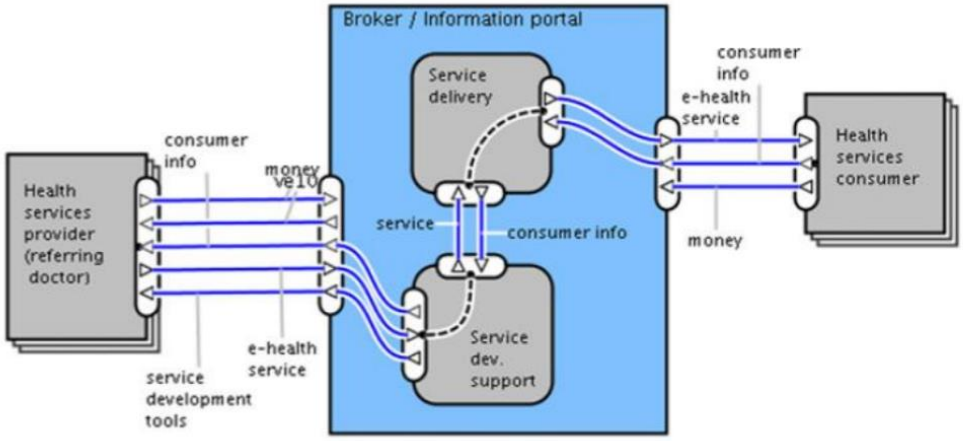
Other insights on business model in relation to digitalization are for example those of Ladib and Lakhal (2015), in which they consider the advancement of technology. In their view, it is important to consider the role of the information to create an advantage by conceptualizing the structure of the business model of exchange based on the contribution of the theory of transaction costs (TTC). Indeed, TTC has been used by many authors to conceptualize the business model (Amit and Zott, 2001; Warnier, Demil, and Lecocq, 2004; Zott and Amit, 2007; Brettel et al., 2012). Moreover, the findings of Casadesus-Masanell and Zhu (2011) are related to the literature on platforms and multi-sided markets (e.g., Rochet and Tirole 2003; Caillaud and Jullien 2003; Armstrong 2006;

Hagiu 2009; Casadesus-Masanell and Ruiz-Aliseda 2009; Zhu and Iansiti, 2012). Platforms are observed as institutions that act as intermediaries to enable transactions between multiple sides of a market-such as sponsors and consumers. Based on their work, (Casadesus-Masanell and Zhu, 2011) highlight that most of the literature on multi-sided markets and platforms considers situations where the sides attract one another as previously mentioned in the review. For example, operating system platforms connect two sides: independent software vendors and users. Clearly, the more applications are available for a 51-particular operating system, the more attractive that system is to users. Likewise, the larger the number of users of a particular operating system, the more attractive it is for developers to produce applications for that system. When a platform is sponsor-based, however, consumers prefer to access the product without interference by the sponsors (i.e., consumers prefer books without ads, or access to slopes without sales pitches). An example in the context of sponsor-based business models the authors used the case of Metro Spain, the first ad-sponsored free newspaper launched in Spain in 2001. After observing the implementation of Metro Spain, several incumbents copied its business model. For example, Recoletos launched Qu´e! in 2005 and Editorial Pagina Cero launched ADN in 2006, both of which are ad-sponsored free newspapers. In 2009, Metro Spain ceased its operation as a result of stiff competition. The business model of Metro, the parent company of Metro Spain, is also being imitated in many other countries (e.g. Switzerland) by incumbent newspapers. Hence, Casadesus-Masanell and Zhu (2011) paper contributes to the literature by exploring the desirability (or lack thereof) of entering a market with a two-sided business model when one side imposes a negative externality on the other. Muzellec et al. (2015) indicated several gaps in the multi-sided business model literature, first one in respect to identifying the importance of B2B and B2C customers; and second point of exploration need in how marketing strategies focus is shifting on one or another side within the time in the context of Internet ventures operating purely through the Internet. For the explanation of the phenomenon authors selected case study of five internet entrepreneurial ventures, from which the data was gathered and analyzed by applying Osterwalder's business canvas components. All internet platforms served two sides of customers, which can be defined in B2B and B2C terms. B2B is a customer paying for the service, while B2C is the end user, who may be charged or not for the service. In any scenario the participation of both sides provides mutual advantage. Authors identified that Internet business models lean on the fundamental element a value proposition of the business model (Muzellec et al., 2015). As it involves two 52 groups of customers, the question is why these two groups would like to engage in using a platform. The end-user can get certain benefits, while the B2B client is in need

for the data of end users or the potential reach size. The demand and the needs of customers define the price and who should pay it, therein normally B2B client is obliged to cover the fee. Due to that the value proposition has to be considered separately for both groups of customers, for business model to achieve financial success. In regard to B2B the end users and data about them is the key value proposition. Depending on the size, unique characteristics from a demographic, psychographic, and behavioural aspect based on the activities they perform in Internet. The data of the time spent online, websites visited, and other attributes form the end-user profile, which can be used for commercializing B2B. The results of the research revealed the business model evolve over time, and value proposition is shifting. Muzellec et al. (2015) classify business model development into stages as embryonic, emerging, growth, and maturity. In the early phases internet ventures tend to concentrate on end users and offer free services to gain the critical mass. The marketing strategies used in this stage comprised search engine optimization and push communication on social networks. In the later stages firms must to attain revenue from the provided service, and therefore the business customers come to the centre. Usually business stakeholders and venture capitalists act as change agents in this refocus decision, as monetization is the main goal of the firm. B2B customers become clients paying for the service and key partners in adding inputs to the offering. Finally, the mature business models of such firms represent the dynamic interplay of both audiences, which affects the service offering and revenue streams, even though the end users are perceived as contributing less to a co-creation. Hagiu and Wright (2015) discuss multi-sided platforms in relation to other more traditional models, i.e., vertically integrated firms, resellers and input suppliers in a context of professional services.

The m-health business model should encompass the boundaries set in relation to the specific market segment and context as business model should solve particular problem. The pattern should explain well the stakeholders and the restrictions faced by actors. Moreover, it should work as a blueprint, providing understanding on how business model will function. The formation of pattern should come from other real examples with successful commercialization experiences, not necessarily from healthcare industry. The three patterns included in the study (Mettler and Eurich, 2012) focus on how the created value could create a financial outcome. The freemium pattern leads to offering free service to the customer and extra service, i.e. expert doctors consultation, for a premium fee. The increased free user’s base leads to expanded portfolio of free services, and their feedback attract users, who may be willing to pay. The second option for subsidizing

health service is crowd-based design pattern, which is based on donations and volunteer inputs, and led by the free service idea.



The other pattern for gaining financial value of the project is serving multi-sided markets (Fig. 13). It is applicable, when one party is interested in another, therein the second one is provided with free or easier access. In this scenario the key market segments are health care providers, such as hospitals, private doctors, and the health service consumers. The consumer gets the health service, while provider can gain information of patient history and diagnosis. The main boundaries in this pattern is the service can have very complex technology or face lack of trust, if the interested party works on its own. The major actor in multi-sided is the intermediary, who facilitates the service delivery, support and match between two parties, e.g. health information portal broker. The broker has a significant task to find a balance of subsidies and revenue, to attract large customer base, i.e., gain the trust of users, and facilitate a high quantity and quality of services (Eisenmann et al., 2006). To achieve that the broker has to think in a long-term perspective and invest to security and marketing. Mostly the freemium and multi-sided market patterns demonstrated success in other industries, thus are promising to apply in healthcare context. These models are useful for explaining the business logic in a common language in a long-term perspective to achieve sustainable profit. Nevertheless, the consideration of the model itself, do not promise progress. 58 Based on past research (Engelen, 2012), it is necessary to refocus from technology driven attitude to mere business orientation and listen to the exact needs of customers.

4 Research Methodology

4.1 Purpose of the Study

The topic of the thesis, the Impact of data from mobile health applications for Health Insurance Companies in India is a relatively recent topic which is why the purpose of the study is of explorative and descriptive nature. Exploratory studies are a typical research method when the topic under consideration is still quite new which is definitely the case with the research question at hand. Exploratory studies are often done for three main purposes, "(1) to satisfy the researcher's curiosity and desire for better understanding, (2) to test the feasibility of undertaking a more extensive study, and (3) to develop the methods to be employed in any subsequent study "(Babbie, 2010; p.92). In a descriptive survey the researcher's aim is to observe and later on describe what has been observed (Babbie, 2010). The units of analysis within this study are from some random Health Insurance companies in India and the way these health insurance companies can make use of mobile health applications for business model innovation and creating customer value. Since companies cannot be surveyed as a whole, the analysis is observed indirectly by surveying employers working for the companies that are knowledgeable about the topic. These employees are then categorized as the units of observation and will act as the study population which is the collection of elements from which the study sample is chosen.

4.2 Research Design

Survey research is used to collect information from a sample of individuals with the use of questionnaires. A positive aspect of survey research is that a variety of different conclusions can be drawn (Babbie, 2010) which, in light of the circumstance that the research topic is relatively new, and a variety of insights can be illuminated, is quite beneficial. Groves (1989) discusses that in order for a survey to be successful the risk of two types of error must be minimized, namely the errors of observation and the errors of non-observation. Errors of observation could potentially come from the construction of the questionnaire such as the way the questions are formulated or how they are presented and the respondents personality traits. Errors of non-observation are however concerned with the sample that is chosen for the research. Therefore, problems can arise from a poor sampling frame, sampling error and non-response of respondents. These types of

errors can result in a decreased generalizability of the results. Detailed information on the selected method of data collection is given in the following section.

4.3 Method of Data Collection

A structured non-systematic review of literature was conducted for this dissertation. The relevant literature was identified and collected through structured searches of 5 databases namely Pubmed, CINAHL, Embase, SCOPUS and Science direct. Cochrane library was also used as search engine to identify peer-reviewed literature. Likewise, hand searching of the reference lists and journal relevant to the research topic was done. Google scholar and UiT library database (BIBSYS) was used to find any additional relevant research articles. Grey literature was searched using WHO and other organizational websites to obtain an overall background literature for this dissertation on the use mobile health application.

Search engine	Journal databases	Grey materials	Hand search
• The Cochrane Library • Google • Google scholar • BIBSYS	• Pubmed • EMBASE • SCOPUS • Science direct • CINAHL	• UN Agencies • WHO • Relevant websites	• References • Relevant journals • Google • Google scholar • BIBSYS

Data collection is also being carried out by following the survey research method of a pre-constructed questionnaire. This implies that a standardized questionnaire is created. Babbie (2010) explains that questionnaires can be defined as “an instrument, specifically designed to elicit information that will be useful for analysis “(p.255). In constructing a questionnaire, a variety of aspects need to be considered, which include the style of posing questions, as well as including only questions that are of relevance for the research objective, the general format of the questionnaire and the order of the questions (Babbie, 2010). Table 3 shows the argumentations for posing each of the questions within the questionnaire.

Questionnaire Question	Argumentation
Part 1: General questions about the firm and the insurance industry market	
What is the name of the health insurance company that you work for?	General information about the company that the interviewee works for
What is your position within your organization?	General information about the interviewee
How would you assess the competitiveness within the health insurance market?	General Information to assess and reassure the literature that the competition among health insurance companies is quite fierce
Part 2: Questions about mobile health applications	
Does your company offer one or more health-related apps?	General information about the company that the interviewee works for
What kind of mobile health application does your company offer?	General information about the company that the interviewee works for
Does your company plan to offer a mobile health application in the future? If not: why not?	Growing digitalization of the health care system. Mobile applications designed around user health are booming. Riley et al. (2011) present 4 health behavior areas where mobile technology has been studied. Will the health care firm use apps in the future and what are their decisions against mobile apps (thus also asking for limitations)
In which category would you classify the mobile health applications that your organization employs or plans to employ?	Triantafyllidis et al. 2015 describe three main areas of personalized health monitoring (mobile phone sensing, self-reporting & social sharing); 4 proposed categories of health apps based on Klasnja & Pratt (2012) and based on what types of health insurance health apps could be found within Apple's app store.
Part 3: Questions about cost reduction	

How do you assess the potential of health-related mobile apps to assist in the early detection of diseases?	Current evidence suggests that the use of mobile technology can improve diagnosis and compliance with treatment guidelines, as well as patient information, and can increase administrative efficiency (Fiordelli et al., 2013) Devices that track a user's bio-signals can notice sudden changes and can serve as an early warning system for potentially critical health complications (Li & Guo, 2016)
How do you assess the potential of health-related mobile apps to support treatment of diseases?	Current evidence suggests that the use of mobile technology can improve diagnosis and compliance with treatment guidelines, as well as patient information, and can increase administrative efficiency (Fiordelli et al., 2013); This type of telemedicine system guarantees patient supervision while reducing costs (enabling more autonomous patient care and avoiding hospital overflows) (Lasierra et al. 2013)
How do you assess the potential of health-related mobile apps to prevent diseases, especially widespread diseases such as obesity and diabetes?	The main use of mobile applications by users is to track and monitor personal health-related data to create self-awareness of behavior patterns (Klasnja & Pratt, 2012); Self-management practices and programs can trigger customers to keep working towards their fitness goals and learning new skills which will lead to long-term health and thus will eventually reduce costs of health insurance companies as these patients are potentially less likely to suffer from diseases that are provoked by obesity (Handel, 2011)
How do you assess the relationship between preventative check-ups and early detection of diseases?	Complying to the suggested preventive checkups can reduce the unnoticed

	development of severe diseases which is linked to early disease detection.
How you assess the potential of health-related apps in reducing administrative costs through possible digital business processes?	Current evidence suggests that the use of mobile technology […] can increase administrative efficiency (Fiordelli et al., 2013)
Part 4: Questions about customer retention	
How do you assess the impact of health-related mobile apps on customer retention?	Offering users that are active and regularly provide proof of their active lifestyle and behavior through mobile application usage additional perks could potentially result in the acquisition of new customers as well as retaining current customers.
How do you assess the influence of health-related mobile apps on the ability to influence customer relations?	Each relationship between a company and its customer is deepened by insights which are derived from all relationships. (Weinmann, 2013)
How do you assess the ability to detect underlying health related trends in big data sets?	The collection and analysis of a multitude of data can potentially uncover underlying patterns and trends which can provide guidance in multiple cases such as individual as well as collective risk screening.
If your company offers a health-related mobile app, how would you assess the impact of that app on customer retention?	Asking for previous perceptions of whether health related apps have had an impact on customer retention
Part 5: Questions about customer acquisition	
How do you assess the impact of customer knowledge on providing targeted offers to customers?	A very important aspect within customer intimacy is in-depth customer knowledge as well as the ability to quickly respond to customer needs which has a great positive effect on customer loyalty (Treacy & Wiersema, 1993)

How do you assess the impact of health-related mobile apps to offer more targeted options to customers?	Health related apps offer a lot of in-depth customer knowledge which could be used to create targeted options.
How do you assess the influence of health-related mobile apps on building deeper and longer lasting customer relationships?	A very important aspect within customer intimacy is in-depth customer knowledge as well as the ability to quickly respond to customer needs which has a great positive effect on customer loyalty (Treacy & Wiersema, 1993)
How do you assess the interest of customers to use health-related mobile apps from health insurance companies?	Asking for an opinion on the general willingness of customers to use health apps from insurance companies
Part 6: Final Questions	
Do you have additional comments or remarks concerning this study?	General question to get additional information and feedback from interviewee

Table 3: Argumentation for questionnaire questions.

4.4 Sampling

As previously mentioned, the study population consists of everyone that has knowledge in the research area of health-related mobile applications and their potential effects on health insurance companies. In order to reach out to possible respondents of the questionnaire, a business networking site was used. This approach was selected as it bypasses several negative aspects of other methods in that for instance the direct contact to highly knowledgeable employees of health insurance companies within the topic of interest could be established. This approach does have a downside in particular that one is limited to 20 messages that can be sent out to non-contacts per month. 4 premium accounts have been created to reach a larger number of possible respondents. Knowledgeable respondents were selected based on their job description, prior employments and interest in the field of digitalization and mobile applications. The business networking site that was used to select the most fitting respondents was www.Linkedin.com. The decision for this business networking site was based on the circumstance that this research focusses on the Indian health insurance industry. Approximately 55 employees of different health insurance companies are contacted directly via a personal message

on the business networking site. This included employees from Government aided as well as private health insurance companies. 44 respondents have filled out the questionnaire which leaves a response rate of 13,92 percent. However, six responses have to be excluded from the analysis due to several reasons that will be explained in more detail in section 5.1. The response rate thus decreases from 13,92 percent to 12,03 percent.

4.5 Data analysis

The next step is to analyse the data that has been provided through the electronic questionnaire. In order to allow for qualitative assessment in terms of how data from mobile health applications can enable business development the data generated from the surveys is then analysed among certain aspects. The questionnaire starts with general questions concerning the respondent personally and the health insurance company that he/she works for. This also included questions concerning the current situation of whether the company offers one or more health applications and whether the firm plans to offer health apps in the future. The following segmentation variables are used to explore whether there are differences in responses among groups of respondents.

- How would you assess the competitiveness within the health insurance market?
- Does your company offer one or more health-related mobile applications?
- Does your company plan to offer a mobile health-related application in the future?
- In which category would you classify the mobile health applications that your organization employs or plans to employ?

4.6 Reliability and Validity

Reliability is the idea that “a particular technique, applied repeatedly to the same object, yields the same results each time “(Babbie, 2010, p.150). The extent of this research only allows for a onetime observation which means that it will be impossible within the scope of this thesis to test whether repeated application would generate the same outcomes every time. One form of enabling reliability is by providing respondents the option of keeping data anonymous which can enhance the willingness to share sensitive information which will in turn increase reliability of the research. Pretesting the questionnaire before sending it to the actual sample respondents can also yield a higher rate of reliability. Through these measures it was tried to make the research as reliable as possible.

The second measure of quality is validity. Validity is concerned with “the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration “(Babbie, 2010, p.153).

5 Results

5.1 Analysis of the sample and the current status concerning Mobile Health Applications across the sample

The first part of the analysis will revolve around the participants and their companies to summarize and give an overview of the participating sample. 44 participants started the questionnaire however six out of those 44 failed to complete the survey which results in 38 completed surveys and a completion rate of 88.6 percent. The six unfinished responses are left out of the further analysis. Ultimately a total of 38 respondents have successfully completed the survey. Out of these 38 respondents, 30 are employed by a health insurance company that offers private health insurance and eight are employed by a government aided health insurance company which results in a percentage of 78,95 percent of respondents working for a private health insurance company and 21,05 percent of respondents working for a government aided health insurance company. Appendix C shows a list of the participating health insurance companies along with information about respondents within their health insurance companies. Section 2.1 discussed the high intensity of competition within the health insurance market in India. Table 4 shows the results of the questionnaire regarding this topic. The results prove that most of the participants perceive the competition among health insurance companies as being high although around 34% believe that the competition is average. As far as mobile health application provision currently goes, slightly more than half of the respondents (in particular 20 respondents) have stated that the company for which they work for is currently not offering a health-related mobile application. Of those 20 respondents that claim that

Level of insustry competitiveness	Statutory health insurance	Private health insurance	Total
Low	0	0	0
Average	11	2	13
High	19	6	25

Table 4: Perceptions of competitiveness for types of health insurance providers

their company does not offer a health-related mobile application, 15 works for a private health insurance provider and five works for a government aided health insurance provider. The remaining 18 respondents (47,37%) indicated that their company is currently offering at least one health-related mobile applications. Of those 18 respondents, 15 works for a private health insurance provider and three works for a government aided health insurance provider.

When asked about whether their health insurance company is planning on offering health-related mobile application 28 respondents answered with yes and six respondents answered with no. Looking further into the numbers it becomes apparent that respondents whose companies currently offer at least one health-related application have also indicated that their company plans to implement health-based applications in the future. In total out of the 28 respondents that stated that their company offers at least one health-related application 24 are respondents from private and four from government aided health insurance companies. In order to make a further distinction table 5 shows the answers of the respondents that have said that their company does not offer at least one health-based application so far on whether their company plans to offer a health-related application in the future. Respondents that answered with no were additionally asked to give an indication as to why their employer does not plan to offer health-related applications in the future. Five respondents have explained why their company does not plan to offer one or more health apps. The answers reach from negative opinions such as" we deployed an application but discontinued it "," still indecisive regarding a useful utilization "over" still uncertain" to more positive answers such as" probably! "and" application for invoices ".

	Private Health Insurance	Government Aided
Plans to offer a health app in Future	11	2
Does not plan to offer a health app in Future	3	3

Table 5: Distinction between Private ad Government aided health Insurance companies as to weather they plan to offer a health apps in the future.

From figure 3 it becomes obvious that among the sample of this study informative health apps are the most common health related applications that health insurance companies

are currently providing. Excluding the category of ‚others' the next most common forms of mobile applications that health insurance providers are offering are apps where users can log health and fitness related data in form of a journal or diary and apps that remind users for instance to take medications or of upcoming preventative check-ups. Table 6 shows the answers of respondents to the request of naming “other” applications that would not fit within the given taxonomy of health apps. Looking at the answers it becomes apparent that a lot of apps by health insurance companies revolve around providing a more simple, fast and convenient service for customers such as submission of invoices and other documents as well as a way to enable communication with the insurance provider.

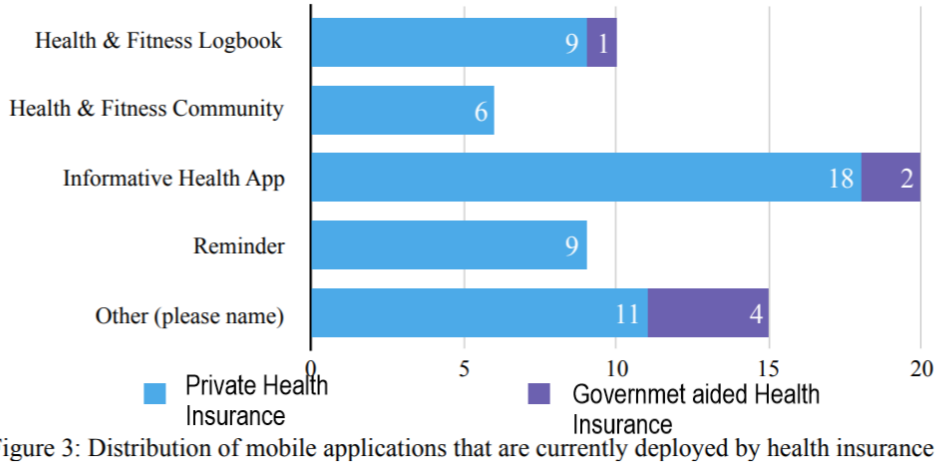


Figure 3: Distribution of mobile applications that are currently deployed by health insurance companies.

5.2 Analysis of potential positive outcomes of providing health-related mobile applications

The second part of the analysis revolves around the possible business value that health insurance firms can potentially attain through the deployment of health-related mobile apps. In the survey respondents were asked to answer questions about the possible influence of mobile health apps on aspects such as cost reduction, customer retention and customer acquisition. The following section will discuss the statistical results. Figure 4 shows the percentage composition of all responses to the questions that are covering the topic of potential positive business outcomes. In order to find an overarching structure within the data a common factor analysis was conducted. The Kaiser-Meyer-Olkin score for this sample is 0.690 which is according to Hair et al. (2010) a mediocre yet acceptable value. The score for Bartlett's Test of Sphericity ($\chi 2=311.018$; $DF=120$; $p<0.0001$) is significant, meaning that the correlation is high enough to continue with the factor analysis.

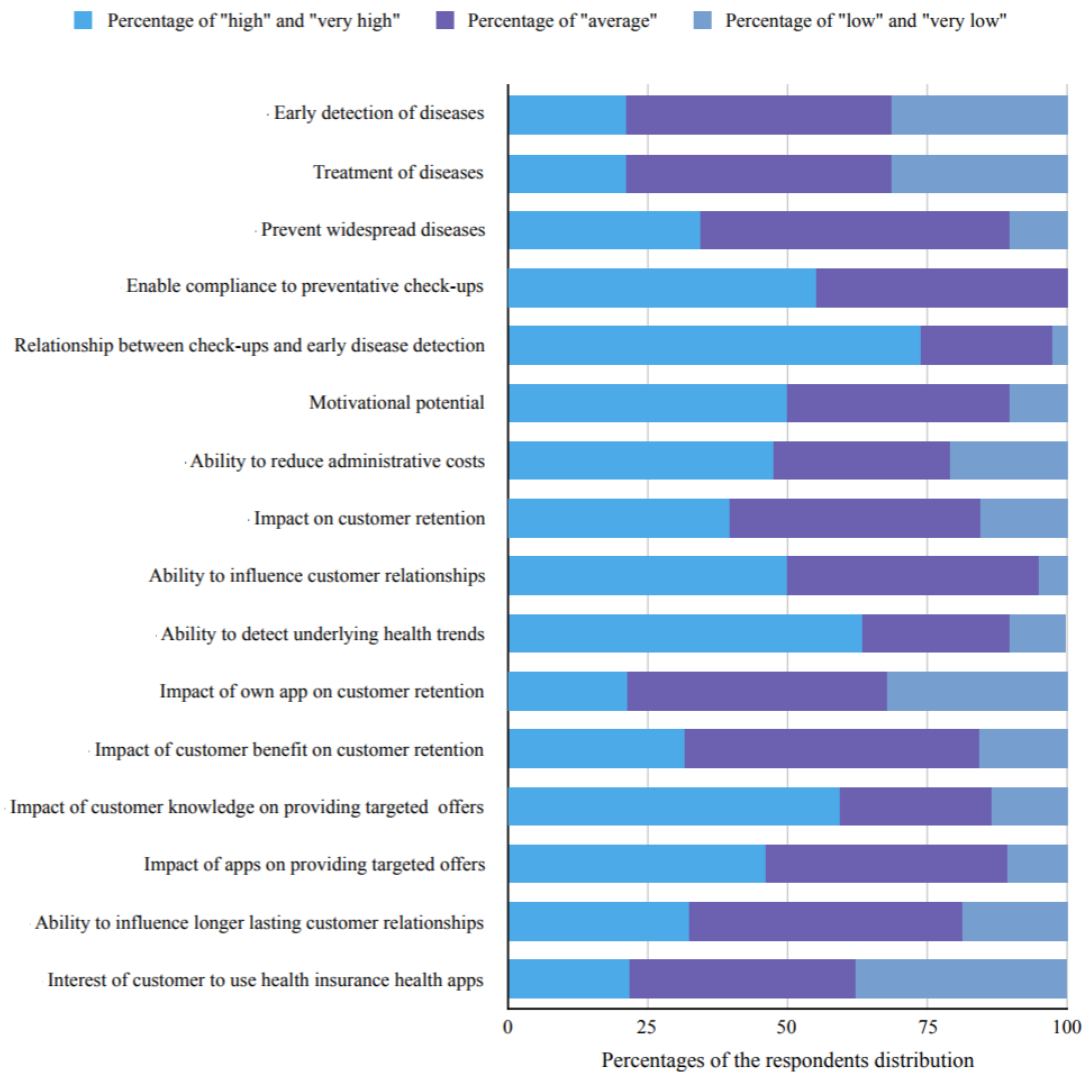


Figure 4: Distribution on a percentage basis of respondents answers to questions

	Factor			
	1	2	3	4
Influence of your firms app on customer retention	.882			
Influence of health apps on customer retention	.847			
Influence of health apps on building deeper and longer lasting customer relationships	.847			
Influence of customer benefit enabled through health apps on customer retention	.785			
Influence of health apps on customer relationships	.548			
Potential of health apps in reducing administrative costs through digital business processes	.548			
Potential of health apps in enabling compliance to suggested preventative check-ups	.480			
Potential of health apps in treatment of diseases		.701		
Potential of health apps on the provision of targeted customer offers		.683		
Potential of health apps to prevent widespread diseases		.551		
Potential of health apps to detect diseases early		.477		
Ability to detect underlying health trends in big data sets			.867	
Influence of customer knowledge on provision of targeted customer offers			.703	
Influence of preventative check-ups on early disease detection				.791
Customer interest in using health insurance health apps				.621
Motivational potential of health apps to follow a healthier lifestyle	.529			.561

Table 7: Common Factor Analysis results using Varimax rotation

The initial common factor analysis results in 4 components that have an eigenvalue of over 1. However, there are several cross-loadings throughout the factor matrix which is why the factors are additionally rotated using Varimax rotation, an orthogonal rotation method. The resulting rotated factor matrix is portrayed in Table 7. There are still five cross-loadings however a general rule of thumb suggests that for smaller factor loadings to be significant a higher number of samples would be needed. Again, in this case the sample is very small which means that the loadings lower than .5 are disregarded. In a next step the Cronbach's alpha for each factor is calculated using SPSS. The complete results are presented in Appendix E. In general, for the interpretation of Cronbach' alpha it is said that an α score of higher than .7 is acceptable, higher than 0.8 is good and higher than .9 is excellent. α values that fall below that are questionable but can be

included within exploratory factor analysis (> .6), poor (> .5) and unacceptable (< 0.5) (Hair et al., 2010).

Factor 1: ‘Customer Retention’ The original Factor 1 consists of seven variables and covers 27,08% of variance. The highest factor loading is .882 and the lowest factor loading is .480 which is relatively low, but the variable will remain included for now. The overarching topic of factor 1 is concerned with customer relationships and customer retention. The Cronbach’s alpha for the first factor is 0.911 which is a quite good score. It can even be improved to 0.923 if the variable with the lowest score, namely ‘Potential of health apps in enabling compliance to suggested preventative check-ups’ is removed from the factor. Additionally, looking at the commonalities of each of the variables of factor 1, two variables have low extracted communalities, therefore ‘Potential of health apps in reducing administrative costs’ is also removed from this factor. The new factor 1 now consists of five variables.

Factor 2: ‘Targeted Customer Offering’ The second factor consists of four variables, ‘Potential of health apps in treatment of diseases’, ‘Potential of health apps on the provision of targeted customer offers’, ‘Potential of health apps to prevent widespread diseases’ and ‘Potential of health apps to detect diseases early’. The value of Cronbach’s Alpha is 0.724 and it is not increased through deletion of any variable. This factor explains 17,21% of total variance.

Factor 3: ‘Big Data Possibilities’ the Cronbach’s alpha for the third factor is .693 which is just around the cut-off point of an acceptable alpha value. Due to the exploratory nature of this research it will be accepted but interpreted with caution. This factor consists of two variables ‘Ability to detect underlying health trends in big data sets’ and ‘Influence of customer knowledge on provision of targeted customer 36 offers’. Both items are not directly linked to health apps however indicate what could be possible with Big Data potentially from mobile health applications. This factor explains 11,56% of variance.

Factor 4: ‘App Use’ This factor consists of three variables which are difficult to interpret. The aspect of customer interest in using health apps by health insurance companies does not seem to fit with the other two variables which are concerned with the motivational potential of health apps to follow a healthier lifestyle as well as the influence of preventative check-ups on early disease detection. Moreover, the Cronbach’s alpha value ($\alpha = .588$) is classified as poor. which indicates that this factor can be neglected. The original variance covered by this Factor is 10,70%. The previous section has

analysed the survey data by conducting an exploratory factor analysis using SPSS with the purpose of revealing an underlying construct within the data. It has been shown that certain questions of the survey do cluster together. All of the four factors that were produced within the factor analysis are kept for further consideration. However, a few variables have been excluded from the factors due to reasoning based on Conbach's alpha, low extracted communalities as well as content assessment. The resulting Factors can be seen in Table 8.

Factor 1: Customer Retention	Factor 2: Targeted Customer Offering	Factor 3: Big Data Possibilities	Factor 4: App Use
Influence of your firm's app on customer retention	Potential of health apps in treatment of diseases	Ability to detect underlying health trends in big data sets	Influence of preventative check-ups on early disease detection
Influence of health apps on customer retention	Potential of health apps on the provision of targeted customer offers	Influence of customer knowledge on the provision of targeted customer offers	Customer interest in using health insurance apps
Influence of health apps on building deeper and longer lasting relationships	Potential of health apps to prevent widespread diseases		Motivational potential of health apps to follow a healthier lifestyle
Influence of customer benefit enabled through health apps on customer retention	Potential of health apps to detect diseases early		
Influence of health apps on customer relationships			

5.3 Analysis of variations between different groups of respondents

Four factors have been filtered out of the exploratory factor analysis in section 5.2. This subchapter discusses the significant relationships among the respondent's answers, presented for each factor. Again, the segmentation variables are as follows:

• How would you assess the competitiveness within the health insurance market?
• Does your company offer one or more health-related mobile applications?
• Does your company plan to offer a mobile health-related application in the future?
• In which category would you classify the mobile health applications that your organization employs or plans to employ?

Factor 1: 'Customer Retention'

The first factor has an overall mean of 3.18 which means that the relationship between health applications and customer retention is regarded as being slightly higher than the middle option of 'average'. The questions 'influence of health apps on customer retention'(F(1,36)=7.770, p=.008), 'influence of the firm's own application on customer retention'(F(1,26)=7.056, p=.013), 'influence of health apps on building deeper and longer lasting relationships' (F(1,36)=5.851, p=.021), 'influence of customer benefit enabled through health apps on customer retention'(F(1,36)=7.092, p=.012) and 'influence of health apps on customer relationships'(F(1,36)=6.094, p=.018) have been answered significantly more optimistic by respondents that work for private health insurance providers. Moreover, respondents whose company currently offers a health and fitness community application have answered on higher on the questions ''influence of health apps on building deeper and longer lasting relationships' (F (1,36) =5.955, p=.020) and 'influence of the firm's own app on customer retention' (F (1,26) =7.056, p=.013).

Factor 2: 'Targeted Customer Offering'

The second factor has an overall mean of 3.14. This shows that respondents see a moderate potential in health apps in terms of treatment of diseases, prevention of widespread diseases, early disease detection and potential of provision of targeted offers. Two significant relationships were found within this factor. Firstly, respondents who said that their company currently does not offer a health-related app see a lower potential of health apps in the provision of targeted offers (F (1,36) =5.531, p=.024). Secondly, respondents whose companies offer informative health apps perceive a lower potential of health apps in early disease detection (F (1,36) =5.158, p=.005).

Factor 3: 'Big Data Possibilities'

The overall mean of this factor lies at 3.60 which indicates that the questions within this factor have been answered on average more optimistically than average. This is potentially explainable as the questions within this factor are quite generic and it is a more widespread believe that big data can positively influence the questioned aspects. Respondents are more optimistic towards the underlying Big Data Possibilities provided through health apps. There is however no significant relationship found between the various answers within this factor.

Factor 4: ‘App Use’

The last factor scores an average mean of 3.15. This indicates that there is a moderate acceptance of a customer interest in health apps from health insurance companies and a moderate acceptance of the motivational potential that can lie within health-related applications. Two statistically significant relationships could be found. In particular, respondents whose company currently offers an application based around providing a health and fitness community see a higher motivational potential in health apps than other respondents ($F(1,36) = 6.475$, $p = .015$). And furthermore, respondents whose firm currently offers informational applications signify a lower customer interest in health apps than other groups of respondents ($F(1,36) = 5.004$, $p = .032$).

6 Discussion and recommendations

6.1 General Discussion

This chapter will discuss the results of the survey, the results of the statistical analysis and in how far recommendations can be built from these results. A good way to start the discussion is to revisit the initial sub questions of this research and answer them shortly. The first question „What are mobile Health Applications and what data is generated by them? “cannot be answered with a single answer. Mobile applications can come in a vast amount of different forms and thus create a variety of different data for health insurance firms. Based on the results it can be seen that the possible applications that are discussed in section 3.1 almost fully cover the applications that health insurance companies in India are currently providing. The results of the survey show that the prevailing mobile health application among the sample are informative applications. As informative health apps are used to inform the customer about for example the health insurance company, tariffs or bonus programs they do not generate much qualitative customer data. The second most chosen answer option was ‚other’ for which most respondents then clarified that they offer service apps in which customers can easily communicate with the health care provider, send invoices or other paperwork digitally. The data that is generated by those applications is similar to what type of information health insurers are currently receiving from customers but rather digitalizes it. Another category of health-related apps is labelled health and fitness logbook. This provides highly valuable data for insurance companies about the individual customer, their exercise routines or nutritional habits.

Health and fitness logbooks can however also include diaries in which customers enter and control possible side effects of medications, illness symptoms or allergy circles. This shows that the data generated by these apps is rich of different types of information. Another common health application provided by health insurance companies are reminders. These apps remind customers of medication intake or upcoming preventative check-ups or other doctors' appointments. This also provides very personal data such as what medications someone is using and whether the person regularly goes to doctors' appointments. The last and least often selected category of proposed health applications is the category of health and fitness community. This includes applications in which customers can engage among each other to give certain impulses, motivate and discuss. This form of health application also provides very personal information, but this information might not be as rich of valuable information alone as other type of applications but rather more in combination with for instance a health and fitness logbook. The second sub question asked for how data from mobile health applications can be useful for health insurance companies. The results of the survey show that the assumption that health insurance companies can detect underlying trends and coherences within large data sets hold true for the sample of this survey. This is because many respondents, in particular 24 and thus 63,16 percent, believe that large data sets can be used to detect hidden trends within data sets. For the future this could generate tremendously large new insights if health insurers could spot relations between different aspects such as for example complications or outcomes due to the synergy of different medications sooner rather than later. Looking at the entirety of customer data not at the data of a single individual can enable the detection of hidden patterns and lead to new medical insights. One respondent also included the fact that health apps can be helpful in collecting large amounts of data for research and patient inquiries which in turn will evoke health-related information useful for the collectively of customers. Thirdly, the question „how do mobile health-related applications relate to business model innovation? ". In light of the high competitiveness within the Indian health insurance market there seems to be the need to differentiate oneself from other health insurance providers. As described in paragraph 3.4.2 business model innovation can be a way to achieve this differentiation. Health related mobile applications offer a way to innovate the business model in that they offer new forms of generating customer value and increasing customer relationships with specific service applications. In particular, this means that the customer segments have to be revaluated in order to target the mobile offerings as best as possible. Even though nowadays smartphones are omnipresent and spread across all age ranges it can be assumed that a specific age range fits better than another due to the fact that for a lot of

elderly people the continuous use of smart phone technology for various aspects might be a burden or strenuous. A customer segment that is assumed to be to a large amount willing to accept health insurance health apps is the range of 20-60. Based on the segmentation of customers it is important for health insurance companies to think of the type of relationship that each customer segment is expecting. Those that fall within the range of accepting and being potentially interested in using health-related apps from health insurance companies might be willing to have a closer relationship with their insurance provider to attain other positive outcomes such as more targeted offers based on their acceptance to analyse data for underlying trends. Another aspect is that a lot of people are already using such health-related applications. Providing a holistic application that incorporates various aspects from documenting health data, to being reminded of health-related events or tasks to be able to submit documents digitally etc. holds a large amount of customer value. The responses to question have revealed that even though most respondents have chosen for an average impact of enabled customer value through mobile health applications on customer retention, 12 respondents have indicated that the impact could be higher which slightly supports the idea that the business model can be innovated in terms of providing a new customer benefit. There is however also a negative side to this idea. One respondent has pointed out that mobile health related apps are most likely coming and going comparable to marketing trends. Another respondent has indicated that mobile health-related applications are somewhat interchangeable once these applications achieve the stage of market penetration. Thus, it is extremely important for health insurance firms to create a coherent digital strategy and position oneself in the market with this strategy concerning both the service sector and the care sector. This is where the app-enabled business innovation cycle becomes relevant. This framework describes the way in which business value can be created through four linked dynamic capabilities. For health insurance companies this would be as follows. First it would be important to choose for an enabling technology such as mobile technology as well as the operating and distribution platforms which can help in creating value. The outcomes of the choosing capability are then used for the matching capability. Based on learning from the first capability a health insurance company now looks into what kind of economic opportunities can be achieved. This includes aspects from business model innovation as it is concerned with what can be done different to provide a better solution to the customer segment. A holistic application which covers multiple aspects of the various types of health apps could be a way to differentiate oneself from other health insurance firms. The next capability is the executing capability which focuses on the execution of the designed plan to achieve business value. In the case of this research this means

that resources are used to develop the idea into a product. This can be done for instance in-house or the insurance company collaborates with a technology firm that is specified in apps. Once the application is finalized it can be taken to the market to be assessed by the target market. Furthermore, it is crucial that health insurance companies are constantly learning from the market and that knowledge from the market is incorporated within each step of the circle in order to constantly be able to provide what customers need. Health insurance companies can track the customer value by engaging with customers to find out what their needs are, analyse reviews and feedback that is provided on the distribution platforms or analyse the number of 42 downloads and the general customer behaviour to identify which aspects are used more commonly and where improvements can be made. All of the four capabilities are seen as a circular evolution based on learning and feedback between each of the capabilities. It is therefore important for health insurance firms to constantly provide feedback and rethink the options in order to generate business value. The next sub question was „what possibilities for health insurance companies exist from Mobile Health Applications? ". (Note: This paragraph looks only into the responses from the questionnaire. The following section, section 6.2 discusses the possibilities on a statistical basis). In order to answer this question, it is interesting to take a closer look at the responses where the answer option ‚average 'was not selected most commonly. The first case was question 12 which indicates that health-apps have a large potential in increasing coherence to suggested preventative check-ups. This is further supported by an answer to question 20 where one respondent states that the value for insurant and insurer lies mainly in the following aspects, increasing compliance during chronic diseases in terms of support within disease management programs as well as reminding patients of preventative and other check-ups. The responses to question 9 show that there is a high belief that preventative check-ups are related to the early detection of diseases. Another question which highlights the possibilities of health-related applications is question 10 regarding the motivational potential of health apps to follow a healthier lifestyle. The prevailing answer was that health-related applications do have a motivating potential to follow a healthier lifestyle. All of the above-mentioned aspects can potentially decrease costs for health insurance companies as customers are motivated to follow a healthier lifestyle as well as to adhere to suggested preventative check-ups which in turn can lead to an earlier detection of diseases. The outcomes to question 14 reveals that there is also a tendency towards the belief that health-related applications can improve customer relationships. With regard to health insurance companies this implies that the deployment of health-related applications that evolve around building a connection between the insurer and the customer. Another

possibility for health insurance companies lies within providing targeted offers for customers. The results of the survey reveal high influence of customer knowledge on creating targeted offers. With the use of data from health-related applications health insurance companies can generate knowledge about the customer entirety and then use this knowledge to offer more targeted options. The last sub question was concerned with possible limitations of the use of data from mobile applications. Question 21 asked respondents whether they had any further comments or remarks to this study. The answers that have been given to this open question are presented in Appendix D. These answers give a few insights into the limiting factors of mobile health-related apps. The main limiting factor are stringent regulations given to health insurance companies in India as to what is possible and what is permitted to happen with customer data. It has also been argued by one respondent that customers are rather confused by the complex topic of data privacy which indicates that there has to be some form of enlightenment of the issue to make it more transparent for customers and to what they are willing in if they use health-related applications from health insurance companies. Another limitation is that smart phone use is not spread equally over all age groups which eventually means that a lot of the data that is generated comes from only a few age groups and might therefore not be generalizable across all ages groups.

6.2 Discussion of the statically analysis

The generalization of this study's sample is very difficult due to the fact that there was a large number of non-responses and the low sample size. The results are therefore only interpretable with utter caution. The original questionnaire was split into three different sections, namely cost reductions, customer retention and custom acquisition and asked respondents to assess questions within these sections. Since the questionnaire was not built based on a validated scale, a common factor analysis was conducted to find whether some of the survey questions cluster together to then build a new overarching construct. The Common Factor analysis resulted in four factors covering altogether 14 of the 16 analysed questions. Due to the exploratory nature of this research all the four original factors were further looked into. These four factors are 'Customer Retention', 'Targeted Customer Offering', 'Big Data Possibilities' and 'App Use'. The outcomes show very clear that Factor 1 'Customer Retention' reaches the highest factor loadings and the highest value for Cronbach's alpha. Questions concerning customer retention and customer relationships clustered together within this first factor which an indication might be that one major advantage of health insurance health applications lies in building

relationship with the customer so that customer retention is achieved. The second factor 'Targeted Customer Offering' consisting of four variables that are not directly outcomes of the provision of health-related apps but indicate that they together can be influenced by health insurance companies though the provision of health apps. Thirdly, the factor 'Big Data Possibilities', is concerned with the possibilities that open up through the large amount of data that is provided by customers using health apps. For health insurance firms this would mean that health applications are the last factor is 'App Use'. This factor has a Cronbach's alpha value of .588 which is classified as being poor. This factor consists of three variables that are difficult to be explained by one distinct label. Therefore, this factor is left out of the suggested model for mobile health apps and their potential business value (Figure 5).

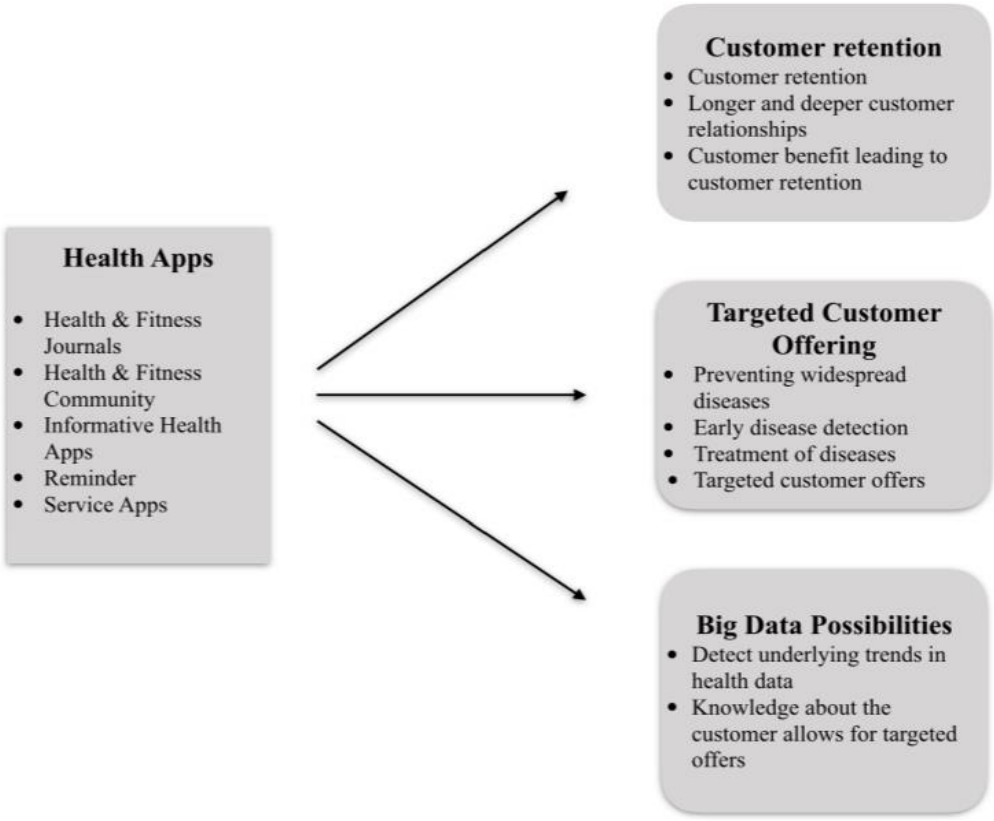


Figure 5: Suggested model for mobile health apps and their underlying

The remaining findings show how the questions of the questionnaire have clustered together. Interestingly, two of the questions that have been valued most positively have been removed from the common factor analysis as well as the model presented in Figure 5. These questions were concerned with the influence of health apps on the adherence to suggestive preventative check-ups (Question 9) and the motivational potential of

health apps to follow a healthier lifestyle (Question 11). The left side of figure 5 shows the health apps that based on the survey were among the most popular deployed applications. On the right side of the figure the constructs of the common factor analysis are presented. The model shows the three major findings of the research. The first one being that there seems to be a correlation between health apps and customer retention Figure 5: Suggested model for mobile health apps and their underlying and customer relationship. The second finding is that health apps hold an underlying potential in four aspects. Namely they aid in the prevention of widespread diseases, early detection of diseases, treatment of diseases and offering targeted customer offers. These parts can be reached by increasing overall health consciousness among insurant. The third finding is concerned with the possibilities that arise from the vast amount of data that is generated by customers through app usage. This data could be further analysed to make statements about latent correlations within the large data set. In addition, the third finding does also include the aspect of providing targeted offers to customers based on knowledge about the customer. Important in that sense is knowledge of the collectively in order to detect coherences within the data rather than knowledge about each individual customer. Under the current strict regulation and especially considering privacy concerns and data protection, this finding is harder to implement and to harvest at this time. The research has also looked into differences between five distinct groups within the sample. There is however not a statistically relevant relationship between all groups and variables from the four factors. The first group, respondents that work for private health insurance companies have overall indicated a higher influence of health applications on customer relationships and customer retention. No reason can be found as to why their answers are significantly higher than the respondents that work for a government aided health insurance companies. A next group within respondents are those that currently offer a health-related application based around the idea of a customer health and fitness community. This group has indicated a significantly higher influence of health apps on customer retention as well as on the ability to build deeper and longer lasting relationships. Assuming that apps revolving around providing a health and fitness community to customers increases active intercommunication between users and between users and the insurance provider this can be an explanation for why this group perceives a higher rate of customer retention. Next, respondents said that their company does not currently offer a health app perceive a significantly lower influence of health apps on the provision of targeted customers offers. Overall the values for all variables are lower compared to respondents whose firm offers health applications. This can be explained by bias or by lack of knowledge of the potential relationships. Lastly, respondents that are employed by a

company that offers informative health-related applications sees a significantly lower potential of health apps to prevent diseases. This can be due to the fact that these respondents only employ an application based around informing customers about tariffs and bonus programs and can thus not make the connection to the actual value potential of health apps.

7 Conclusion, limitations and further research

7.1 Conclusion

The previous chapter discussed the results of the research. In order to come to a final conclusion to the research question of „How can the use of mobile health applications enable business development in terms of business model innovation/customer value creation in Indian Health Insurance Companies? “the results of the previous chapters will be tied together. This chapter will furthermore deliberate on limitations of this study, consider theoretical and practical implications and provide suggestions for further research. First of all, from the responses to several questions it can be concluded that the attitudes towards health-related mobile applications are divergent. While some say that health-related apps are a temporary phenomenon and that there is only little interest on the customer side in using health related applications from health insurance companies, others see a larger potential in them. There are different ways in which medical insurance companies can make use of health-related applications in order to increase customer value. Service Applications where paperwork can be handed it increases administrative efficiency for customers and might solve an issue of bureaucracy. A major aspect on the way of creating business value is however to follow the ABIC. This framework sets out how to implement the business innovation process to arrive at business value. Four steps and intermediary learning and feedback from each step and the customers is needed to create a thought through application which includes desired outcomes and ways to achieve these outcomes to create an advantage over other health insurance companies. One recommendation to harvest the potential business value of health and fitness applications is for health insurance providers to integrate different concepts of the types of health applications into one application. This way a sort of one-stop shop kind of application is created with the specific functionalities of each type of application combined, where customers can retrieve information, submit documents, be reminded of certain

tasks such as measuring blood sugar levels, track health and fitness data like for blood sugar levels and interact with one another and with the health insurance company. Even though the potential business value derived from health apps seems promising there are limitations and even barriers. For example, the current legal situation is very restricting, and it is thus interesting to observe how this subject matter might shift in the future. Overall due to the split opinions it is a topic that needs to be considered with caution to not get carried away with overly 47 positive assumptions of outcomes. The Indian health insurance industry is a mature market and creating a differentiation is hard to achieve. Lastly, the results of this study are to be viewed with caution and not to be accepted overenthusiastically as they are not generalizable.

7.2 Limitations of the research

Despite the previously presented contributions this research is also subject to limitations. The first and largest limitation of this research is the sample. The Sample size is very small which results in an extremely limited representativeness and overall significance. Moreover, the response rate of 12,03% is also a limiting factor. Furthermore, the sampling of the sample is based on respondent's descriptions. The contacted individuals might be biased based on the fact that they are part of the team that is responsible for digitalization, social media and / or customer relationship management. Another limitation is resting upon the choice of data collection method of this study. Survey research in and of itself contains of a few limitations, the first one being that this study is conducted at one specific point in time. It cannot be known whether the results will be the same or similar at a different point in time. This holds especially true since the topic of digital health is growing and becoming ever more interesting for firms which might result in a shift of perceptions. Furthermore, based on the selection of the sample the respondents can be biased and have thus influenced the results of the survey. A further limitation is that this study does not focus on one specific type of health-related mobile application only, but rather includes a large amount of different types of mobile applications. On the one hand this allows for a broader spectrum of information but on the other hand it was more difficult for respondents to answer the general questions. This might be an explanation for the fact that the answer option ‚average ' was selected most commonly. A further limitation of this study is the type of response that respondents were asked to give. The questions demanded for an assessment of a relationship or an assessment of the impact of health-related mobile applications on certain business aspects. Thus, the outcomes of the survey are only estimates and opinions of the respondents. For this

research it was assumed that health insurance companies would harness their own mobile health-related applications. It might even so also be the chance that a health insurance company might be in a partnership with a technology corporation or wants to enter a partnership with a technology corporation that is specified on health applications. This idea was excluded from the study but could have provided potentially different outcomes which is why this aspect could be seen as a limitation. Another limitation of this thesis is that the factor builds up and constellation might have looked different if one considers that there may be noisy data or noisy factors within the data set that might interfere with the generation of a clear picture. Lastly, respondents were contacted based on their profile and job description on a business networking site. Due to the fact that not all employees of health insurance companies are members on this site there is a potential that the survey was sent to someone that was not the ultimate fit for answering the questionnaire which might lead to sampling error in the data.

7.3 Relevance

The following sections will discuss the relevance of this research in terms of theoretical as well as practical implications. Sections 7.3.1 and 7.3.2 will discuss these topics respectively.

7.3.1 Theoretical implications

This study has looked at various theoretical concepts and ideas such as Big Data Analytics, Business Model Innovation as well as the App-enabled business innovation cycle. Big Data Analytics is concerned with the analysis of large data sets to filter out underlying trends or specific hidden aspects within large sets of data. Business Model Innovation can be explained as reconfiguring what the company currently does and how it does it with the purpose of creating a new value proposition to its customers (Souto, 2015). The Business Model Canvas has been used to explain what company aspects are important to best leverage the potential of health apps and to create customer value. Additionally, the app-enabled business innovation cycle has been utilized to give tips on how to create business value using applications. The ABIC includes routines for how start-ups can leverage business value though apps, interactions between the four capabilities and moreover four types of app-enabled business value. Due to the nature and results of this thesis the academic contributions are to a greater degree of theoretical nature rather than of empirical nature. This research however holds theoretical relevance due to the fact that it combines aspects from each of these above-mentioned theories to draw

conclusions of a relatively recent research area, namely of the possibilities for Indian health insurance companies of employing mobile health applications. This paper shows for example a new area of employment, a re-contextualization, of the app-enabled business innovation cycle for existing health insurance firms which originally was developed to uncover how start-ups can create business value with mobile applications. As far as the business model concept goes, this study shows theoretical relevance as it shows that health insurance companies can use mobile health related applications to create business value by increasing customer relationships, using a new channel to reach customers as well as targeting customers in a more specific way. A combined aspect of all theories has been attempted to fill the research gap between mobile health applications and their potential business value. Moreover, the study has worked out an overview of three types of business outcomes that can be achieved though the deployment of health-related applications. This can be used as a basis for further critical research in order to validate the model or in order to build new theories from this model.

7.3.2 Practical implications

The goal of the study was to identify the potential of mobile health applications for health insurance companies and to investigate the current situation of health-related apps in the insurance market. The results have shown show that around half of the participating insurance providers are currently offering a health-related application, however around 82% of respondents have indicated that their company plans to offer a health-related application in the future. The most commonly deployed applications at the moment within the sample are as follows: (ranked by decreasing selection) (1) Informative health apps, (2) Service apps that for instance digitize processes, (3) Health and Fitness Journals, (4) Reminders, and (5) Health and Fitness Communities. However, as the Indian health insurance industry is very competitive and highly regulated in India it is difficult for health insure companies to offer differentiated value to customers. With regard to the potential of health applications four different factors have been worked out. Out of these four, three are presented within a framework that tries to explain how business value is created for Indian health insurance companies through the provision of customer-targeted health apps. This study yields practical relevance as it shows that health applications hold the potential to increase customer retention, contribute to aspects such as early disease detection, treatment of diseases, and prevention of widespread diseases like obesity as well as hold the potential for further data analysis based on big data possibilities. As Ehrenhard et al. (2017) state, value is not just created through the sole provision of an application but rather through an interplay between three points, the technology, the user and the purpose of use. Moreover, an application needs to be well developed and

implemented in order to attain some sort of business value from it (Ehrenhard et al., 2017). The framework that has been developed within this research gives an overview as to what 50 kind of potential lies in health-related apps. The research also explains how health insurance companies can leverage business value by using the app-enabled business innovation cycle.

7.4 Recommendations for further research

This study tries to provide insights into a relatively young research topic as well as to generate and gather as much information about the current status and potential benefits of providing health related mobile applications for customers. However, based on the limitations of this research there are some recommendations for future research. It would for instance be interesting to conduct in-depth interviews with experts in this area of research. This will result in more extensive information which might then result in a better understanding of the effects that health-related applications might have. Furthermore, during interviews the interviewee could raise new aspects of the matter which might not be acknowledged otherwise. A more extensive study analysing each of the discussed aspects would be needed to verify and validate the findings of this research. Therefore, to successfully exploit the potential positive aspects of health apps in the Indian health insurance domain and in order to generate reliable results, deeper experiments and research has to be conducted in the future. This holds also true for a deeper analysis of which type of health application has how much and what kind of influence on each of the three presented constructs. Considering the responses to question 20, that asked respondents to assess the interest of customers in using health-related mobile apps from health insurance companies, where the most striking answers were average and low, an especially interesting research would be the perspective of customers on the topic of health apps from health insurance companies. Therefore, for creating a comprehensive picture and to provide practical information to health insurance companies a further research should look into the customer perspective on mobile health-related apps.

Everyone should be covered by some form of health insurance. People are always vulnerable to injury and illnesses from their everyday activities. Whether it is an individual plan or employer or government-sponsored coverage, having health insurance is better than not having it at all. Millions of Americans are uninsured in part due to high premium costs. Many are forced to pay these high health costs out of pocket, which can create more problems medically and financially. Indian Health insurance or medical insurance sector has been growing, since the country's economic reforms. The reason why

Mediclaim insurance, has grown is that it ensures good medical care from reliable health care institutions.

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9 Survey:

Health App Survey Introduction for Participants Thank you for your interest in this survey The purpose of this study is to generate an overview of the deployment of health-related mobile applications and their potential impacts on the health insurance business. The term mobile healthrelated applications is a broad term and can include a vast amount of applications. In this survey we are mainly interested in those applications that are designed for customers of your health insurance offerings. This includes apps that are designed for the use on either smartphones and / or tablet computers and can potentially be linked with other devices such as smart watches or other tracking devices. Furthermore the term health-related mobile application can also comprise apps that for instance remind users to take medications, offer a community of like-minded people, provide insurance related information to the user and logbook or diary apps in which users can log for instance physical activity, nutritional information or side effects of certain medications. Your responses to this survey will be treated confidential. Instructions for the questionnaire It will take approximately 10 minutes to complete this questionnaire. The questionnaire consists of 6 parts that will ask for your personal opinion on the deployment and impact of health-related mobile applications. To submit the completed questionnaire please click on ‚send' at the end of the questionnaire.

Part 1: General questions about the firm and the insurance industry market:

1. What is the name of the health insurance company that you work for? (Information will be treated confidential)

2. What is your position within your organization? (Information will be treated confidential)

3. How would you assess the competitiveness within the health insurance market?

Part 2: Questions about mobile health applications

5. Does your company offer one or more health-related apps? If no: Continue with question 7! Yes (continue with question 6!) / No 8 (continue with question 7!)

6. What kind of mobile health application does your company offer? Please describe shortly!

7. Does your company plan to offer a mobile health application in the future? If not: why not? Yes / No, why not? _____

8. In which category would you classify the mobile health applications that your organization employs or plans to employ? Health and Fitness Logbook Health and

Fitness Community Informative Health App Reminder Other (please name) _____

Part 3: Cost reduction

9. How do you assess the potential of health-related mobile apps to assist in the early detection of diseases? Very low / low / average / high / very high

10. How do you assess the potential of health-related mobile apps to support treatment of diseases? Very low / low / average / high / very high

11. How do you assess the potential of health-related mobile apps to prevent diseases, especially widespread diseases such as obesity and diabetes? Very low / low / average / high / very high

12. How do you assess the relationship between preventative check-ups and early detection of diseases? Very low / low / average / high / very high

13. How do you assess the motivational potential of health-related mobile apps to follow a healthier lifestyle? Very low / low / average / high / very high

14. How do you assess the potential of health-related apps in reducing administrative costs through possible digital business processes? Very low / low / average / high / very high

Part 4: Customer retention

15. How do you assess the impact of health-related mobile apps on customer retention? Very low / low / average / high / very high

16. How do you assess the influence of health-related mobile apps on the ability to influence customer relations? Very low / low / average / high / very high

17. How do you assess the ability to detect underlying health related trends in big data sets? Very low / low / average / high / very high

18. If your company offers a health-related mobile app, how would you assess the impact of that app on customer retention? Very low / low / average / high / very high

19. How do you assess the impact of customer benefit established though health-related mobile apps on customer retention? Very low / low / average / high / very high

Part 5: Customer acquisition

20. How do you assess the impact of customer knowledge on providing targeted offers to customers? Very low / low / average / high / very high

21. How do you assess the impact of health-related mobile apps to offer more targeted options to customers? Very low / low / average / high / very high

22. How do you assess the influence of health-related mobile apps on building deeper and longer lasting customer relationships? Very low / low / average / high / very high

23. How do you assess the interest of customers to use health-related mobile apps from health insurance companies? Very low / low / average / high / very high

Part 6:

24. Do you have additional comments or remarks concerning this study?

Appendix C - List of participating health insurance companies (in alphabetical order)

Name of the insurance company	Providing private or government aided health insurance	Position of respondent(s) within their company
Apollo Munich Insurance Co Ltd	Private	Head of division strategic marketing; Assistant marketing and communication
Aviva Life Insurance	Private	Marketing Assistant; Social Media and Marketing
Bajaj Allianz General Insurance Co Ltd	Private	Division manager online marketing
Bajaj Allianz Life Insurance Co Ltd	Private	Online marketing assistant
Bharti Axa General Insurance Co. Ltd.	Private	Organizational Development
Bharti AXA Life Insurance Co Ltd	Private	Specialist
Cholamandlam MS General Insurance Co. Ltd	Private	Head of marketing
Future Generali India Insurance Co.Ltd.	Private	Executive board advisor Marketing and Communications
HDFC Ergo Genral Insurance Co Ltd	Private	Marketing Assistant; Member of the executive board
HDFC Standard Life Insurance Company Ltd.	Private	Head of marketing

ICICI Lombard General Insurance Co. Ltd.	Private	Chief executive officer
ICICI Prudential Life Insurance Co. Ltd.	Private	Member of the executive board
IFFCO Tokio General Insurance Co. Ltd	Private	Head of organization and IT department
Life Insurance Corporation of India	Government aided	Social media manager; Group leader
Max Life Insurance Co. Ltd.	Private	Member of the executive board
MetLife India Insurance Co. Ltd.	Private	Head of innovation and digitalization; Company and process organization
National Insurance Co Ltd	Private	Team leader sales management
Reliance General Insurance Co. Ltd.	Private	Head of management of electronic media
Royal Sundaram Insurance Co. Ltd.	Private	Member of the executive board; Marketing abstractor
SBI Life Insurance Co. Ltd	Government aided	Head of performance and health management
Star Health and Allied Insurance Co. Ltd.	Private	Head of marketing, communications and sales department
Tata AIG General Insurance Co Ltd	Private	Division manager customer service and sales
TATA AIA Life Insurance Co. Ltd.	Private	Data processing administrator
The New India Assurance Co. Ltd.	Private	Senior project manager
The Oriental Insurance Co. Ltd.	Private	Marketing and sales assistant

United India Insurance Co. Ltd	Government aided	Unit manager
Universal Sompo General Insurance Co. Ltd.	Private	Group leader online marketing, communication and technology