Julius Francis Gomes

Futures business models of an Internet of Things (IoT) enabled Healthcare sector

Master’s Thesis
Department of Management & International Business
Autumn 2015
Abstract

This research is a qualitative case study analyzing probable business models for the future Internet of Things (IoT) enabled healthcare sector. To look at the future, this study utilizes the prominent futures research method, Causal Layered Analysis (CLA). This study combines business model and CLA to test the applicability of business model as a potential futures business research tool. In doing so, this study chose to understand the futures of a tech aided social context; the IoT enabled healthcare sector.

This thesis offers extensive theoretical understanding on business models, Internet of Things, mHealth, eHealth, futures studies and Causal Layered Analysis (CLA). Grounded literature review has enabled the author to collect a high quality dataset. Based on five individual interviews with seasoned campaigners from the IoT/healthcare industry, author developed three linear futures scenario; they are: the ploughed field scenario (short-term future), the breaking dawn scenario (medium-term future) and the ant super-colony scenario (long-term future). Each of the scenario is created with a CLA framework presenting the four layers: litany, social causes, worldview and myth.

Analyzing the scenarios author provides a detailed discussion on different business model elements for the IoT enabled healthcare sector in Finland. This discussion also presents several business opportunities for the futures market. Additionally, this study uncovers several social and global trends that are impacting the sector considerably. Success of this sector can foster significantly if policy makers consider these social and global issues in strategy development for the society.

This research presents three different sets of business model elements for different time frames in the future. Additionally, author presents a simple conceptual framework for the business ecosystem for the IoT enabled healthcare sector in Finland.

Important notion about this research, it is the first attempt to combine business models with a futures research methodology to speculate an industry’s future. All in all, with solid theoretical base, high quality & a smart quantity of empirical dataset, well-argued results and maintained ethical standards, this study offers a comprehensive description of the studied topic.

Keywords
Business Models, CLA, eHealth, futures studies, foresight, IoT, mHealth.
Table of Contents

1. Introduction .................................................................................................................. 6
  1.1 Research objective and research questions ......................................................... 6
  1.2 Structure .............................................................................................................. 8

2. The IoT (Internet of Things) enabled healthcare ................................................... 14
  2.1 Internet of Things (IoT) .................................................................................. 14
  2.2 Healthcare as a sector ...................................................................................... 20
  2.3 IoT as the enabler in Healthcare .................................................................... 30

3. Business Model ......................................................................................................... 33
  3.1 Business Model origin ...................................................................................... 33
  3.2 Defining Business Model .................................................................................. 38
  3.3 Components of a Business Model .................................................................. 43
  3.4 Business Modelling tools ............................................................................... 47
  3.5 Business Model for IoT and Health Care sector ............................................. 53
  3.6 Towards “business models for the futures” .................................................... 58

4. Methodology ............................................................................................................. 60
  4.1 Causal Layered Analysis ................................................................................. 65
  4.2 Layers of CLA .................................................................................................. 66
  4.3 CLA Characteristics ....................................................................................... 68
  4.4 Why CLA for this study ............................................................................... 70

5. Research design ....................................................................................................... 73
  5.1 Research strategy ............................................................................................ 73
  5.2 Data collection and analysis method ............................................................... 75

6. Findings and data analysis ....................................................................................... 81
  6.1 Futures scenarios ............................................................................................ 81
    Short-term future: “The ploughed field” scenario ........................................... 81
    Medium-term future: “The breaking dawn” scenario .................................... 84
    Long-term future: “The Ant Super-colony” scenario .................................... 86
  6.2 Analysis of Business Model elements .............................................................. 88
    “What” elements ............................................................................................ 89
    “How” elements .......................................................................................... 94
    “Why” elements ......................................................................................... 102

7. Discussion and conclusions ................................................................................... 107
  7.1 Answering research questions ........................................................................ 107
    Response to the context specific research question ..................................... 107
    Response to the generic research question ............................................... 113
  7.2 Theoretical implications .................................................................................. 118
  7.3 Managerial implications .................................................................................. 121
  7.4 Reliability and validity of the study ............................................................... 123
  7.5 Limitations and suggestions for further research ........................................... 126

REFERENCES ............................................................................................................. 129

Appendices .................................................................................................................. 139
  Business Modeling Tools .................................................................................... 139
Tables

Table 1: Definitions of mHealth........................................................................................................26
Table 2: Evolution of the Business Model Concept........................................................................35
Table 3: The overarching Business Model Concept; BM as ideas, concepts and meta-models.........36
Table 4: Business model definitional variations ...............................................................................40
Table 5: Business model components and the frequency of appearing in different publications........45
Table 6: Connecting the 4C Model and the Service oriented architecture of IoT ...........................56
Table 7: Interviews conducted for the research................................................................................77
Table 8: Probable business models of an IoT enabled healthcare sector in Finland .....................109

Figures

Figure 1: Types of Future..................................................................................................................11
Figure 2: Four layerd SoA for IoT....................................................................................................17
Figure 3: Development of the business model concept.................................................................34
Figure 4: Knowledge funnel............................................................................................................42
Figure 5: Causal Layered Analysis .................................................................................................69
Figure 6: Probable ecosystem business model for the IoT enabled healthcare sector...............112
### Abbreviated terminologies:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM</td>
<td>Business Model</td>
</tr>
<tr>
<td>BMC</td>
<td>Business model canvas</td>
</tr>
<tr>
<td>BMW</td>
<td>Business model wheel</td>
</tr>
<tr>
<td>CLA</td>
<td>Causal Layered Analysis</td>
</tr>
<tr>
<td>EHR</td>
<td>Electronic health record</td>
</tr>
<tr>
<td>IoT</td>
<td>Internet of Things</td>
</tr>
<tr>
<td>SoA</td>
<td>Service Oriented Architecture</td>
</tr>
<tr>
<td>RFID</td>
<td>Radio Frequency Identification</td>
</tr>
<tr>
<td>NFC</td>
<td>Near field Communication</td>
</tr>
<tr>
<td>eHealth</td>
<td>Electronic Health</td>
</tr>
<tr>
<td>mHealth</td>
<td>Mobile Health</td>
</tr>
<tr>
<td>IPR</td>
<td>Intellectual property rights</td>
</tr>
</tbody>
</table>
1. Introduction

Since the introduction of Internet for public use in the early 1990s, the sphere of technology advancements has propelled extensively till today. Internet has evolved from “Internet of Computers” to “Internet of People” and now to be the “Internet of Things” (IoT) by enacting the possibilities of small “things” benefitting humankind with a whole new scale of usable information (Coetzee & Eksteen, 2011). With billions of connected devices, IoT promises to enhance decision making and data analysis to a level that was never achieved before. Healthcare is one major application sector of IoT identified by numerous researchers since the early stage of IoT innovations (Atzori, Iera & Morabito, 2010; Domingo, 2012; Xu, He & Li, 2014), where IoT eventually combines all three perspectives of Internet, computers, people and things, to solve different problems. Nevertheless, for longer sustainability from a business perspective, contribution of IoT in healthcare progress is still a matter of enquiry.

Mobile device assisted healthcare and medical applications are believed to create the next big advancement in the industry due to increasing usage of mobile technologies and mobile devices (not limited to mobile phones) in the recent years (Balandin, Balandina, Koucheryavy, Kramar & Medvedev 2013, Briggs, Adams, Fallakhhair, Iluyemi & Prytrench 2012). This trend is gaining momentum for a longer sustainability by the growing introduction of wearable, environmental or implanted medical IoT devices and solutions (Amendola, Lodato, Manzari, Occhiuzzi & Marrocco 2014). Massive adoption of mobile devices in modern societies makes it a potential way of intervention in many different ways. According to recent studies about the trends and facts within mHealth, business models are going to evolve and broaden (research2guidance 2013) as the mHealth industry has recently exited the trial phase and now entered the commercialization phase in the market (Research and Market 2013).

In regards to shift of one industry from one phase to the next, Charles Fine (1998) introduced the term clockspeed. Clockspeed refers to varied pace of each industry’s change in the life cycle of its own. The clockspeed of an individual sector is significantly driven by technological developments and advancements in the industry (Osterwalder 2004). The difficulty for modern organizations lies in understanding
what is happening in their operating environment and how to tackle the rapidly changing and increasingly uncertain business environment, both internal and external to the firm (Hayward 2004). These fast business environmental changes pose both dynamic opportunities and complex threats for organizations, making it tricky for them and for the industry at the same time to viably sustain for a longer period of time. Playing with the business model of the firm and developing it continuously can help the company in such turbulent situation (Wirtz, Schilke & Ullrich 2010).

Business modeling means the rationales behind organizations’ as well as industry’s capturing and creation of value for different stakeholders. Business modeling has risen to be a more and more important factor for companies especially to gain and secure competitive advantage (Johnson, Christensen & Kagermann 2008, Wirtz, Pistoia, Ullrich, & Göttel 2015). Additionally, scholars have shown growing interest for the concept in recent period too. A business model answers to the why, how, what and where questions to the business concept which is built on the business idea (Ahokangas, Juntunen & Myllykoski 2014). In recent period, different authors have analogized business models as a recipe (Baden-Fuller & Morgan 2010), architecture (Teece 2010) or a design (Smith, Binns & Tushman 2010). A design, architecture or a recipe at hand can help make the future more manageable in an uncertain reality.

Osterwalder (2004) points out five categories of functions of business models in practice; understanding & sharing, analyzing, managing, prospects (refers to the possible/probable futures) and patenting. Based on significant advancement in business model research, Ahokangas et al. (2015) argues that the next generation of business model research will focus on the future centrism of the concept. Building on futures thinking, this research perceives that organizations can foresight industrial future by using business models. Additionally, Richard Slaughter (1995), a noble futurist points out foresighting as a valuable tool to strengthen organizational armory in combating environmental turbulences through extending the focus to far future. Thus, this study will concentrate on Business Models and transformation of business models as the core concept which will be used as a tool to explore and analyze the probable futures of an IoT enabled healthcare sector by creating a conceptual space of the context. In doing so, the concept of business models will be combined with a prominent foresight or futures research methodology.
Scientific foresight or futures research helps researchers to look at the far future of a specified problem by discovering possible, plausible, probable and preferable futures (Voros 2012). Futures thinking from a general perspective has always been present among human societies even without being a scientific practice (Masini 2006). Scientific foresight or foresight as it is generally referred in the literature, enables researchers to eliminate illogical assumptions to look at the future while being creative (Kuusi, Cuhls, & Steinmuller 2015). This research employs one of the most widely used foresight technique titled as Causal Layered Analysis, CLA (Inayatullah 1996). CLA involves integrating empiricist, interpretive, critical and action learning modes of knowing to unleash the future (Inayatullah, 2004). Unlike other foresight/futures methodologies, CLA involves less of predicting the future rather it focuses on creating transformative conceptual spaces to create preferable and alternative futures. CLA is usually applied to go into the deeper future as one of its specialty and longer-term policy change feature (Inayatullah, 1998).

From a general perspective, any progressive industry or sector transforms hugely over time, for some industry that time frame is long and for some the time frame is shorter. This study will try to picture how the IoT enabled healthcare sector will evolve over relatively longer period of time, e.g. the next 5 years, 10 years and 15 years. This research offers three different linear progressive futures scenarios for the short-term future (5 years), the medium-term future (10 years) and the long-term future (15 years). Despite presenting the scenarios, this study does not intend predicting the exact future, rather it is an attempt to locate a conceptual and temporal space within the context where the phenomenon of business model will be played with. This study also considers the present situation of the industry and the recent past period to gain a better idea about the possible transformation and progression.

1.1 Research objective and research questions

IoT promises to enhance decision making and data analysis to a level that was never achieved before with billions of connected devices under a broader umbrella. Healthcare is one of the major application sectors of IoT identified by numerous researchers since the early stage of IoT inventions (Atzori et. al 2010). IoT interventions are supposedly to take place in the face of sensing, tracking, identification, data analysis, data exchange, etc. in healthcare (Fernandez & Pallis
2014, Atzori et al. 2010). However, as already mentioned earlier, for longer sustainability from a business perspective, contribution of IoT in healthcare progress is still a matter of enquiry.

Research endeavors explicitly claim the huge potential of IoT in healthcare, yet only a handful of studies consider the business perspective of the coupled phenomenon. This study from a different perspective with an eye in future will attempt to picture how this healthcare IoTs are going to flourish. The financial perspective will be considered in the study both for private sector and public sector since a lot of healthcare apps and services are being offered recently from the private sector, while the major healthcare operations are still maintained by public bodies.

Business model has been one of the major talking points within business research arena for about more than two decades now about different industries and technologies (Timmers 1998, Amit & Zott 2001, Johnson et. al 2008, Wirtz et. al 2015). There are few studies about how business model for IoT can be designed and there are few for the healthcare as a sector. There are very few studies also focusing on business models for healthcare IoT services (Liu & Jia, 2010, Whitmore, Agarwal & Xu 2014). This study will contribute to that area by studying the phenomenon with a futures research tool, CLA. With CLA, we are able to understand and speculate far and deeper future of a discourse in order to better prepare the industry.

With qualitative analysis of the conceptual space created for the contextual setting of this study, it will provide results that in managerial aspect can help industry players to strategize in a way to achieve the pictured future in this study or design a strategy to avoid that and reach an alternative preferred future. For academic contribution from a business research perspective, this study uses business model as a tool to uncover the future of IoT enabled healthcare sector. So far in the literature, the effort of using business model in such a way has not been employed yet. I tend to display a possible way to utilize the business model concept as a futures tool. Due to the novelty of the study, it can be considered as the harbinger of developing a futures business research technique. The approach and results of this study is supposed to represent the usability of business model in such way and display its potential in future uncovering. It will be a step towards a standardized futures business research methodology.
To achieve both managerial and theoretical objectives of this study, I have structured two research questions. A generic research question is designed which will answer on a general level and have theoretical contribution. The answer to this research question less regards the contextual facts, rather focuses on how business model helps constructing a futures conceptual space.

Generic RQ: How could business models be utilized in futures business research?

The second research question of this study is more specific to the IoT/healthcare context. Answer to this question has empirical and managerial implications. Since the intention has already been clarified to understand the futures of IoT enabled healthcare sector using business models, the following research question will be used in answering that:

Specific RQ: How could the Business Models of an IoT enabled healthcare sector probably evolve in the future?

Since healthcare sector is very important for human well-being, further research is needed in this ground to make the future more predictable and manageable. This study contributes by creating a conceptual and temporal space about the industry by foresighting futures business model. The presented research questions will help find the answers in a structured way.

One significant aspect of the context specific research question is the use of the word “probably”. In the literature of foresighting/ futures studies, future is seen as a journey from present towards future in a funnel/ cone form. Future consists of mainly four concepts, they are; possible, plausible, probable and preferable futures (Voros 2012). The range of possible and plausible futures are too wide and sometimes vague for managerial implications, on the other hand preferable futures are case specific and managers decide which factors they prefer or not.
1.2 Structure

The structure of this text is planned in a way to maintain an easy flow between the contents of the thesis. As the research involves studying four (business model, internet of things, healthcare and causal layered analysis) different aspects, it is supposed to be a literature intensive output. Thus the intention has been to use the most relevant research papers as sources.

Business models, as the core concept from literature of business research, it will be discussed through an extensive review. For contextual setting, both IoT and healthcare will be briefed from the literature having less inclusion of technical details as this study focuses more on the business side. The research methodology used in this study, Causal Layered Analysis, has rarely been used in core business application so far. Furthermore, as a research methodology it is quite complex. For better clarification a thorough review of it will also be provided.

Due to the extensive literature inclusion, the approach for writing will be easy and simple; attempt to maintain connection between each chapter in a way is made that it will help readers with a recap of the previous parts. In doing so, after introduction of
the study in a comprehensive manner, next thing that will be opened up is the context settings of the study, namely IoT and healthcare. There will be one subchapter within the chapter of contextual framework focusing only on Internet of Things, one subchapter will focus on the healthcare sector and a final subchapter will discuss the inclusion of IoT in healthcare sector or an IoT enabled Healthcare sector.

Once the contextual framework is ready, the next chapter deals with the conceptual framework, where the contextual framework will be brought in discussion in the light of the main theoretical concept of this thesis, Business Models. The first subchapter will generally discuss business models and evolution of business models. This chapter contains a chronological historical representation of business models, how it evolved in literature and in practice over period. This part of the theory is presented to support answering the generic research question. A detailed note on how business model is perceived and defined is also presented, which also shows the existing definitional debate. For new readers to business models, some prominent business modeling tools are also introduced. In this chapter, brief about business models in healthcare and business models in IoT will also be presented. Finally, the chapter summarizes with the vision towards “business models for the futures”.

As the objective of this study is to find out the makeover of business models in the IoT enabled Healthcare sector over time, it involves the taste of futures study, ergo foresighting. The chapter for opening up the methodology of this research will discuss the art of foresight as a research tool and the science of futures studies. It also discusses the specific tool that is used to conduct the study as research method. In one subchapter basic introduction of Causal Layered Analysis (CLA) will be done and in another subchapter how CLA can facilitate this research will be discussed.

With the overall theoretical construct been built, the empirical part of the study will be presented. How the data is collected and analyzed will be discussed in one subchapter. The research strategy and justification will be discussed to clarify the reasoning to readers. This part will also discuss how CLA is used in practice in the study as a futures research methodology.

In the next part of the thesis, three linear progressive future scenarios are presented with the layers of CLA been explained for short-term future, medium-term future and
long-term future. These scenarios are created solely based on the empirical evidence of the study. Based on the scenarios, author next presents a detailed analytical discussion on different business model elements that are key to the success of the sector.

To conclude the thesis, author presents detailed response to the research questions of the study. This section also presents theoretical and managerial implications of the study. Author also argues to prove the reliability and validity of the research grounded on traditional scientific practices. Finally, this chapter discusses few limitations and possible further research avenues.
2. The IoT (Internet of Things) enabled healthcare

Sustainable global development is the unanimous purpose of modern societies, while health challenges pose perhaps the most significant obstacle in that goal (Akter & Ray 2010). In this chapter, I open up the contextual setting for this study. First, a brief discussion about the technological aspect will be presented; how IoT is perceived in theory and what specifics are actually categorized under the title IoT. Next I will present a brief introduction about the healthcare sector; how it has advanced towards a more tech dependent sector from a human managed sector.

We are living in the age of digitalization where the proliferation of electronic gadgets and smart devices are increasing every day (Coetzee & Eksteen 2011). This has always been a forward moving trend since the inception of Internet. With the help of Internet, now we are entering in an era where devices are being connected together to communicate and exchange information automatically for different purposes. Internet of Things (IoT) has the potentiality of connecting billions of smart devices and make the decision making process better informed and increase the accuracy significantly.

Healthcare sector answers to one of the basic needs of mankind and the concern has been addressed to the best of abilities. Previously the sector was advancing more in knowledge about diseases and medications. However, in the last couple of decades digitalization has taken considerable involvement in this sector’s advancement. In one of the earlier studies, McMichael & Beaglehole (2000) pointed out that the future prospects of healthcare will depend on the process of globalization and the care delivery pattern will shift from how it used to be. Their early comment also included the role of economic growth and dissemination & utilization of technologies in the advancement of healthcare sector. In the following paragraphs the concept of electronic health (eHealth) and mobile health (mHealth) will be discussed to clarify the basic understanding for general readers. But, first, a conceptual description of IoT is presented before discussing healthcare as a sector.

2.1 Internet of Things (IoT)

One of the most significant inventions of the modern world, Internet, is a reality now which is available for public use for about 25 years. One of the most significant aspects
of Internet has been the varied perspectives of its utilization (Coetzee & Eksteen 2011). New applications and technologies dependent on the Internet is surfacing every day. Once, Internet was used only for conveying message from one end to another using computers. Then it enabled the online social network paradigm where Internet’s major use is to connect people through interactions and not only computers. Now, again, the use of Internet is again shifting from only connecting people and computers towards connecting “things” and “objects”, titled quite fancily as the Internet of Things.

**Defining the jargon**

The concept of direct machine to machine communication is not new (Whitmore, Agarwal & Xu 2014), but the idea in Internet of Things (IoT) is different and more holistic. Van Kraneburg (2008) defined the phenomenon as “a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual ‘Things’ have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network”. Similarly, but more simply, Coetzee & Eksteen (2011) defined the jargon as, “a vision where objects become part of the Internet: where every object is uniquely identified, and accessible to the network, its position and status known, where services and intelligence are added to this expanded Internet, fusing the digital and physical world, ultimately impacting on our professional, personal and social environments”. As a matter of fact, there are numbers of definitions in the literature which carries deviated meanings to some extent (Atzori, Iera & Morabito 2010). However, IoT, since the inception about 10 years prior to now, have only gained width and depth as a concept. It might not be the best idea to narrow the concept too much at this point (Stankovic 2014), since the proliferation of this technology has been successful so far.

Atzori et. al (2010) points out why mainly the concept seems confusing and they proposed a graphical presentation of how IoT is constructed. According to them, there are instances when researchers have defined IoT from either an Internet oriented perspective or a Things oriented perspective. Unfortunately neither of these provide a full picture of the phenomenon. Atzori et. al argues both perspectives need to be in conjunction and also need to include the semantic orientation to the discussion. Semantic orientation includes technologies which uniquely address every involved
things and executes the communication between nodes. Atzori et. al stresses that the IoT paradigm is a result of the convergence of these three main visions; Internet, Things and Semantics.

**The “Things” of IoT**

One of the major confusions about IoT lies in understanding what the “things” are. Coetzee & Eksteen (2011) marks that the definition of “things” in IoT is enormously wide, which includes a variety of physical elements. The list includes personal gadgets that we carry with us all day, like: smartphone, tablet, smart watch and digital cameras. According to the authors, elements in our environment will also be added to this list be it at home, car, office or restaurants. To be defined as a “thing” that can be connected to the internet needs a way to be bridged to the connection. Objects with Radio Frequency Identification (RFID) tags, other types of wireless sensors are so far the biggest foundation of things in IoT.

Objects having smart capability of gathering data and producing information from that already demonstrate interesting opportunities (Kortuem et. al 2010) for data mining and analysis. However, smart things’ true power can only be harnessed if the capabilities of millions are coupled together for a purpose. As envisioned in the IoT literature, billions of things are going to be connected, each one providing data and many of them with the ability to act and influence the environment (Coetzee & Eksteen 2011). If that enormous amount of data can be managed and processed intelligently through smart solutions, it will enhance decision making to greater extent.

**Architecture behind IoT**

Xu, He & Li (2014) discussed a simplified service oriented architecture (SoA) for IoT in their recent publication on this topic. Service oriented architecture (SoA) means an infrastructural architecture which focuses more on providing services than networking. They proposed this SoA for IoT because of its demand to integrate heterogeneous systems and devices. The framework itself has four different layers. Figure 2 presents a summary of their presentation.
This four layered architecture of IoT makes the effort to conceptualize how it works very simple. In the first layer of sensing, there is usually physical hardware for data collection. Since IoT is considered to network numerous connected devices, in this layer those devices sense and collect relevant data. During the first days of IoT, only RFID tags were considered as the sensing source (Xu et al. 2014). But ever since then, researchers have thrived to widen the scope and generalize its scope for a more comprehensive technology. Nowadays more and more sensors and actuators are being placed in this sensing layer. In the sensing layer, the smart sensors with tags are now able to automatically sense and exchange information among different devices.

In the second layer, network layer, the role of connecting all the “things” together is done. This network layer is also capable of aggregating information from existing IT infrastructures. This is a vital part of the IoT architecture due to the fact that a network is assumed to be enormous and reliability of the solution needs to be sustainable. The network structure needs to be designed in a way which will address issues like energy efficiency, service discovery and retrieval, data & signal processing, security, and privacy besides the ability to manage a huge and heterogeneous network.

Service layer mostly relies on the middleware technologies which actually provides solutions that an application promises to deliver. Middleware technologies provide the IoT infrastructure with a cost-effective platform, by reusing hardware and software platforms together. A well designed service layer is expected to identify common application requirements and provide APIs and protocols to support required services, application, and user needs. Xu et al. marks four distinct components of this layer; they are service discovery, service composition, trustworthiness management and service APIs.

The final layer is named as the interface layer. As the title suggests, it deals with the face of the application at the user end. The point is, there might be several applications
from different organizations which retrieves data from the same database. When designing applications or programs, these entities need to make sure that their design maintains the standard in retrieving the data. It is not possible to access the same database with various platforms if there is no standard access protocol. Interface layer deals with such issues to provide highest accessibility and ease of use at the same time.

These four layers together make a meaningful architecture of how the overall technology works and provide usable results. The service oriented IoT allows every component to offer its functionality as standard services, which eventually will help improve efficiency of both devices and networks significantly.

**Applications of IoT**

Atzori *et. al* (2010) presented different applications of IoT encompassing a wide range of applications that is mentioned in many other studies as well. They segregated the applications of IoT in four major domains:

- Transportation and logistics
- Smart Environment
- Personal and social domain
- Healthcare sector

Advanced transportation mediums are increasingly getting more and more instrumented with sensors, actuators, bar codes and other technologies. These advances enable this sector to benefit from IoT as well. Real time information processing technology built on RFID and NFC (near field communication) can enhance better monitoring of elements in the supply chain. IoT can also help in assisted driving, mobile ticketing, monitoring environmental parameters while transporting degradable (perishable) materials and introducing augmented maps.

One of the success stories of IoT in the transportation industry is Uber, www.uber.com. Uber presents a technology based on a mobile app and a collaborative network which has disrupted the taxi industries in more than 50 countries. With Uber, anyone can become a taxi driver and anyone can call for a taxi using the system at any time. There are benefits of hassle-free payment, fare splitting and a cashless payment even without
punching a card. Uber also promises at its website to employ 1,000,000 women throughout the globe by 2020. In 2014, the company was valued at an eye-popping 18.2 billion US dollars at the age of only 3 (Trewin 2014).

Smart environments are defined as indoor locations with smart devices enabled with sensors and actuators. Sensors and actuators distributed in houses and offices are already making its impact in reducing power consumption by managing electric lights in many places. Smart solutions can also enhance the alarm systems for indoor locations. In industrial locations, there are massive utilization of RFID tags associated in the production process. RFID tags also help production robots realize arrival of ready parts for further processing.

Applications of IoT in the personal and social domain are those that enable users to interact with other people to build and maintain social relationship (Atzori et. al 2010). There are applications like automatic update about specific social statuses of a person in online social networks. Mobile applications like Endomondo sports tracker are also capable of posting about people’s workout activities automatically. In the social domain, preventing losses and theft has turned to be a very practical application of IoT in the recent years.

For the healthcare sector there is huge potential for IoT’s successful application according to Atzori et. al (2010). They grouped the applications in four major types; they are: tracking, identification & authentication, data collection and sensing. Further detail about applications of IoT in healthcare will be presented in a following subchapter.

All in all, as an emerging technology, IoT has definite potential for the future. All we have seen so far is just the tip of an iceberg, as they are just the early stage of a technology that is yet to mature completely (Stankovic 2014). With billions of devices connected to a single network generating information for problem solving, it promises of a world making more well informed and smart decisions. There will be challenges, but with proper research efforts those can be averted for better.
2.2 Healthcare as a sector

The stride towards a sustainable healthcare system is one of the core concerns of every government in the world. Currently the western world is undergoing remarkable changes (Länsisalmi, Kivimäki, Aalto & Ruoranen 2014). This nonstop changes and advancement requires the healthcare organizations’ ability to stay up to date where medical information, technologies and organizational relationships are in flux all the time (Cohen et al. 2003). McMichael & Beaglehole (2000) argues in their work that the better future of the sector lies in blending it well enough with the process of globalization. According to them, healthcare advancements in the western world resulted from broad based changes in the social, dietary and material environment during the last two centuries. On the other hand, in the developing countries, healthcare advancements have begun very recently with increase in literacy, family spacing, improved transfer of knowledge about health and safety. Public healthcare is deemed to have improved by using the broad view of sustainability of population health. In the western world, healthcare is mostly governed by state parties. On the contrary, in most of the developing countries huge portion of the healthcare sector is managed by private authorities and mostly insurance based.

The idea of globalization in healthcare provides us with the lens to look at the future in two ways. First, the economic globalization helps building better healthcare systems and infrastructures globally for a better mankind. Secondly, technological globalization helps spreading technological advancements in the sector globally in order to secure societies through innovations; such technologies can include computerized machines to cloud solutions. But the problem with globalization so far has been that it has helped making the wealth dispersion bigger and bigger instead of solving the issue (McMichael & Beaglehole 2000). However, recent technological sharing and mobile apps for healthcare has made the situation better, as the scenario of low expense technology sharing has been higher than ever.

Länsisälmi et al. (2014) in their study focused on innovations in healthcare analyzed 31 papers and concluded with the need for generating, adopting, and diffusing service, practice and technology innovations in the sector as urgent. They consider the retiring workforce, increasing number of elderly patients and cost-efficiency as major challenges for the sector coupled with expectation of high quality care. Innovations in
general is defined by Länsisälmi et al. (2014) as the intentional introduction and application within a role, group, or organization, of ideas, processes, products or procedures, new to relevant unit of adoption, designed to significantly benefit the individual, the group, or wider society. To be specific, innovation in healthcare does not solely include innovations that are focused towards treating patients, rather innovations that make the system performing smoothly, improves work environment for healthcare professionals, data management tools, training tools, surgery assistance, alarm systems and such issues which can be categorized similarly. Goyen & Debatin (2009) defines “medical technology” as the procedures, equipment, and processes by which medical care is delivered.

The list of healthcare innovations is long and it keeps getting longer for the betterment of mankind, but the width of types of innovation has evolved and increased in recent years. In this study, innovation in healthcare is considered with such broad view. And as the foci of the study lies in IoT, thus the intervention of IoT solutions in such broad manner will be considered as a subject matter. In a similar way, this study considers the importance of management and dissemination of personal health data. There have been research efforts to understand how the field of health record management will become a key element in the future. Sittig (2002) & Iakovidis (1998) realizes the central aggregation of personal health data can be used as information to enhance services in the sector.

Since this work is conducted to understand the business applicability of healthcare innovations, financial aspect of the sector is considered quite importantly. Goyen & Debatin (2009) states that the major challenges in the sector continuously requires more technological innovations which results in higher cost. Almost all the countries in the world allocate substantial financial resources for this sector (Chowdhury & Khosla 2007), which in some cases seem insufficient. From Goyen & Debatin’s (2009) point of view there are some innovations which has taken place in return of huge expense but the value has not always been delivered up to expectations. Healthcare innovation is highly expensive as there is practically no room for error while trialing. They also mention that medical technology is one of the dominant driver of healthcare cost increase and hence the insurance premium goes up. Healthcare policy makers have been trying to contain the huge cost, but virtually all of the efforts resulted as failure.
Cost-efficiency has been a very important concern while policy makers think about future advances in healthcare. Goyen & Debatin (2009) shows there have been some technologies that have reduced the cost in short-term but in longer-term the results are again on the negative aisle. Innovations take place due to continuous effort of scientists, but the cost-efficiency issues sustain because of the inability to take over previous technologies which results somewhat similar with significant lower cost in the real market. This issue withstands because the healthcare market is usually governed by governments, and governmental bodies cannot just call an operating system outdated just because a newer and more expensive solution has arrived.

Healthcare in the modern era is no more just like it used to be before, but more like a connected system of health technologies, applications and services for public health (Ahokangas, Perälä-Heape & Jämsä 2015). Ahokangas et al. (2015a) presents 16 alternative futures scenario for individualized connected health. They mark that connected health solutions have attracted remarkable attention from health professionals; however that does not necessarily make it obvious that all of the implemented technologies will succeed. There are numerous obstacles in implementation and wider adoption. Despite the challenges and obstacles, Ahokangas et al. (2015a) refers to Atkins & Cullen (2013) which provides us with some trends of connected health. Their projections state that connected health will be the central part in the care delivery system as patients will be able to control their own data and who can access that. They argue that the ownership of healthcare data will lie with patients instead of clinicians. More data will be used as aggregated collection and dissemination of data will be more customizable. This study considers data collection and dissemination improvements as one of the major scope.

In the following sub-chapters I will discuss the involvement of electronic technologies, internet and mobile technologies in healthcare advancements. eHealth has been a lively title in the discussion for quite long time now which is supposed to make the patients’ life easier through self-service technologies. Following that, I present the core portion of healthcare where IoT is supposed to make the highest amount of interventions, mobile healthcare.


**Electronic Health**

Since the birth of Internet, a lot of “e”-terms started to appear in the media and in the literature as well (Oh, Rizo, Enkin & Jadad 2005). Such terms include email, e-commerce and also eHealth. As a terminology, eHealth promised in its early days to solve health and healthcare related issues by the use of information and communication technologies. It has not only stayed as promise since the term was coined as early as in 2000 (Pagliari et al. 2005), but the importance of Internet as the source of health related information has increased significantly (Kummervold et al. 2008). Kummervold et al. states that the use of internet for health related queries is increasing in all age groups and for both genders, with especially high growth among young women in their study. Understanding this growing interest in Internet search and usage is quite vital, because it might provide with an opportunity to a better informed patient cluster and more interactive Internet based communication system.

Some think eHealth is a fancy term that is being used for a few years without enough impact evidence, but research efforts do not support that speculation. E-Health, eHealth and electronic health has been used interchangeably, since the introduction of the term. For better understanding and justification of the jargon’s existence for so long Oh et al. (2005) conducted a definitional survey to see how is it conceptualized in the scientific world. In their study they included 51 unique definitions and found two universal themes which were present in each of the definitions; health and technology. Health was an obvious element of all the definitions, but technology came in different faces. 27 out of the 51 definitions explicitly mentioned Internet. The presence of health and technology was apparent, but what they found more was six additional themes which appeared quite frequently in the definition of eHealth. They are: commerce, activities, stakeholders, outcomes, place and perspectives. Few interesting definitions Oh et al. cited included notions like “health care’s component of business over the Internet”, the “application of ecommerce to health care and pharmaceuticals” or as “new business models using technology” in healthcare.

Most of the definitions focus how care is being delivered, however some of them focus on the expected outcomes. Also, while some authors define eHealth by focusing explicitly on health professionals and patients, most other looks into the applications for all stakeholder groups (Pagliari et al. 2005). All in all, existing definitions together
reflect the idea of improving cost effectiveness of healthcare and making the process more efficient at the same time. Available definitions of eHealth makes it evident that the field has not evolved to take over conventional healthcare, rather assist it and take it further ahead through cohesive performance. Oh et al. considers eHealth as a consumer centered model of health where stakeholders collaborate. For this study, I will consider the extended definition offered by Pagliari et al. (2005), which is an extension to the previous work of Eysenbach.

“eHealth is an emerging field of medical informatics, referring to the organization and delivery of health services and information using the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a new way of working, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology.” (Pagliari et al. 2005; 12).

Understanding what the terminology means helps us appreciate the practical happenings of the industrial context. Since its inception it has attracted quite significant attention, but it is yet to make the massive boom in practice. In the literature eHealth has been alive for about 15 years now and similarly aged in practice too. But two major concepts for success in eHealth implementation are eHealth literacy and readiness which explains why some of the previous efforts went in vein.

Norman & Skinner (2006) argues eHealth tools and services provide little or no value, if the targeted users lack the skills to efficiently utilize them. Despite the major population of the western world is more than capable of browsing the Internet, they lack the skill to best utilize an eHealth platforms. Conventional literacy and eHealth literacy is not the same thing. Norman & Skinner proposed a six-petal lily model for eHealth literacy consisting six different types of literacy; traditional literacy, information literacy, health literacy, computer literacy and scientific literacy. According to the authors these six kinds together provide users the best ability to utilize eHealth. With the existing skill gap of population, it is difficult to realize the potential of eHealth in improving public health. eHealth literacy is defined as the ability to seek, find, understand and appraise health information from electronic sources and apply the knowledge gained to address or solve a health problem (Norman & Skinner 2006; 3).
Very closely tied to the concept of eHealth literacy is public readiness towards eHealth. Lanseng & Andreassen (2007) stresses the need of self-service technologies in healthcare as conventional healthcare in most countries are highly expensive. In their study, they understand self-service technologies are the key to reduce expense in the sector on a longer-term, but the biggest challenge is the acceptability of those technologies. Public readiness generally refers to people’s tendency to accept and embrace new technologies for achieving goals in work and daily life. When designing and implementing a new technology, private sector organizations can play a more independent role than a government body while thinking readiness (Lanseng & Andreassen 2007). This is because private sector companies can target and differentiate in the market as they would like, but the government managed bodies are supposed to serve the whole population. They conclude their findings with three major findings; expected usefulness of a service, ease of use and trust of the service provider. Their argument states, if one service regardless of whether it is privately governed or not, does it promise useful outputs that has real impact, has an easy layout to work with and coupled with a trusted brand of a service provider is more likely to shine.

eHealth interventions take many faces. In one research Norman et al. (2007) studied eHealth interventions for physical activity and dietary behavior changes and noted the increased interest of people in internet based health services. In their study they discussed the changing preference of people from face-to-face and telephone calls for health issues to internet support as superior solution. As this data concerns only a niche location of the whole industry, it should not be considered as a representation of the total sector. But the 2009 American Recovery and Reinvestment Act, which includes a 34 billion US dollar allocation to incentivize health professionals to use the electronic health record in a meaningful manner (Catwell & Sheikh 2009) gives us a hint in which way the industry is heading. Catwell & Sheikh (2009) among many other academicians comments that eHealth interventions are likely to play the most substantial role in shaping up the healthcare sector in the 21st century.

Mobile Health

From the simplest perspective mobile health (mHealth) refers to those health interventions initiated by mobile technologies. To fight health development challenges, mobile communications is playing a transformational role by making
services more accessible, cost efficient and available (Akter & Ray 2010). Timely delivery and availability of vast information promises to help users make better informed and effective decisions in case of health issues. mHealth already demonstrated its effectiveness in resource poor regions according to Akter & Ray. In 2009 there were 51 mHealth programs operated only in the developing countries (Consulting, V.W. 2009) to validate that argument.

In the extensive healthcare literature, mHealth is a subset of eHealth using mobile platform for health services (Akter & Ray 2010). Similar notions were mentioned in the 2009 United Nations Foundation & Vodafone Foundation’s report (Consulting, V.W. 2009) as eHealth and mHealth are closely connected and can together bring improvement in global health scenario. In articulating the term different authors have used different viewpoints. Table 1 shows few popular definitions.

<table>
<thead>
<tr>
<th>Citation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Istepanian, Jovanov &amp; Zhang (2004)</td>
<td>mHealth refers to the emerging mobile communications and network technologies for healthcare.</td>
</tr>
<tr>
<td>Mechael (2009)</td>
<td>It is a subset of eHealth using mobile devices to deliver health services to the patients.</td>
</tr>
<tr>
<td>Akter, D'Ambra, &amp; Ray (2010)</td>
<td>It is a personalized and interactive service which provides ubiquitous and universal access to medical advice and information to any users at any time over mobile platform.</td>
</tr>
<tr>
<td>UN Foundation &amp; Vodafone Foundation (Consulting, V.W. 2009)</td>
<td>It is defined as using mobile communications- such as PDAs and mobile phones- for health services and information.</td>
</tr>
</tbody>
</table>

Table 1: Definitions of mHealth

Mobile communications technology brings easy accessibility, personalized solutions and location based services to the table for the health sector, which serves in a substantially cost-efficient way with wider coverage (Akter & Ray 2010). mHealth promises to help transform the whole industry with all these benefitting factors not only for patients, but as well for health professionals by building an effective and strong infrastructure.

Varieties of mHealth intervention have so far come by directly using existing mobile phone solutions. It includes voice, text, video, automated sensing and during the last few years only we have seen ample amount of smartphone applications. In understanding different types of mHealth interventions, it seems justified to
contemplate how mobile technology is defined. Adapting Riley et. al’s (2011) definition of mobile technology as computer devices that are intended to be always on and/or carried on the person throughout the day (i.e., during normal daily activities).

The increasing trend of individuals using more mobile devices for health issues is gaining momentum for a longer sustainability by the increasing introduction of wearable, environmental or implanted medical IoT devices and solutions (Amendola et. al 2014). Thus, despite most of the existing mHealth intervention researches are mobile phone focused so far, in this study I consider the wider sphere of using mobile phones, smartphones, wearable techs, smart watches and other mobile (easily portable) devices which can connect with other devices in order to communicate and exchange data.

Kahn, Yang & Kahn (2010) argues mHealth applications has vast opportunities in the developing countries, however that does not negate the opportunities of mHealth in the other parts of the world. In a 2012 statistical report on mHealth, Fox & Duggan (2012) asserted some inspiring numbers from the United States. According to that report, one third of all cell phone owners in the US used their phone to retrieve medical information. This figure was significantly low in 2010 with 17%. From 2010 to 2012, the number of people using phones to access health related information had almost doubled. About one in every ten person owning a cell phone claimed to receive health related text messages. According to this research, more than half of all smartphone users looked up for medical information in their cell phone. Their study also marked one-fifth of all the smartphone users in US had health apps in their phone. All these facts suggest a potential positive market for mHealth intervention.

Akter & Ray (2010) reports recent mHealth interventions were used to collect remote data, track disease & epidemic outbreak, support diagnostics and treatment, remote monitoring, education and awareness and communication & training. Balandin et. al (2013) provides us with another classification of mHealth intervention, which includes major usage of mobile apps for general healthcare and fitness, medical information, remote monitoring, collaboration & consultation and healthcare management for health professionals. Similar work from Handel (2011) includes a long list of smartphone applications which serves in many different purposes. Purposes consist of
nutrition/ weight loss, health conditions such as diabetes and heart health, fitness, meditation/ relaxation, yoga and addiction recovery support.

As for challenges of mHealth, there are few to be considered. Incorrect information, poorly designed mobile applications, poorly structured campaigns, ill-coordinated supply chain and loss of confidentiality were mentioned by Kahn et. al (2010) in their study. Nkoski & Mekuria (2010) raised one major issue with conventional mHealth solutions. They state that mobile devices face severe challenge in regards to delivering secure multimedia solutions having limited computational capacity. As a solution, they suggested the use of cloud solution to eradicate this issue and make the implementation more successful.

Nkoski & Mekuria (2010) simply defines “cloud” as the data center hardware and software that can solve secure multimedia computing with superior security to solve confidentiality issues as well. Cloud computing can be accessed anytime from anywhere in the world using Internet, which makes it a potential companion of mHealth. Despite cloud computing has its own challenges, still, it can help mobile devices perform as good as a PC providing superior computational capability (Nkoski & Mekuria 2010). In doing so, all computationally intensive operations can be offloaded to the cloud counterpart from mobile devices.

An earlier study by Ilias Iakovidis (1998) explains the idea of electronic health record (EHR), which is a reality now. EHR is defined as digitally stored health information about individual’s lifetime with the purpose of supporting continuity of care, education and research. There are standalone EHR systems and there are shared or collaborated EHR systems. Health information technology companies are designing personalized health records where users can text and update their facts (Atienza & Partick 2011). The process of updating EHRs can be converted to an automated mobile based system to update physical activity, vital symptoms and similar information.

Some studies have also discussed the utilization of IoT based technologies in healthcare recently. Amendola et. al (2014) discussed how RFID technology can help create an IoT enabled environment to support healthcare. Significantly cheap sensors offer the possibility to use them inside home, on clothes and with personal items to collect health related data to monitor in a private way. In another study Istepanian,
Hu, Philip & Sungoor (2011) presented an IoT based healthcare architecture to address non-invasive glucose level sensing for diabetes.

All of the above scenarios are very much possible in the future to take the industry forward. A recent statistical trend report from Research2Guidance (2013) highlighted ten major future trends for the mHealth sector. In constructing the report 324 opinion leaders from global companies and health related application developers were interviewed. These ten key mHealth trends are listed below as it is in Research2Guidance’s website.

“1. Smartphone user penetration will be the main driver for the mHealth uptake.
2. mHealth applications will be tailored specifically for smartphones or tablets.
3. mHealth applications will be native rather than web-based applications.
4. mHealth niche stores will become the home of the 2nd generation of mHealth apps.
5. Missing regulations are the main market barrier during the commercialization phase.
6. Buyers will continue to drive the market.
7. Applications will enter traditional health distribution channels.
8. mHealth market will grow mainly in countries with high Smartphone penetration and health expenditure.
9. 2nd generation mHealth applications will focus on chronic diseases.
10. mHealth business models will broaden.”

According to this report the first phase of trialing mHealth is over by now and mHealth has already entered the second phase of commercialization. In this phase mHealth is expected to commercialize its solutions with innovative business models. Finally, according to Balandin et al. (2013) mHealth is expected to enter the third phase of mass market when more than half of the smartphone using population will use mHealth technologies.
In the following subchapter a presentation of IoT application in healthcare will be presented. How IoT has so far helped the sector to advance and how more can it propel this advancement.

2.3 IoT as the enabler in Healthcare

Healthcare as an industry has fostered in the era of Internet with relatively cost efficient and smart solutions. However due to the fact that this study deems to understand the impact of IoT as an enabler in this sector, in this sub chapter this notion will be pictured with examples, applications and some challenges too. In the previous paragraphs basic understanding of how Internet and mobile technologies have so far played a role was presented, but the specific use of IoT is not clearly visible in all of those solutions.

The biggest advantage of health IoT solutions is perhaps the personalized solutions that can provide a universally accessible database for better healthcare maintenance (Xu et. al 2014). With billions of sensors accumulating a robust network of data collection and data sharing coupled with ubiquitous identification system, enables the sector with better monitoring, sensing, communicating and controlling abilities. Different types of healthcare information like logistics, diagnosis, recovery, therapy, meditation, management, finance and even daily activities can be collected through the IoT architecture (Xu et. al 2014, Domingo 2012). Fernandez & Pallis (2014) listed existing wearable devices including heart rate monitors, ECG monitors, glucose monitors, pulse oximeters and blood pressure monitors. Similar notion was shared by Atzori et. al (2010) earlier when they spoke of four major application scope of IoT in healthcare as tracking, identification & authentication, data collection and sensing. Fernandez & Pallis (2014) speculate about future micro and nano technologies which will offer to detect additional chemical signatures in breath and sweat to translate them into medical information.

In 2014 at “Slush”, the biggest business idea pitching event in Finland, one innovative product that claims to track emotional health of a person and suggest activities as remedies. “Mood Metric” (www.moodmetric.com) offers a wearable ring which is not only a health wearable but also can become an un-detachable part of one’s daily style. The product uses technology that senses vital readings from user’s skin and uses the data in interpreting emotional status. Based on the finding, they also suggest remedial
activities for mood enhancement. The company sell their product to be the technology that promotes happiness. Till date Mood Metric is using storage and computational capacity of individual mobile devices, but they are already developing the Internet based infrastructure to adapt to a real wide customer base.

Fernandez & Pallis (2014) classified the applications of IoT in healthcare in a different way. There classification includes segments as: home health services, hospital health services, consumer medical services, telehealth, personal emergency response system, health & fitness monitoring and wearable technologies. Classifications of healthcare technologies can take different faces, but the fact there is enormous potential of this technology for further flourishing using and enhancing the health big data analytics in this modern era of information dependency.

Pang et. al (2015) asserts the benefit of IoT for making the healthcare services and information being more end user centric than career centric as a part of accumulating different technologies under one umbrella. They additionally noted the huge business opportunity for private producers to the enormous consumer base in the sector. Despite their confidence for this context, authors marked couple of serious caution points for the future, which are at the same time challenges and opportunities.

First, they spoke of huge amount of healthcare software mobile applications that are easily available. According to them, the functionality and added values of them individually are still limited and there is potential of harvesting way more by combining the capabilities through a better holistic framework or platform (Pang et. al 2015). Secondly, there are IoT interventions in the scope of sensors and actuators to support software and applications through wireless connectivity in most cases. There are some sensors in most high end products like iPhone and iPad, but till date their medical capability lacks to provide an accurate measure for professional output. Similarly Fernandez & Pallis (2014) listed the challenges to be managed for the betterment of IoT implications in healthcare in managing the non-functional requirements. The list of non-functional requirements includes safety, security, availability, stability, resilience, usability, accessibility, scalability, modifiability, flexibility, interoperability, maintainability and extensibility. All points of this list can be perceived as potential opportunity if managed well but it might pose significant problems otherwise.
The inclusion of IoT to healthcare also enhances the goal of MyData in Finland, through which multiple types of health related data about individuals are being collected. MyData is defined as personal data over which individual has legal and practical control. Individual users can control the access of other parties to that data. MyData can be the next generation of electronic healthcare data. Accumulating all sorts of health related data in one central location and by individual access control; patients can allow only specific hospitals, clinics, therapists or doctors to retrieve relevant data from their repository. IoT interventions can easily enhance the way of personal data collection and dissemination in this scope.

The future seems to be bright for the healthcare sector enabled by IoT (Xu et. al 2014, Pang et. al 2015), but deeper analysis is required how things might turn out to be. This innovative data collection and derivation paradigm allows continuous medical data access from any connected device over the internet (Fernandez & Pallis 2014). In this chapter the concept of Internet of Things as an emerging disruptive technology is first discussed to lay the foundation of a technology oriented healthcare sector. Following to that the healthcare sector in general is introduced and the two modern wings, “eHealth” and “mHealth”, are presented along with examples of application. Finally, a summary subchapter discussed how IoT is perceived as an enabler for the future healthcare market. Further in this study, with this contextual understanding, the business model idea will be discussed in analyzing the possible future of an IoT enabled healthcare sector’s business models.
3. Business Model

In this chapter, the concept of Business Model as a phenomenon in the business literature will be exhibited. Business Model has been a very lively topic within the business literature since the 1990s; but rarely can we find a chronological historical discussion about the concept about how it evolved and from where it came into the limelight as it is today. It is justly argued in many scientific articles that the term business model was popularized during the 1990s and after the dot com boom especially (Amit & Zott 2001, Timmers 1998).

In this chapter a brief evolution of the terminology will be pictured while going through the definitional variety of Business Model. The idea is, Business Model as meta-models did not just came into literature out of nowhere but it had some preceding form within the literature perhaps with a different focus or extent or range of problem solving. In so doing, Business Model will also be compared with the concept of “Knowledge Funnel” by Roger Martin (2009) in order to clarify the basic of business model transformation and design thinking, which is very important in this volatile and highly competitive market.

From the literature, I will also present the different elements/ components of a business model in this chapter to assist creating the space for futures business models for the IoT enabled Healthcare sector. Business Models in different sectors and for different companies take different patterns in practice. In many circumstances they are case specific but very often quite significant in shaping the industry as a whole. This chapter will also include brief discussions about the business models in healthcare sector and how business models are being used for IoT solutions. Finally, this chapter will conclude with the understanding of how can we use Business Model as a tool to create the space for scientifically assuming the future in this context.

3.1 Business Model origin

Surveying the previous literature about business model research, it is evident that despite the term is being used quite too often, academics are yet to decide on an agreed understanding of the concept (Alt & Zimmerman 2001). Similarly Linder & Cantrell (2000) argues that there are many publications where the term has been used but with
varied meanings. This lack of understanding clarification or agreement about the concept poses potential source of continuous confusion and might hinder cumulative research effort on business models (Zott, Amit & Maasa 2011). Despite the term, business model, was first coined in the literature by Bellman & Clark in 1957, it gained popularity during the late 1990s (Amit & Zott 2001).

Prior to going into detailed literature representation of the definitional variation of business model, the chronological historical evolution of the terminology will be displayed first. B. W. Wirtz (2010) makes a nice assertion of this in his book “Business Model Management” where he presents the evolution of the concept to current state of the phenomenon.

For the first time in the literature “Business Model” was coined in 1957 by Bellmann & Clark without any specific use that was actually related to business. Since then the discussion about business model was a bit silent till 1975. Following 1975, business model again came in the literature and was being used quite frequently. In that early era the term was mostly used as a mean to system construction in tech industry mostly and especially for E-businesses until mid-1990s. During that period business model was more used to explain technical terms into business context but not business and organizational construction in detail for achieving greater sustainable performance. In this period, the business model literature was discussing the technological business Ideas and how they can be marketed on a superficial level. However, from 1995 the discussion started to revolve around the idea of company structure and how it should

![Figure 3: Development of the business model concept (adapted from Wirtz 2010:20)](attachment:image.png)
operate its business. This period actually started conceptualizing the terminology as a blueprint of organizations. Later in the early 2000s authors started to consider business model as an integrated portrayal of business and entrepreneurial activities. And the latest stems of business model research are considering the transformation of business models, action based business models and future oriented business model.

Similarly in another study by Osterwalder, Pigneur and Tucci (2005) have identified five (5) stages in the evolution of business model literature. Osterwalder et al. classified these phases by extensive literature review. Following table shows the summary of their classification.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Activity</th>
<th>Outcome</th>
<th>Key Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th</td>
<td>apply business model concept</td>
<td>applications &amp; conceptual tools</td>
<td></td>
</tr>
</tbody>
</table>

*Table 2: Evolution of the Business Model Concept (adapted from Osterwalder et. al 2005: 6)*

In this classification, Osterwalder et. al states that during the first phase of the evolution, authors were only defining the term and classifying the linguistic jargon (Timmers 1998, Rappa 2001). In the next phase, researchers and authors started to absorb the definition and showed their interest in completing the definitions. But still the definitions were more like a “shopping list” where they were only talking about specific components of a business model (Linder & Cantrell 2000, Amit & Zott 2001, Magretta 2002). It was only in the third phase when authors started to discuss the detailed description of these components (Afuah & Tucci 2001, 2003, Hamel 2000, Weill & Vitale 2002). During the next phase researchers started to model the conceptual components and test them more precisely theoretically. This effort resulted
in proposition of business model meta-models in the form of reference models and ontologies (Gordijn 2003, Osterwalder et al. 2005). In the final phase, these reference models are being applied in organizational management and in information systems.

One assumption of this study is that the term business model was not coined into the literature as the way it is today. Above presented discussions nicely complements that assumption of this study. Taking this forward, once the work by Osterwalder et al. (2005) was further analyzed, it shows a different and deeper level of classification of the evolution of business model in the literature. Table 3 is a summary from their analysis of the overarching business model concept.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Focus</th>
<th>Key Authors</th>
</tr>
</thead>
</table>

Table 3: Evolution of the overarching Business Model Concept; Business Model as ideas, Business Model as concepts and Business Model as meta-models

When we are referring to the overarching business model concept, the deeper definitional progress is not evaluated in the classification. Rather, only the way the jargon is perceived and defined is in question in this school of categorization. From this perspective of classification, it can be observed that the early authors like Timmers (1998), Magretta (2002) have defined the term as ideas of business and the discussion did not go much deep in their hands. Rappa (2001) proposed taxonomy of business models for digital organizations; he divided them into nine categories. On top of that, I find clear relation with today’s business model literature and Swedish author Richard Normann’s (1977) business idea. Normann used the business idea concept to describe businesses, more as a theory of the existing firm, and included both resource bases and environmental factors. Normann identifies three essential components for his “business idea”: first, the external environment, its needs and what it is valuing – what is crucial to the environment, next, the offering of the company, and finally, internal factors such as organization structure, resources, organized knowledge and
capabilities, equipment, systems, leadership, values. The systemic nature of the business idea requires that there is coherence. The relation to the external environment depends on the offering, which in turn is dependent upon internal factors, such as resources and activities. Some of the early definitions of business model also followed the clue that Normann provided researchers with.

In the second phase, management author Gary Hamel (2000) viewed business model as a conceptual tool with his business bridge model where he divides the model in four parts; consumer interface, strategy, resources and network along with three bridging components. For Hamel (2000) business model is just business concept that has been put in to practice (Osterwalder 2004). Similarly, Lecocq, Demil and Warnier (2006) proposed a conceptual wireframe named as RCOV (resources, competencies, organization and value proposition) framework which provides a resource based conceptual view to business modeling.

The third phase of business models as meta-models are those where authors have accumulated multiple components from the definitions and constructed an algorithmic or flowing relational model. Osterwalder and Piguneur’s (2010) business model canvas is one of the most popularly used such model where he accumulated nine components. Those components are; value proposition, revenue streams, cost structure, customer relationships, channels, customer segments, key activities, key resources and key partnerships. Ahokangas et al. (2013) recently introduced another tool which is more applicable for action based business modelling, known as business model wheel. This tool is inspired by Onetti, Zucchella, Jones & McDougall-Covin’s (2012) Locus, Focus and Modus view to business modelling. In the business model wheel, unlike value proposition in the business model canvas (BMC), business opportunity is at the heart of the consideration. With that at the center, BMW asks what, how and why questions to the business activities depending on their environmental location (internal or external) to the company.

The aforementioned discussion provides a multifaceted perspective to the historical development and evolution of the term business model in academic literature. This chapter has shown three different scopes to look at the phenomenon to understand its evolution. In the following sub-chapter, I will pull in definitions of the jargon which are widely discussed in the literature and have had impact in practice as well.
3.2 Defining Business Model

Many authors have offered definitions of business model with various perspectives. In this sub-chapter, I present definitions from the literature from fourteen studies to build a comprehensive view on how the phenomenon is perceived in the literature till date. This definitional presentation will provide with an idea how the debate and confusion has grown over period and where it stays now. Finally, the reason for presenting so many definitions in the master’s thesis signifies the lack of convergence and huge ambiguity in conception within the literature about the phenomenon.

At a general level, business model has been depicted as a *description* (Applegate 2001; Weill & Vitale 2002), an *architecture* (Dubossen-Torbay, Osterwalder, & Pigneur 2002; Timmers 1998), a *representation* (Morris, Schindehutte, & Allen 2005; Shafer, Smith, & Linder 2005), a *model or conceptual tool* (Osterwalder, 2004; Osterwalder, Pigneur, & Tucci 2005), a *structural template* (Amit & Zott 2001), a *method* (Afuah & Tucci 2001), a *recipe* (Baden-Fuller & Morgan 2010) a *framework* (Afuah 2004), a and a *set* (Seelos & Mair 2007) within academic literature.

This above mentioned dense depiction of what authors think about the phenomenon already provides readers with basic understanding of key logics. However, it also at the same time triggers the idea of definitional ambiguity among readers for why a phenomenon should have so many single worded meanings. Table 4 presents fourteen definitions from different studies in a chronological order of when the study was published. For the cases of multiple studies been published in the same year, I have presented them in alphabetical order of the last name of first author of the paper. On the left column of the table, I have marked the citations and the definition on the right column.

<table>
<thead>
<tr>
<th>Author</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timmers (1998)</td>
<td>The business model is an <em>architecture</em> of the product, service and information flows, including a description of the various business actors and their roles; a description of the potential benefits for the various business actors; a description of the sources of revenues.</td>
</tr>
<tr>
<td>Tapscott, Ticoll &amp; Lowy (2000)</td>
<td>Business model is a <em>distinct system</em> of suppliers, distributors, commerce services providers and</td>
</tr>
</tbody>
</table>
customers that use the internet for their primary business communication and transactions.

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weill &amp; Vitale (2002)</td>
<td>Business model as the <em>roles and relationship</em> among a firm’s consumers, customers, allies and suppliers that identifies the major flow of product, information and money, and the major benefits to participants.</td>
</tr>
<tr>
<td>Chesbrough &amp; Rosenbloom (2002)</td>
<td>The business model is the <em>heuristic logic</em> that connects technical potential with the realization of economic value.</td>
</tr>
<tr>
<td>Magretta (2002)</td>
<td>Business models are <em>stories</em> that explain how enterprises work. A good business model answers Peter Drucker’s age old questions: Who is the customer? And what does the customer value? It also answers the fundamental questions every manager must ask: How do we make money in this business? What is the underlying economic logic that explains how we can deliver value to customers at an appropriate cost?</td>
</tr>
<tr>
<td>Chesbrough (2003)</td>
<td>Business model is a <em>cognitive map</em> across domains, able to help managers in identifying a target market, articulating the value proposition, building the value chain and the costs/margins structure, describing the position of the firm in the value network and formulating the competitive strategy.</td>
</tr>
<tr>
<td>Morris, Schindehutte &amp; Allen (2005)</td>
<td>The business model is related to a number of other <em>managerial concepts</em>. It captures key components of a business plan, but the plan deals with a number of start-up and operational issues that transcend the model. It is not a strategy but includes a number of strategy elements. Similarly, it is not an activity set, although activity sets support each element of a model… It is a <em>concise representation</em> of how an interrelated set of decision variables in the areas of venture strategy, architecture and economies are addressed to create sustainable competitive advantage in defined markets. It has six fundamental components: Value proposition, customer, internal processes/ competencies, external positioning, economic model, and personal/ investor factors.</td>
</tr>
<tr>
<td>Osterwalder, Pigneur &amp; Tucci (2005)</td>
<td>A business model is a <em>conceptual tool</em> containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm. Therefore we must consider which concepts and relationships allow a simplified description and representation of what value is provided to customers, how this is done and with which financial consequences.</td>
</tr>
<tr>
<td>Shafer, Smith &amp; Linder (2005)</td>
<td>Business model as a representation of firm’s underlying <em>core logic</em> and strategic choices for creating and capturing value within a value network.</td>
</tr>
</tbody>
</table>
Amit & Zott (2001) and Zott & Amit (2010) The business model depicts “the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities” (2001: 511). Based on the fact that transactions connect activities, the authors further evolved this definition to conceptualize a firm’s business model as “a system of interdependent activities that transcends the focal firm and spans its boundaries” (2010: 216).

Teece (2010) A business model articulates the logic, the data, and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value. It’s about the benefit the enterprise will deliver to customers, how it will organize to do so, and how it will capture a portion of the value that it delivers.

Demil & Lecocq (2010) Business model is the way activities and resources are used to ensure sustainability and growth.

Onetti, Zucchella, Jones & McDougall-Covin (2012) The business model as the way a company structures its own activities in determining the focus, locus and modus of its business.

Table 4: Business model definitional variations

Aforementioned table depicting different definitions about business models provide us with a wider perspective to understand the phenomenon. It gives us different lenses to look at business models and how is it being conceptualized among industry and academics. Since the increase in e-business, business models as a term in the literature has gained tremendous momentum with various usage and meanings. However, this frequent use of the term in different fields of study and reasons resulted in fragmented theoretical understanding of the concept (Ahokangas et. al 2014). According to Zott et al. (2011) this definitional confusion is promoting dispersion rather than convergence of perspectives and also obstructing cumulative research endeavor. Ahokangas et. al (2014) argues that some of the recent efforts in business model research has been helpful to provide a coherent ground of understanding.


Similarly, Nenonen & Storbacka (2010) points out major correspondences in the prevailing definitions of business models. They mention about the significance of value creation as one of the core element. Nenonen & Storbacka (2010) also states the presence of revenue model/ profit models is highly important to the discussion about the phenomenon. They also mention the presence of value network besides the resource and capability in the definitional discourse. They argue that for a company, the business model should be both internally and externally oriented and utilize the networked relationships to create the best value for both the internal and external stakeholders of the company by using possessed resources and capabilities. Finally, they mention the presence of strategic decision making within the definitional debate of business models. Some authors have analyzed business models alongside strategic management, where authors like Seddon & Lewis (2003) and Zott et al. (2011) argues that business models are not the same as strategy but might be a part of strategy. Seddon & Lewis (2003) stated that strategy of firm itself can consist numerous business models, thus business models can be perceived as a tool to attain strategic goals.

Business model has also been recognized as a new valuable unit of analysis that measures the firm’s capacity to create, capture and deliver value to end users (Amit & Zott 2001). Discussion about business models as unit of analysis takes the focus from company resources to how they utilize them in creating value (McGrath 2010). And there are also authors who sees business models as a way to create sustainable competitive advantage (Teece 2010, Zott et. al 2011) having the business opportunity creation at the center of the concern (Ahokangas et al. 2014). Ahokangas et. al (2014) states that business models are never static and develops continuously through refinement, adaptation, revision and reformulation. This idea is based on previous work on business model innovation by Morris et al. (2005) who advices evolution of business model upon starting with perhaps an incomplete model.
Previously, while discussing the history and evolution of business models in the literature I argued business models as ideas, concepts and models. Now, in the discussion of definition of business models, it seems appropriate to relate the overall concept of business model innovation / transformation with similar stances; ideas, concepts, models. Roger Martin’s (2009) Knowledge Funnel will help us understand the logic. In the knowledge funnel for design thinking there are three levels; they are mystery, heuristics and algorithms.

![Knowledge Funnel](image)

About the knowledge funnel, Roger Martin (2009) argues that managers think in solving organizational problems often without enough concrete evidential information. Thus they stay in a mystery about the problem and try to create logics by understanding the problem in reality which Martin referred as heuristics. Finally, when heuristics are implemented and succeed continuously, then only companies design the real algorithm which is supposed to be specific steps to do something without any deviation. But Martin (2009) also argues, rarely that happens when with the exact solution someone can keep solving problems of all types over indefinite time period. He states design thinking is a cyclic process of the knowledge funnel for better design performance in the volatile competitive business environment.

Referring to the concept of the knowledge funnel, I argue that process of business model innovation also follows the process similar to knowledge funnel and we can
address the steps as business ideas, business concepts and finally business models. To clarify the resemblance, entrepreneurs generate business ideas from dust and they stay as dust unless they are better structured and some logics can be conceptualized. When the idea is a bit structured with some elements of a business, we can refer it to a business concept. But only the concept is not good enough to make it a key to success. There needs to be some more trial and errors and then only entrepreneur/ managers get the magic model that succeeds over time.

This algorithmic discovery provides with a business model for the company. However, in the highly technology oriented competitive market; no business model is expected to sustain forever. Thus, organizations need to consider their existing business model as the mystery/idea on how to improvise on that in order to get the next break through. Thus, business models can also be perceived as the process of ideating simple problems and conceptualize them for commercialization by creating and disseminating value utilizing the value networks of the firm internally and externally. From this perspective, business models can be seen as a dynamic and continuous enhancement tool towards greater organizational competitive advantage and a sustainable future.

In this master’s thesis, business model is considered as a dynamic transformational force which helps practitioners conceptualize the rationale behind the overall value creation and delivery for long-term economic sustainability. With business model, practitioners can model the conceptualized problem in order to implement the dynamic and dendritic components in a cohesive manner with success.

**3.3 Components of a Business Model**

With dense understanding about what business model actually is, in this sub-chapter major components of business model in the existing literature will be discussed. The preceding chapter about business model definition has clarified the prevailing lack of consensus about the concept and some major drawbacks in practice due to that. In many cases business model, strategy, business concept, revenue model and economic model has been used interchangeably (Morris et al. 2005). And in many cases the term business model has been used with varied meanings. Having said that, it has been evident that business model as a research interest has been active for about 20 years
now, for that reason, differed perspectives are expected for such an interesting and new topic.

If the multifaceted use of the term in literature hinders our overall understanding in reaching a consensus about the concept, same time it provides us with wider scope to look at the phenomenon if we consider the breadth and width of the evolution of the topic in literature. In the following paragraphs along with one statistical table I will open up the most used components or elements of a business model that has appeared in different publications.

In this sub-chapter I accumulate works from four different journal publications which mainly focused in finding a coherent meaning and definition of business model. All of these papers concern the identity crisis of business model and offer holistic view to the phenomenon though extensive literature reviews. Shafer et al. (2005) analyzed 12 definitions in their studies and gather 42 business model components which are unique building block components according to the authors. Similarly, Morris et al. (2005) studied 19 different definitions to have a wider understanding how the phenomenon was being shaped up in the literature till then. They also provided a tabular presentation of the definitions with individual counts of components of business model for each definition. In the 19 definitions that they analyzed, Shafer et al. (2005) pointed out 24 different items which they highlighted as important to have a unified perspective.

In 2011, Zott et al. published their work on recent developments and future research of business model where they discussed the evolution of business model as well in the literature. They concluded analyzing 103 publications, where they analyzed business models in the light of e-business in focus.

Finally, Onetti et al. (2012) did the widest analysis of existing literature of business model. Their analysis is based on 70 different definitions published from 1996 to 2009. They mentioned that their work was inspired by Shafer et al. (2005), where Onetti et al. (2012) reduced and normalized the list of components of business model from 42 to 26 to minimize duplication and redundancy of too many similar elements. They finally used 48 definitions for analysis to avoid similar definitions.
### Table 5: Business model components and the frequency of them appearing in different publications. (Adapted from Shafer et. al 2005, Morris et. al 2005, Zott et. al 2011 & Onetti et. al 2012)

<table>
<thead>
<tr>
<th>Components</th>
<th>1996 -2002</th>
<th>2002 - 2010</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mission/ objectives</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mission</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>8 %</td>
</tr>
<tr>
<td>Value creation</td>
<td>10</td>
<td>4</td>
<td>14</td>
<td>24 %</td>
</tr>
<tr>
<td>Sustainability</td>
<td>7</td>
<td>4</td>
<td>11</td>
<td>19 %</td>
</tr>
<tr>
<td>Exploitation</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3 %</td>
</tr>
<tr>
<td>Innovation</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>10 %</td>
</tr>
<tr>
<td>Corporate reputation/ Culture</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>8 %</td>
</tr>
<tr>
<td><strong>Strategy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategy</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>14 %</td>
</tr>
<tr>
<td>Value proposition/ Offering</td>
<td>15</td>
<td>20</td>
<td>35</td>
<td>59 %</td>
</tr>
<tr>
<td>Competitors /Competitive environment</td>
<td>7</td>
<td>7</td>
<td>14</td>
<td>24 %</td>
</tr>
<tr>
<td>Differentiation / Cost Leadership/ Pricing</td>
<td>11</td>
<td>10</td>
<td>21</td>
<td>36 %</td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processes/ Activities/ Value chain</td>
<td>12</td>
<td>16</td>
<td>28</td>
<td>47 %</td>
</tr>
<tr>
<td>Resources / Assets</td>
<td>9</td>
<td>11</td>
<td>20</td>
<td>34 %</td>
</tr>
<tr>
<td>Competencies/ Capabilities</td>
<td>6</td>
<td>6</td>
<td>12</td>
<td>20 %</td>
</tr>
<tr>
<td><strong>Modus</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partners / Actors / Suppliers / Value Network</td>
<td>15</td>
<td>21</td>
<td>36</td>
<td>61 %</td>
</tr>
<tr>
<td>Customers / Customer Relationships</td>
<td>14</td>
<td>18</td>
<td>32</td>
<td>54 %</td>
</tr>
<tr>
<td>Information flow</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>14 %</td>
</tr>
<tr>
<td>Transaction</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>7 %</td>
</tr>
<tr>
<td>Infrastructure/ Infrastructure management</td>
<td>7</td>
<td>5</td>
<td>12</td>
<td>20 %</td>
</tr>
<tr>
<td>Functionalities/ Supporting processes</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>5 %</td>
</tr>
<tr>
<td>Technology</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>12 %</td>
</tr>
<tr>
<td><strong>Locus</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>3 %</td>
</tr>
<tr>
<td><strong>Finance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue</td>
<td>14</td>
<td>14</td>
<td>28</td>
<td>47 %</td>
</tr>
<tr>
<td>Cost</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>25 %</td>
</tr>
<tr>
<td>Profit</td>
<td>7</td>
<td>7</td>
<td>14</td>
<td>24 %</td>
</tr>
<tr>
<td>Financial aspects</td>
<td>9</td>
<td>7</td>
<td>16</td>
<td>27 %</td>
</tr>
<tr>
<td>Cash flow</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5 %</td>
</tr>
</tbody>
</table>

For this master’s thesis, I have considered Onetti et. al’s (2012) list of 26 components of business models as the foundation as it is well structured and summarized. However, I have considered the other three articles mentioned previously to make the collection of definitions wider to test which elements have more frequent presence in more publications. In total, table 5 includes and summarizes information based on 59 different definitions of business models from different authors. In constructing the table, I have segmented the definitions in two clusters. First group is from 1996 to early
2002, and the second cluster is from late 2002 to 2010. This data provides us with vital insights about which elements of business models have attracted the most attention in academic publications and which are left for more devotion.

There are only three components that have appeared in more than half of the definitions of the pool, they are; value proposition/ offering, partners/ actors/ suppliers/ value network, and customers/ customer relationships. Alongside these three components there are eleven more which starred more than twenty percent occasions. In this thesis I consider this list of fourteen components which have 20% or more frequency as vital components of the business model. Interestingly, despite the concept of business model came into literature as an active discipline following the dotcom boom, this analysis shows that technology as a core element of business model is only repeating in 12% cases. However, despite technology does not accumulate the 20% margin of occurrence in the table, I consider to keep it along with the list of vital business model components due to the interest of this study.

Below is the list of fifteen vital business model components analyzed from the above table:

- Partners / Actors / Suppliers / Value Network
- Value proposition/ Offering
- Customers / Customer Relationships
- Processes/ Activities/ Value chain
- Revenue
- Differentiation / Cost Leadership/ Pricing
- Resources / Assets
- Financial aspects
- Cost
- Value creation
- Competitors / Competitive environment
- Profit
- Competencies/ Capabilities
- Infrastructure/ Infrastructure management
- Technology
The list is organized in a chronological order according to their corresponding percentage in the table from highest to lowest. Despite structuring the list in such way, each of the elements will be considered as equally important in the next parts of the study. This list of business model components will be later used in this study as the base to design the data collection interview framework which will enable creating the conceptual space in understanding the deeper future of health care sector.

This list suggests value network, value proposition and customers have been most important notions in the discussion to define business model. It also depicts that financial aspects such as revenue, cost and profit are core to the concept and cannot be overruled while thinking about longer sustainability. The components of a business model together make the overall model structure a compelling set up to conceptualize how the business is done, how revenue is being generated, how profit is being maximized, how sustainability is being ensured and how the company/industry is being transformed. A business model to perform better, all the components should be organized in a complementing way to support the others.

3.4 Business Modelling tools

Besides theoretical definitions of business model in the literature, various authors have proposed different conceptualization tools to use business models in practice. Some authors constructed their tool as a design tool, some created the constructs as conceptualization tool, whereas some designed it as an algorithm builder with specific blocks. The Lean Canvas is a well-popularized tool that is used by startups in constructing their business models. Whereas the RCOV frame introduced by Demil & Lecocq (2010) talks about how business modelling is a resource based cyclic process.

In this master’s thesis I observe business model in the literature and in practice has been through an evolution and the start of this story was by Richard Normann’s (1977) business idea. In his work he identified three distinct components of business ideas; the external environment, the offering and the internal factors. I argue that the next phase of business model was introduced by Gary Hamel (2000) with his business concept where he presented the business concept innovation model. Next to that I perceive the business model canvas by Osterwalder & Pigneur (2010) brought tremendous advancement in the discussion. Finally I see the lean canvas by Ash
Maurya (2012) and business model wheel by Ahokangas *et. al* (2014) as the next generation of business models which consider the innovation cycle keeping problem and opportunity as the core in the construct respectively.

In the following paragraphs I present a briefly some of the most popular business modeling tools. All of the conceptual models being discussed here are graphically pictured in the appendices chapter of this thesis.

*Gary Hamel’s business model bridge model*

After almost two decades of Normann’s introduction of the term “business idea”, some authors were again discussing the term “business model” in their publications and also developed some vague definition of the notion during the mid-1990s. But it was Gary Hamel (2000) who first came up with a concrete and holistic approach in explaining business model. Hamel is till date considered as one of the key management authors with his best seller books which has been translated in various languages as well. His idea about business model was quite different than the one we have these days. Hamel perceived business model as just business concepts that are put in practice. He further argues new business models are completely novel business concepts and not just disruptive technologies itself. Hamel described business model as the implementation of business concepts and possibly visual presentation in order to that.

Hamel’s bridging model is a comprehensive tool to understand the phenomenon but interestingly he did not promote the tool much to create and practice business modelling rather for conceptualizing the phenomenon. According to Hamel, there are four major components of business concepts; they are core strategy, strategic resources, customer interface and value network. Hamel argues that all of these components have multiple sub-components which in the end make a total picture of how the business concept is being implemented. Additional to that, he states that the major components cannot perform as islands but needs connections, hence bridging.

Hamel also iterates that the success of company’s business model can be better understood by analyzing the efficiency, fit, uniqueness and profit boosting ability of the components of this given model. One key aspect of this model is observing Hamel’s use of the words “opportunity” and “innovation”, which provides with the
essence of a process in understanding a business model. Albeit, Hamel did not talk about a transformational process but his discussion had some essence of that as he mentioned the innovation of concepts. He also spoke of incremental innovation and non-linear idea generation in relation to the bridge model. Hamel’s work was a key advancement in business model research at that time and has been cited in many publications as well.

**Business model canvas**

Osterwalder & Pigneur (2010) designed and introduced the business model canvas which consists of nine building blocks of the construct. All the blocks surround the main three streams of components from the vital business model components list that has been presented earlier. At the heart of the business model canvas is the value proposition that the firm or product/service is offering. According to the canvas logic, value proposition is surrounded by customer, competencies and financial logics. Thus, despite the business model canvas comprises nine blocks they can be segmented in four sub-groups. Customer segments, customer relationships and channels make the customer orientation wing. On the other end of the model key activities, key partnership and key resources make up the competencies wing. Revenue streams and cost structure constructs the financial logic of the model. These three wings justify the value proposition together in a complementing manner.

Osterwalder & Pigneur (2010) states that organizations can focus any of the four logics while designing their business model depending on the company’s main strength. They also mention that companies can start designing the canvas from any of the four logics to maintain the purpose of why this model is being used.

*Value proposition* being the center of the structure marks what product, service, package or solution is the company offering to solve a problem for the end users. Value proposition does not exactly speak of the product/service itself but what sort of value do they bring. A specific value can be inexpensive service, or superior quality or something else as well. Value proposition is a combination of benefits that a company offers to their customers in return of price for the product. There are value propositions and unique value proposition (UVP). UVPs are hard to locate but once identified can be key to huge success for a company.
In the customer orientation wing of the business model canvas there are three building blocks. In the Customer Segments block, companies need to identify which proper customer group whom they are going to serve with the product they have. In doing so companies need to design proper Customer Relationship programs to support their business goals. Companies usually have distinct customer relationship program to address different customer segments. These relationships can take personal interaction or automated platform depending on the company’s strategy and segments value and size. Finally, Channels is the building block that describes the way a company delivers its value to end users. Channels are customer touch points to deliver product and service and improve customer experience as well.

The competency logic of the business model canvas also consists of three building blocks. Key partnerships speak of the vital value network that a company has or targets to have in order to deliver specified value to the customers. Key partners are usually external parties bringing solutions to the company either in the supplier part or in the distributor part of the value chain. Key activities are those special business as usual acts for the firm that they perform to deliver the value. Key Resources are those assets, knowledge, human resource, other intangible assets like goodwill or brand which helps the firm in performing the key activities or attain and manage key partnerships.

The last part of the business model canvas entails the financial logic of the firm. In uttering the financial logic of the organizations, they need to conceptualize how they are going to generate revenue, which is reflected in the Revenue Stream building block. And, how overall cost will be distributed for all the activities that are going to be performed is named as Cost Structure.

The business model canvas is till date the most popular tool that is being used by entrepreneurs in practice. However, one drawback of this model is that it provides us with a static view to the company’s rationale as if things are not going to change in the long run.

**Lean Canvas**

Inspired from the business model canvas, Ash Maurya (2012) created and licensed an altered version and titled it as Lean Canvas. The lean canvas is most applicable for
entrepreneurs, startup accelerators and similar parties. Maurya compiled the ideas from business model canvas; the worksheets from Steve Blank’s book *The four steps to epiphany*, and the lean approach to startups. He admired the idea of a one page modelling tool instead of a business plan and designed this tool which is supposed to be done in twenty minutes. Despite the lean canvas looks very similar to the business model canvas, it has some core difference; such as the focus and flow while dealing with the canvas. Lean canvas has nine components like the business model canvas and five out of nine are just the same.

In this discussion, I am not presenting what is meant by each of the building blocks in the lean canvas as five (value proposition, channels, customer segments, cost structure and revenue structure) of them are already briefly covered. However, the rest four makes the modelling quite an interesting perception of modelling. Maurya argues companies cannot just focus and build their business on a value proposition/offering as it might not actually solve any problem for the company or for the customers the company is serving. Though he admits value propositions are important, but he stresses it has to be unique instead of generic to give the startup a head start. He marks that it is very important to identify the problem that is to be solved and at the same time the customer segment is to be targeted so that the unique value proposition (UVP) can be designed. Once the UVP is identified, startups are supposed to identify how they are going to solve the issue at hand through which channels. One of the complex ideas of the lean canvas is the block called unfair advantage which simply refers to those features of the company to bring competitive advantage once implemented.

I argue lean canvas is the next generation of business modelling tool following business model canvas as it has evolved with the idea of problem identification and designing the whole model based on that. Furthermore, lean canvas is a part of the lean approach revolution for startups and where the action based learning is highly appreciated and considered as a way to fine tune the way a company operates. Hence, the lean canvas also offers entrepreneurs with a transformational business modelling tool which is not as static unlike the business model canvas.
Ahokangas et al. (2014) presents the business model wheel where they argue instead of value proposition, business opportunity should be in the heart of business modelling. This perspective to business model considers the way a company do business depends on what opportunity is there in the market to exploit. Often companies find an opportunity that suits their resources and competencies and modelling is carried forward in a way which can result in superior performance of the company. But, rarely a single opportunity sustains for long in today’s highly competitive and volatile market conditions. In such cases companies need to find new opportunity and align their overall business model keeping the business opportunity at the center.

Since this tool acknowledges the expiry of opportunities and renewal of business model by finding new opportunity, makes it an action oriented transformational and dynamic tool. This way of business modelling criticizes the business model canvas for two main reasons. First, the business model canvas is static and ignores the changes in the market setting as a tool. Transformation is left on the managers alone to take up, where in paper the business model created by BMC looks evergreen despite it might not be applicable at all at a given point of time. Secondly, this school argues that value proposition is sometimes an internal decision and vague articulation of entrepreneurial bias about their own product. Thus, Ahokangas et. al’ s (2014) work says value propositions need to base on market conditions and business opportunity.

Based on Onetti et. al’s (2012) work, Business Model Wheel also considers the focus, locus and modus in designing a business model. The four questions in the business model wheel are what, how, why and where. Usually the what question finds the value proposition, offering, customer segments and differentiation. The how question answers to how the “what’s” are to be found or managed in order to exploit the opportunity. How questions typically finds out the key operations, activities, partnership, marketing, mode of delivery, sales. The “why” question simply justifies “what” and “how” elements of the wheel. Why elements include cost drivers, cost elements, base of pricing, ways of charging etc. Finally, the fourth question is where, which includes either internal or external. By the presence of this where question, managers can locate where they need to act more efficiently in order to attain the business opportunity.
The business model wheel provides us an action based way to business model. It helps us consider the overall changes a market might have and how the opportunities might change over time. It suggests that organizations need to revisit the core, the business opportunity, in order to stay profitable and competitive by making sure the opportunity they are exploiting still exists. Otherwise, companies need to identify or create new opportunity and build new business model around that.

3.5 Business Model for IoT and Health Care sector

Since the focus of both lean canvas and business model wheel is very closely tied; business opportunity and problem identification, I consider them together as the first step of business model designing. An identified problem can be converted into a business opportunity with a valuable product/service proposition. Reiterating the consideration of this thesis’s stance as to keep the problem and opportunity creation at the center and design value proposition towards that. Similarly business models for IoT and healthcare sector both individually and together are more successful if designed in such ways.

The vertical-horizontal-oblique logic of BM in health IoT

Considering the vertical, horizontal and oblique logics of business models, the contextual setting of this study also makes reasonable sense. Taking Messerschmitt & Szyperski’s (2003) work on ICT ecosystem forward, Ahokangas (2015) presents the logic of vertical, horizontal and oblique business models. Starak (2014) also presents similar notion of vertical and horizontal business models but with a slightly different favor towards vertical business models. The logic of this argument also resembles the product life cycle concept. If connected, it might seem companies are usually forcefully vertical during the early days due to lack of options and later goes horizontal as the infrastructure matures. On the other hand, in the internet era the story has been quite opposite (Starak 2014). Internet enabled businesses usually start horizontally and then tend to become vertical.

Vertical business model is defined as a model that is designed to create value for users being grounded inside specific vertical business scope. Usually technology infrastructure providers work with this kind of business models by developing a certain
customer base and delivering value for them (Jia, Wang & He 2011, Ahokangas 2015). Customer segments are deep but narrow for vertical business models. Starak (2014) argues vertical business models can enhance business performance in the internet marketing era significantly with quality content and service. Accumulation of quality content and services can also be perceived as content infrastructure from a broader point of view. Microsoft’s new introduction of medical IoT solutions has been remarkable in the past few years. Also one in every three success stories of Microsoft’s IoT program involves healthcare intervention.

In the United States at South Jersey Healthcare center, Microsoft helped upgrading an existing system to an intelligent, cloud and secured system to manage patient records, prescription archival, regulatory data and billing. At Siloan St. Trudpert Hospital, Germany, they built a digital operating room for enhancing patience care during surgery and improve real-time training from global learners. At Henry Mayo Newhall Hospital, Microsoft delivered a fast, secure, intelligent and an anywhere access patient record management system alongwith a super-fast physician login procedure. Also at the Great River Medical center, an automated end to end medication management system was deployed with Microsoft’s IoT program. Microsoft has been fostering the application of IoT in the recent years through its infrastructural capacity by using a vertical business model. Their goal is to create value for their target customers and create a sustainable market for long-term business.

Ahokangas (2015) marks horizontal business model as being used by most service oriented and consumer based companies. The idea is simple, companies who have wider product/service base to attract wider but shallow customer base are most likely to use this sort of business model. Unlike vertical business models, horizontal business models capture value instead of creating value. Since the risk factor of failing is lower with multiple customer segments are in action, horizontal business models often attract business managers who are risk averters. However, due to customer base being shallow and customer relations programs are usually weak, sustainable and highly profitable business is not expected always (Starak 2014). Nonetheless, a content customer cluster gathered from a wider range promises for early sustainability which can be translated to focus on specific products upon maturity.
For an example of such product in the IoT enabled healthcare sector, smart things employed for different types of data collection is a probable option. A smart box powered with multiple sensors can collect different types of data and can be disseminated to different service providers (horizontal segments), e.g. hospitals, clinics, therapists etc. Also mobile application developer companies who are focusing on healthcare develop hundreds of applications. This sort of companies also manages within a horizontal business model with multiple applications being managed by the same firm for higher revenue generation by capturing value from different customer segments.

Finally, an emerging form of business models is presented by Ahokangas (2015); namely oblique business models. The idea of this lies in value sharing and utilizing unused valuable assets from different verticals. Ahokangas states that this sort of business models are in most cases employed by fast growing and service oriented companies. One key feature of this business model is utilizing the resources of a third party in business foster. The idea of value sharing comes from the phenomenon of utilizing third party resources. MyData can be a central application of such business model in the future which will most likely collect data from multiple platforms and sources in order to accumulate individual details.

The overall picture from this vertical, horizontal and oblique business model very nicely complements the idea of different business model patterns discussed by Osterwalder and Pigneur (2010). Despite the examples in this subchapter are emerging, it is evident from the present situation of the industry that business endeavors from the health IoT sector can take a single face of business models or it can also combine two or even more business model in order to commercialize operations.

Liu & Jia (2010) discussed a holistic business model for the drug supply chain based on IoT. Their framework also suits the idea of an overall healthcare sector to some extent. Since their work focused only on one aspect of the industry, it seems quite simple to connect all the points from where business opportunities can be created and exploited. The concept of this study lays the foundation of looking at an industry construct with layered business vision.
**Service oriented architecture of IoT and the 4C business model layers**

The concept of a layered vision of business activity can be related to the service oriented architecture (SoA) which was presented in an earlier chapter. This idea will be coupled with Wirtz, Schilke & Ullrich’s (2010) 4C model comprising contents, commerce, context and connection, another layered vision for business models. The concept deliberated by Wirtz *et. al* (2010) is very simple and consistent.

In connecting the 4C model with the SoA, it seems logical to undermine the fact that not all business models in the sector will have a direct impact to public health treatment. Some businesses can only be built to maintain the infrastructure needed for the sector, but still that is a very important economic component and business part of this sector since without maintenance the sector will not sustain.

<table>
<thead>
<tr>
<th>4C Model Layer</th>
<th>Value Proposition</th>
<th>SoA Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>Providing convenient and user friendly access to different types of content.</td>
<td>Interface Layer</td>
</tr>
<tr>
<td>Commerce</td>
<td>Providing cost efficient exchange platform for business.</td>
<td>Sensing Layer</td>
</tr>
<tr>
<td>Context</td>
<td>Providing structure and navigation for users to reduce complexity.</td>
<td>Service (middleware) layer</td>
</tr>
<tr>
<td>Connection</td>
<td>Providing the pre-requisites for data exchange.</td>
<td>Networking Layer</td>
</tr>
</tbody>
</table>

Table 6: Connecting the 4C Model (adapted from Wirtz *et. al* 2010) and the Service oriented architecture of IoT

Wirtz *et. al* (2010) looks at the industry through four different layers. They consider that the business is also modeled accordingly in each layer. The first layer is *Content*, where the business is created by providing convenient and user friendly access to various types of content. Probable applications of content business in the IoT healthcare sector could be promotion of different contents at the interface end. Many health IoT solutions already have user interface mobile applications where they can promote and advertise other contents as a part of promoting this total technology. General healthcare advertisements through IoT platforms can be considered as well.
The *Commerce* business model is supposed to provide a cost efficient exchange platform for buyers and sellers. Since the health IoT sector is still an emerging case, we are yet to see how it evolves. However, we can expect IoT enabled pharmacies where patients will be able to order prescribed only (and general) medicines online. The idea for this layer is to create the platform where different client and provider groups come together to do business.

In the *Context* layer providing structure and navigation for users is vital for the technology. This layer helps buyer to understand the marketplace better by reducing complexity and intransparency. Business models in the *content layer* and this layer can be very similar. I argue that the business models in the *context* layer in health IoT are built on the networking and service layer of the SoA architecture. Probable application could be professional online medical platforms that provide remedial suggestions based on sensed data. Such platforms can be chronic disease based, general health based, for working out, for sports or some other type. The idea is to create platforms where users can navigate through solutions that they need in one location by using data gathered by IoT terminals.

The last one is *connection* business models, which is supposed to provide the prerequisites for the exchange of data and information over the network. Prerequisites for an IoT enabled healthcare mainly include data communication network, the network provider, network equipment provider, smart devices, sensor & actuators. Evidently, business surrounding these locations for health IoT covers the networking layer and again sensing & interface layer of the SoA. Business models of these kinds have the least connection to the public health, however the importance of these business models do not deteriorate due to its high importance for maintenance.

The layers of the service oriented architecture of IoT can be perceived as coupled with the layers of the 4C model (Wirtz *et. al* 2010) with an overlapping logic. Business models can be built for the Content layer using technologies from both sensing and interface layer or just one of them. For commerce layer, business models can include either sensing and service layer or just one. Similarly for Context Layer, technologies from the service layer and networking layer can be used together or individually. And for connection layer business models, networking layer and sensing & interface layer technologies can also be used together or partly.
Wirtz et. al (2010) argued business model can be designed with one or more layers from the 4C model. Similarly, business models for IoT enabled healthcare services can also bring together multiple layers in practice together. Healthcare as a sector is potentially going to benefit smartly from the inclusion of IoT technologies. However, the confusion pertains how businesses are actually going to proliferate. This subchapter has opened up some application ideas grounded on the architecture of IoT and a promising typology of digital businesses.

3.6 Towards “business models for the futures”

Business opportunities are elusive and value propositions are too vague without the opportunity been identified. In today’s highly volatile and competitive global market, business opportunities may vanish if not grabbed in the right way at the right time. It is important to identify and understand business opportunity and act on it to design a killer value proposition. If the value proposition of a product/service is not well aligned with the opportunity, the likelihood of success reduces significantly. Despite the definitional debate about the phenomenon in literature, it has been cherished with the progress of the phenomenon from ideas to concepts to meta-models. Business model tools in the current era provide us with a structured view to look at the problem. Business model components by building blocks help us focus on the problems individually to gain a big picture.

Scholars agree that long gone are the days when a single business model could help sustain a company for longer profitability (Morris et. al 2005, Ahokangas et. al 2014). Now, we need business model innovation to retain market position or to gain greater market share. The art of business model innovation is itself a research focus, and the findings suggest it as a cyclic process of improving the business model. The stance of this study shares the view of understanding the environment and locating newer opportunities to innovate business models. Duin (2006) mentioned business model’s features for planning, communication and mapping the future operations. Till that point business models were not perceived as a tool for participating in futures research. But very recently, efforts are coming forward to look if business models can be practically employed as a futures tool.
On a different note, Ardichvili, Cardoza & Ray (2003) marked business opportunities as the catalyst to create and deliver value for stakeholders. According to them, through experimentation on the business opportunities are the business models can be brought to maturity. Aligning to this school of thought, I argue resonating George & Bock (2011) that locating a future business opportunity can foster the effort to design a future business model which will help uncovering a dynamic future. Ahokangas, Atkova, Moqaddamerad & Juntunen (2015) further argues that business model innovation can be perceived as a form of futures research tool due to its reasonable concentration on the future when understanding the business opportunity.

Since the objective of this study is to understand the futures of the IoT enabled healthcare sector, I consider similar perception of business model to be used as a futures tool. The extensive literature survey on business models that has been presented in this chapter supports the idea of using it as a forward going tool. The components and patterns of business model, along with a detailed discussion on the history and definitions provides with an understanding how business models have so far been used and perceived.

By the end of this thesis, it will be presented how the tool has been used in the process, what were the benefits and obstacles of using business model in such a way. The concept of futures research and foresighting will be discussed in detail in the following chapter as a research methodology.
4. Methodology

“Future is not a gift – it is an achievement” - Harry Lauder

As this study focuses to learn the potentials of business models and also the potential business models in an IoT enabled health care sector, this study will use one of the most widely appreciated futures research methodology which enables researchers to identify a futures space to construct a preferable future. Resounding to Harry Lauder’s popular quote, if someone waits and wants to see what future has to offer, it might fill them with extreme happiness or it might just surprise them with a series of shock. Since we are in an ever-so-competitive modern capitalistic market, there is if not none but very little chance of allowing such risk of waiting for the shock and especially when we are dealing with the sensitive sector such healthcare and wellbeing.

In this chapter, first, I will open up with the basic discussion on futures studies. The basics of futures studies will be presented, how it is appreciated and also the major criticisms of this field. How futurists usually perceive a problem and how they use the findings to construct a future will also be pictured before going in detail about the specific research methodology that will be used for this study.

Futures Studies / Foresighting

Futures studies or foresighting as it seems to many people as a vague concept at first, because for the most of only utters about what might or might not happen after a long period of time and people prefers to think about present most of the time (May 1996). Futures studies date back as long as the Second World War. Although thinking about the future regardless of time-extent of the thought, it has always been there in the back of the mind of individuals since the beginning of human civilization (Masini 2006). But still doubts remain about the discipline among citizens.

Although some might not fancy using futures techniques, existing literature argues that futures studies involve active learning and participation, proper time sense about phenomenon, timing of intervention, and deconstruction of present reality in order to construct a preferred future, able to consume surprise as an element and design & create alternative scenarios towards a vision using myths & metaphors (Inayatullah
2000, Masini 2006). But the discipline itself accepts that the future is not entirely determinable by the scientific approaches these methodologies offer (Dator 1996) as the future is constructed of multiple possible, probable, plausible and preferable outcomes (Voros 2012). Critics of foresighting consider the admission of not being able to determine the future as a severe drawback since it’s titled as the studies of the futures. But the fact lies, foresighting or futures studies enables the individual strategizers to look into the potential outcome of an operation even before it takes place on a level which can be either very vague or general to deeper extent.

Foresighting gives managers and strategizers the tool to look for alternative outcomes of a given situation and managers can then act on the result that they get using foresighting. On a regular day, without the help of foresighting, strategizers might define a goal and start taking actions on them without testing or hypothesizing their outcomes on longer period and might fail. Foresighting help strategizers to design a future oriented action based strategy. This technique helps people better understand the systemic changes so that a better future can be constructed nurturing the challenging present through a planned deconstruction (Inayatullah 2008).

This line of research has also been questioned by different researchers as to why do we need such a title as “Futures Studies”. Arguments include that almost every research conducted within the scientific world have some direct or indirect impact on the future, then why do we need a specific research wing titled as such. Renowned futurist Sardar (2010) published his take on titling the discipline as “futures” and did a title based comparison. In fact, there have been many different names that have been used for addressing this line of research. Sardar (2010) argues that titles as futures, futurology, futuristics, futurism, futuring, futurability are too fuzzy and vague to convey the message and purpose of this technique to the users. Titles closely tied to the word future somewhat means it only deals with future and entirely with it but no other time scopes. But in reality these tools analyzes the past and collects data from the future to find out how to do things best in present in order to attain the preferred future. Rather Sardar (2010) found it more appropriate to use “Foresighting” as the replacement of other titles which are in use by many other researchers and academicians. Responding to Sardar’s (2010) work, Masini (2010) also agrees to most of the ideas that was
delivered as important inputs to the field as to why names and titles are needed for proper semantics.

Masini (2010) also mentions that most of the titles within this sector are highly influenced by the western world. Resonating similar notions Tonn (2010) also stressed on the fact that foresighting is more of a multi-disciplinary or inter-disciplinary field of academy where different tools from different disciplines can be pulled to solve a certain problem, which is also backed by Marien’s (2010) address of the foresighting as interdisciplinary clearing house of all future related information on world and national problems.

One other major criticism about this branch was offered by Ziauddin Sardar (1993) earlier that the discipline was becoming more and more orientalized and most futures studies were focused on too similar problems to address the bigger future. Even though the line of criticism started long back, futurists have been proactive to manage and respond to such criticisms. In such an endeavor, one of leading futurist, Sohail Inayatullah (1996), the introducer of widely popular futures technique Causal Layered Analysis, offered to debate the criticism about the orientalization problem of the issue by constructing a study on how futurists think and perceive.

Inayatullah (1996), in his study admits that future oriented studies need to generate projects that are more versatile as a phenomenon to look at a deeper and wider future of the world. Future oriented projects need to be more cosmopolitan, non-sexist and epistemologically richer according to Inayatullah (1996). Having accepted these facts from complains of the critics, he designed the study in such a way to find out how the scenario in futures society actually looks like. From a poll of 125 futurists, who entirely wrote about their involvement in futures studies and future oriented research for this sake, Inayatullah ended up with finding that the scenario in futures study is not as pale as depicted by critics.

There are many different futurists who perceive the future in different ways, and some want to deal and construct the future in different way as well. Futurist Erik Boulding has faith in the seeds of hope; he believes that if the seed of a brighter future can be planted, then, that can synergize a peaceful and healthy future of the community. Similar notion was depicted from Tony Judge’s account as he refers that too often a
grand idea is ruined due to the lack of proper management and responses. For him, Futures is not just a tool to foresight what is coming, but it is to redesign what we do today to shape up a better tomorrow.

**How to see the future?**

In a fundamental study about futures, Inayantullah (2008) discusses about the foundational concepts which constructs the basics of the concept of future. The concepts that make the future more understandable are the used future, the disowned future, alternative futures, alignment, models of social change and the uses of the future. These concepts state that there are many societies that imitate the present of other societies to construct their future for betterment, sometimes without even considering how much better it can bring. The basic idea is the used future, but as the case stands, while imitating the other society they might have wrongly justified some of their own resources which could have brought them even better future, this idea of disowning owned resources in constructing a future is depicted as the disowned future.

According to the study there are also six key questions about the future when an individual is dealing with it. Curious individuals about the future should ask what sort of future they want (will), what is the most fearful feature in constructing the future (fear), are there any hidden assumptions in the predicted future (missing), what are the alternative futures (alternatives), which alternatives are preferable (wish), finally how to get to the preferred future (next steps). Based on the questions regarding the future, Inayatullah (2008) then unfolds the six key pillars for transforming the future. Those six pillars are mapping, anticipating, timing, deepening, creating alternatives and transforming.

It is highly important to know how the past has been for a certain phenomenon to predict how the future will be, in doing so researchers need to study the past and present to understand the underlying trends and make a map of the scenario. Based on the map, next comes anticipating the future where individuals should try to anticipate the outcome of past trends and the causal effects of such trends as well in the future. Timing is also a very important notion to understand in constructing a future for a specific industry or phenomenon. From the trend and anticipation, it is vital to point out how is the practice of change taking place within that certain phenomenon.
Within the literature about time scales in future studies Nordlund (2012) summarizes the view on this from the best known futurists, by looking into their work and how they perceive the time scale, time frame, time horizon in their studies. In his work, Nordlund (2012) noted that there are many futures work that had been done without definitely or indirectly mentioning the time frame of future intervention, rather some of the works were more like prediction than foresighting. Among the others which had either direct or indirect mention of time span, time scale or time frame for the futures work included terms such as short-term, near-term, medium-term and long-term. From the extensive literature survey he did, the most used range of time within the sample papers lies between 5 years and 50 years. 5 years being the short-term and 15 to 50 years being the long-term intervention range.

His work complements Brier’s (2005) prior research on the same topic where Brier had a different approach in understanding time frame within futures studies. Brier’s finding about the time frame was virtually the same, but he mentioned few things additional to the time frames as a precondition. According to him, some futurists might fancy foresighting future too far to get attention, but the fact is, the further future one wants to see the more complex it gets and the precision starts to deteriorate due to exponential complexity it brings to the analysis. He used a survey on futures researchers to collect direct empirical data in validating the time horizon each individual futurists uses. Researchers need to understand and find out if change within the phenomenon being studied come without any trend, or is it linear, cyclical or spiral trend that the phenomenon usually maintains. If answer to this question about the time behavior is found, it becomes significantly easier to time the construction of future. Once the timing is understood, then it’s the task of deepening into the future.

One of the most widely known tools for deepening into the future is the Causal Layered Analysis (CLA), which introduces 4 different layers of the future; Litany, Social Changes, World View and Metaphor. To go from litany towards myth and metaphors, researchers need to articulate probing questions to find out deeper insight on the phenomenon. These ideas about the layers will be discussed more descriptively in following parts of this chapter. But the core notion is that according to the timing of the future intervention that has been identified, individuals can decide how to intervene there at which layer of the future. On a general level, the longer the time span of
intervention, the deeper the future is being intervened. Finally, individuals need to design alternative futures to really transform the future as they want it to be.

Since the core objective of this study is to discover future developments of business models within an IoT enabled health care sector, it is ideal to utilize the best-in-class futures research technique which suits best to the context. This study will utilize Causal Layered Analysis (CLA), first introduced by Sohail Inayatullah without precise time frame, but with an approximate 15 to 20 years as the long-term parameter of development of the phenomenon as to study the future and sustainability of business models within the industry. With CLA, we get 4 different layers of analysis, which will give us the space to think about the future of the business models in the healthcare sector enabled by IoT. CLA will be used to look beyond the general face of the phenomenon (Litany) and go deeper (World view and Myth) to find out how business models will look like in the healthcare sector. Findings from this will provide us with a probable picture of the future, thus which can be used to act in a way so that the future is achievable if the probable future is also preferable, if the findings of the study are not preferable then strategists can use actions to avoid the probable future which is undesirable and construct another alternative preferable future. The next part of this chapter will focus on causal layered analysis as research methodology, the benefits and drawback that it brings to the study.

4.1 Causal Layered Analysis

Causal Layered Analysis (CLA) was first introduced as a research theory and foresighting methodology by the Pakistan born futurist, Sohail Inayatullah in the 1990s though its conceptualization goes back to 1980s (Inayatullah 2004). As Professor James Dator states, almost after 40 years of Delphi’s introduction, a new and major futures method, CLA, was brought into light as an efficient way to categorize multiple views of and about the future (Inayatullah 2003). Inayatullah introduced this new technique which is an expansion on the previous work known as Critical Futures Research by Richard a Slaughter (Inayatullah 1998, Slaughter 2002:495).

CLA involves integrating empiricist, interpretive, critical and action learning modes of knowing to unleash the future. Unlike other foresighting methodologies, CLA does not involve predicting the future rather it focuses on creating transformative spaces to
create preferable and alternative futures. CLA usually is applied to go into deeper future as one of its specialty and longer-term policy change. This study will also use the methodology to find out what is happening within the business models of an IoT enabled healthcare sector at a reasonable far future. CLA, as a research theory is mainly based on the poststructuralist view. Inayatullah (2004) argues CLA goes beyond the shallowness of conventional research methods and moves both vertically and horizontally when dealing with a specific issue to understand the context better in constructing an alternative future.

CLA has four different layers of analysis, each of which talks of different level about the topic being studied. This following sub-chapter will discuss about the 4 layers of CLA and then the benefits & drawbacks of the methodology will be opened up. Since the methodology is very nascent within the business models research arena, I will also present a case study which will make it easier to understand how usually the methodology is used in practice. Inayatullah (2014), in his TEDx talk nicely explained that the future is not an empty space or hollow, but it is an active aspect of present which is just yet to be revealed. Inayatullah stresses on the past as it has already “passed”, thus nothing can be done to change that, but with the future ‘doing something’ is possible if properly nurtured. With imagination of alternative futures we can design policy changes and deliberate sustainable business models.

4.2 Layers of CLA

As the designer of the methodology, Inayatullah (2005) states that using this methodology researchers can stay on a very surface level of future or they can dig deeper into the future. Most of today’s studies barely go into deep enough to find out the foundation cause of something happening. But CLA provides us with the proper tool to do so. There are four layers of analysis in this technique, they are: Litany, Social causes, Discourses/ World-view and Myth & Metaphor.

The first level of CLA is titled as “Litany” which represents numeric trends and quantitative issues. Among the four layers of CLA, it is the least deep. There is almost no depth in the analysis at this layer and also no interconnectedness among the variables available within the context being studied. Inayatullah (2003) marks it to be the conventional level of depth in usual futures research which sometimes can create
political disagreement. As the data in this layer most structured and quantitative, analytic requirements are thus kept low just for that reason. This layer of analysis is most clear, visible and apparent which require least amount of probing questions and often none.

The second layer of CLA is the “Social Causes”. In this layer we take the findings from the litany and take it fur deep with probing questions to find out the social causes, which includes economic, historical, political and cultural factor in analyzing. In this layer interpretation is given to quantitative numeric data for explanation. According to Inayatullah (2003), this sort of analysis is often used by policy institutes and published as periodical editorial pieces. Unlike litany, there are usually questions posed to the data that is being used in this layer but making sure that the paradigm of the context is not questioned but kept as it is.

The third layer of the CLA is even deeper than the social causes and it is addressed as “discourse/Worldview”. This layer as the title suggests is concerned with the deeper structure of the discourse of the issue in focus and supports that. In this layer, we try to find deeper social, linguistic, cultural constructions that are not variable based on actors, termed as actor-invariant by Inayatullah (2005). According to Inayatullah (2005) discerning the deeper assumptions behind the subject is most important in this layer. In this layer researchers can challenge the findings from the previous two layers and ask questions to find answers to deeper probing questions. It provides with a bigger picture of the issue with deep analysis as it comes with a worldview answer which goes beyond the social boundary.

At this layer not only the causes of a social discourse can be found but it also provides us with an understanding how is the discourse being constructed and how does constitute the overall environment around it (Inayatullah 2003). On this note, Russo (2003) argues that while working in this layer we will find that the issue being studied is often affected by the emotion of tradition and customs of the respective cultures. This notion is important to point, which can be a significant point to mark as the usage of mobile and mobile apps have gained supreme popularity globally, which is one of the major elements of the study. Russo (2003) argues that questioning in this layer is concerned in revising a problem and constituting a strategy to revise such issue.
The fourth and final level of analysis in the CLA is called *Myth/ Metaphor*. In this level we are supposed find inner deep stories that best represents the problem we are analyzing. Slaughter & Bussey (2005) states that, this layer of analysis is concerned with finding the deep stories and collective archetypes that shapes our unconscious and emotional reactions to issues and events. Inayatullah (2003) marks it nicely that this level is less linguistically specific but more visually evoking with choice of metaphorical words. Subject related metaphors are often difficult to identify and connect for some users (Wildman & Inayatullah 1996), but it is highly important to identify a really well connected metaphor or myth to explain and analyze beyond the worldview.

Asking the proper questions in each different layer of the CLA is crucial to gain better insight of the phenomenon. According to Russo (2003) CLA is actually a methodology of asking the right questions to uncover the deeper stories of a problem. Each of the layers of this method has its own boundary and specific characteristics but still they are connected to each other due to the core problem being the same. A normal academic analysis usually tends to stay on the “Social Causes” level and very occasionally they go beyond that. But to get a deeper and a root answer to the problem, the deeper we can go, the more real answer we get.

### 4.3 CLA Characteristics

CLA is one of the most modern foresighting methods that can travel both horizontally and vertically within the subject sphere in solving problems (Inayatullah 2005). In an earlier work (Inayatullah 2003) he drew the overall context of CLA by saying that the way one frames the problem actually creates the solution. In CLA, the use of language is not integral but not neutral as well, it is a very important part of the analysis. Finally, Inayatullah (2003) mentions that the deeper one goes with the layers, the longer lasting analysis and solutions are being done, but along comes the twist of relational complexity to achieve the solution.
The above presented figure is adapted from Inayantullah’s work which very nicely complements the layers to each other. According to the framework, *Litany* is the tip of the iceberg and *Myth* and *Metaphor* is the base of the pyramid. This framework suggests each of the layers have their own breadth and minimal depth of analysis; they are also directly connected to the layers that are adjacent to them. Based on this, Inayatullah (2003) also marks that researchers can either study a specific problem horizontally being in one specific layer, or they can choose to move among the layers and discover the state in varied depths vertically.

On the horizontal level, we are supposed to identify the problem, identify potential solution &, identify potential solver and source of problem information. Horizontally the problem and the solution might look pretty simple, but the issue with this perspective is with this perspective no one can see the further deeper future. It seems easy to do, because the line of questioning is held constant and not any deeper than the standard fixed. To look into deeper future, researchers need to start pivoting vertically and analyze more intensely. With vertical analysis, CLA can go to root of the problem or go up to a superficial level of the issue using myths and metaphors. While speaking of dealing with the vertical layers of CLA, Slaughter (1997) states that CLA is a
groundbreaking tool to go deep but not just stay on the surface of problem to study the common empiricist and predictive orientation, but what he emphasized heavily is that it might be a bit challenging to handle for practitioners at first. Problem construction and designing solution in each layer of CLA is different than the others.

On the *Litany* layer, problems usually seem to be unsolvable for general people, thus is upto government or someone with such power to handle. In the *Systemic or Social Causes* layer, it involves short-term historical analysis; it attempts to accumulate causal variables to articulate a solution. Often the solution comes in a partnership of institutional establishment. For the *Worldview* level, it involves the genealogy of the problem to go in deep of the problems. Solution can be rendered in form of individual’s conscious actions or also actions by voluntary associations to change or rule the discourses. For the final *Myth or Metaphor* layer, solutions can rarely be rationally designed (Inayatullah 2003), rather it is the task of a leader or an artist to express deeper meanings of the state of the problem and a solution.

### 4.4 Why CLA for this study

This study accumulates three research agendas from across disciplines; business model, internet of things and healthcare sector. Overall, the research setting for this study is quite complex. If the methodology to conduct the research is not chosen wisely, it might prove to be very difficult in the end to maintain focus and manage multifaceted complexity. Due to the goal of this study is to uncover the future of the context, the utilization of a credible foresighting method is beyond argument. CLA with its 4 layer helps segmenting the problem and analyze them accordingly.

CLA looks at the future with a layered vision with the capacity to move beyond the limitations of conventional foresighting techniques as most of other methodologies often fail to unleash the internal stories, worldviews and discourses of the problem (Inayatullah 2003). Inayatullah (2003) stresses that CLA overcomes the conventional foresighting methods by including the metaphor level in the analysis. Usual foresighting methods tend to offer packaged futures which in most cases miss out considering important variables. Instead, CLA does not offer predicting the exact future but provides with an open space for the development of preferable discourses.
For drawbacks, CLA sometimes seem to be a bit too much complex for starter researchers as mentioned by Slaughter (1997). Moreover, there are some settings where conventional empiricist foresighting methodologies already dominate, in those cases CLA might lead to cognitive dissonance and internal decisional dilemma (Inayatullah 2003). Thus practitioners in such environment tend to reject CLA due to the complexity it brings with multiple layers of problem solving. However, being an early stage researcher I consider it as an opportunity and a challenge to use CLA for this study. Upon careful application of CLA in this study, results can give us significant insight of how the industry might turn up.

According to the pioneer of CLA, it is better applicable in workshops setup to support scenario building (2003). CLA can be used prior to scenario building in vertical space allocation for certain problems. With growing popularity, CLA is now being used in policy development. Referring back to Inayatullah’s (2003) list of benefits of CLA, following are some bullet points.

- The range and richness of scenarios can be expanded by employing CLA.
- In a workshop setting, researchers can try include different ways of knowing amongst participants.
- CLA attracts a wider range of viewers for the results as it goes from the surface level to the deepest level with artistic and poetic metaphor as well.
- CLA breaks the conventional foresighting ideology of studying the surface issue and goes deeper to find out the root cause.
- It allows for a range of transformative actions by different actors.
- With CLA policy actions can be developed, which can be informed by alternative layers of analysis. CLA also leads to sustainable policy actions which radically solve problems instead of reinscribing contemporary issues.

CLA as a futures research methodology is complex to some extent, but there are benefits of overcoming the challenge. It helps us to see how an event could evolve over time logically. It talks about empirical information, social causes, global discourses and metaphors to simplify the problem. It can be considered, with the theoretical understanding from the previous chapters on healthcare, internet of things and business
models; CLA can help create the conceptual space that is needed to find out the probable futures of the studying set. In the following chapters, I will discuss how data have been collected and analyze them for scrutinizing.
5. Research design

This chapter presents the research design of this study in detail. To deal with the empirical part of the study, presented theoretical framework is used as the foundation for collecting, understanding and analysis. In this chapter, the research strategy is discussed followed by justifying the data collection method. This chapter also includes a brief discussion on how CLA has been applied in this research.

5.1 Research strategy

Theoretical concepts of Business model and CLA have been discussed to deep extent and also the context of IoT enabled healthcare sector is presented in the light of development till date in the previous chapters. Since the future is elusive and business opportunities are also difficult to identify sometimes, this study realizes that the most suitable methodology for conducting this research is to use qualitative approaches. This line nicely comprehends the basics of CLA, since purely quantitative data will obstruct deeper qualitative analysis. To delve into deeper layers with CLA, empirical dataset should be translatable in a qualitative manner for wider and in-depth understanding. Qualitative methods provide researchers with flexibility and sensitivity to the context that has been less explored, and it can help understand how things work in a particularly complex setting (Mason 2002).

Patton (2002) argued that usually the research strategy have a direct impact on the general direction of a research and it explains the decisions of a research that it makes in the process. According to an earlier study by Yin (1981), four different research strategies can be identified for qualitative research; they are case study, experiment, history & simulation. Realizing the fact that the interest of this study is the near and far future of a specific sector, which is not understandable by all the players in current market; case study was observed as the most suitable strategy. By not focusing on a single company case, this study tempted to organize a case by accumulating different stakeholders from the affiliated industry to understand the future market translating the current and previous market history.

Case study enables a research in a context-sensitive way to learn deep phenomena, which can be exclusive and advantageous when the researchers have very little or no
control over the context of the study (Yin 2003). At one hand, the technology market is aggressively progressing and, on the other hand, futures market settings are undoubtedly challenging; which makes the scope of this research complex from a control perspective. Additionally, qualitative case study methods help researchers to collect and utilize data from multiple sources in multiple types to get a better understanding of the topic under research (Dubois & Gadde 2002). Qualitative case study approach is widely used in examining groups, individuals and relations between organizations and within industries (Johnston et. al 1999).

There is no specific standard for a qualitative case study, making it the task of the researcher to formulate and contemplate a suitable approach to collect and analyse relevant data to better find targeted answers to the research questions utilizing case experience, wisdom and creativity (Gummeson 2003). There were certain limitations for this study which at times encouraged combining multiple cases as preference, however to keep the dataset as cohesive as possible the author has formulated a single wider case of the future IoT enabled healthcare sector bringing together various stakeholders. One major goal in the data analysis procedure for the research is to combine the theoretical understanding with empirical findings in a way that no misinterpretations are concluded. Because the topic of this study is wide and the research methodology is less utilized in business research till date, it will make the task a bit more challenging requiring the researcher’s ability to manage the work in a smart way.

Single qualitative case study allows the researcher with an aligned dataset at one hand, however it is important to define the case in a way that both context and theoretical concept of the study is visible in the best possible way. For qualitative research, it is also significant that the empirical data reflects deep enough features of the phenomenon that can be analyzed to deeper logic of the theoretical issues. This clause is considerably applicable for this study, since CLA requires deep stories for analysis in the deeper layers.

This research tends to deal with the contextual setting of an IoT enabled healthcare sector from an industrial/managerial perspective, besides the academic interest of this study is to find a deployment logic of business models as a futures technique. In doing so, it is necessary that the empirical data vibes the theoretical logic of both business
models and foresight. At the same time, the complex context of this study requires a dataset to be coherent, so that an overall future can be constructed in light of the existing literature and historical progress of tech-based healthcare advancements.

Thus it was central for the aims of the research that a network of relevant actors is located to have deep insight of the sector regarding current status and also the futures business model logics of an IoT enabled healthcare sector. Additionally, a good network should obviously benefit in collecting rich data to support the aims of the study with various viewpoints but a common objective. The case network was chosen with the support from the extended network actors of the DIGILE Internet of Things project, where different stakeholders from the futures industry could be interviewed.

This research embraces all the limitations and challenges in conducting the studies. Too many and serious limitations often pose questions about the reliability and validity of a research. A following sub-chapter in the discussion and conclusions chapter describes how this study ensured reliability and validity (chapter 7.4) from a scientific point of view. Also, limitations of the study are explained by the end of this thesis (chapter 7.5).

5.2 Data collection and analysis method

In this subchapter, the case network is further introduced and the data collection method logic will also be discussed. The topic of this study revolves around healthcare and Internet of Things as the contextual setting, Business Model as the theoretical concept and Causal Layered Analysis as the research methodology. Utilizing the advantages of CLA, in this research it is intended to uncover the business logics behind a technology enabled healthcare sector for the future especially fostered by IoT. Deep understanding of the context, concept and methodology was needed to make sure that the highest quality of data can be gathered. Different alternatives were considered as a mean to collect data before actually starting the data collection act, namely: surveys, workshops and interviews.

Survey as a way to collecting data was considered during the early stage in this study. But, a survey framework would have been a too narrow approach to collect deep enough data uncovering different causal logics. Surveys usually best provides
quantitative data and tells about the surface layer of the problem. Even with open ended questions survey, it would have been a challenging task to generalize numerous views from respondents for detailed qualitative analysis. Another challenge will be to fit an open ended qualitative survey within a master’s thesis scope where all four layers of CLA can be accommodated in a decent way. It is also realized that if all four layers are included in the survey framework then it might be too long as a questionnaire and would impact respondents’ behavior and responses while dealing with the final layers. As it is ideal to move within the four layers with sustained focus of CLA, it seemed justified to look for alternative approach to gather data to avoid such challenges.

Optimists of CLA argue that the methodology best couples with workshop setting in order to get premier quality data and to ease the task of creating future scenarios. However, the context of this study deals with a sophisticated industry requiring involvement of experienced campaigners from healthcare, network industry, business model enthusiasts and also people who can think about short-term, medium-term and long-term future maintaining a realistic logic. Organizing a group of people for a workshop complementing such professional backgrounds has proven to be a challenge. Hence, accumulating numbers of professional on a single location was a difficult task and opened up a different option for gathering data for the study through one on one interviews.

Considering the challenges of survey and workshops in this study context, conducting semi-structured interviews is finally selected to get deep understanding and reasoning behind what each participant is thinking about the phenomena. Interviews are a handy way to delve into a problem and it becomes even more useful when we know about our target. For this study, a case was organized by accumulating professional opinion from the industry and from different stakeholder viewpoints. This study collected relevant qualitative data through structured interviews within the start-up scene in Finland, the Finnish health tech arena, healthcare research arena and network service providers. All of the interviewees are in leading roles in their organizations and have deep understanding of the industry from their standpoint as stakeholders.

Five face-to-face one-on-one interviews were conducted for the purposes of this research during May, 2015 and June, 2015. Individuals who were interviewed includes the CEO of one of the emerging wellness startups in Finland called MoodMetric, the
MD of Salwe which is a health and wellness research organization coordinating pre-commercial research within industry and academia, the CEO of Health Innovation Academy, the innovation and business architect at Ericsson Finland R&D Operations, New business development team and the MD of Finnish Health Tech Association (FiHTA). Each of the interviewees agreed that their occupational identity can used for the thesis purpose and have confirmed that no trade secrets were not discussed during the interviews, thus the overall dataset can be used for analysis thoroughly and presented accordingly.

The interview framework was structured with a qualitative stance to understand the futures business models in the IoT enabled healthcare sector from the experienced campaigners in the industry in Finland, therefore, we could accumulate a realistic and high quality data set for analysis. Interview framework that is used for the interviews is presented in the Appendix 2. Despite the structured framework, questions were presented with suitable wordings and timed necessarily making the interviews more semi-structured. A summary of the interviews and the participants are presented in the following table.

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Role of the interviewee</th>
<th>Date of interview</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>NV</td>
<td>CEO of a Wellness Startup, Moodmetric oy</td>
<td>26/05/2015</td>
<td>75:26</td>
</tr>
<tr>
<td>TK</td>
<td>MD of FiHTA</td>
<td>27/05/2015</td>
<td>88:14</td>
</tr>
<tr>
<td>SH</td>
<td>MD of a medical research shock, Salwe Oy</td>
<td>29/05/2015</td>
<td>43:50</td>
</tr>
<tr>
<td>JH</td>
<td>Innovation and business architect, Ericsson Finland R&amp;D Operations, New business development</td>
<td>03/06/2015</td>
<td>67:36</td>
</tr>
<tr>
<td>EK</td>
<td>CEO of Health Innovation Academy</td>
<td>30/06/2015</td>
<td>74:37</td>
</tr>
</tbody>
</table>

*Table 7: Interviews conducted for the research*

Each interviewees were informed beforehand that the interview is likely to take 70 to 90 minutes to cover the overall discussion thoroughly. However due to other professional engagement of one of the interviewee, that specific interview was wrapped under 45 minutes. But the questionnaire was not shortened in a way that
important elements were left out, rather few questions were coupled and probing questions were limited to some extent to cover the time and bring a conclusion.

Since the objective of this research is to try locating few of the business model elements of the future market, the framework was designed in such way. Intention was to develop multiple scenarios of the future based on the empirical data. This study wants to understand the short-term, medium-term and long-term probable future of the context. In doing so, each interviewees were asked with the same question set with variable time frames. Interviewees were given a specific time frame in future/present and was asked to respond to the questions according to their opinion.

To make sure that the responses are not overly skewed by one responder’s opinion for the longer time frame, two interviewees were given the same time frame for the longer time frame who has hefty amount of experience of working in the industry. One of the interviewees were asked about the current and recent past, another one was asked about the short-term future and the other interviewee was asked about the medium-term future. The concept of varied time frames in the future were kept aligning the conventions in futures research as 5 years for short-term future, 10 years for medium-term future and 15 years for long-term future (Nordlund 2012).

Interviewees were contacted via email well before the interview date to confirm the meeting and an introductory note about the topic of the study was shared with each of the participants. Besides that, at the start of each interview a brief introduction of the overall setting of study was presented without creating a bias on the responder’s thought process. All of the interviews were also recorded with prior permission for transcription purposes.

All the interviews were conducted by the author of this thesis being the sole interviewer. An interview framework (Appendix 2) was developed with detailed focus on each components of the thesis topic. The interview framework mainly covered the concept of CLA and business models as the underlying taking into account the context of IoT enabled healthcare sector in Finland. Though the framework helped the questioning process, but the questions were often presented in different styles and varied sequence which suited the situation best for a cohesive discussion rather than a Q&A session. The framework worked as a guideline more than being a stringent order
of procedure. Each interviewees were also asked for additional opinion that was not covered by the framework but might be relevant to the study. The framework helped making sure that the discussion covered all required themes that was intended to cover the theoretical issues alongside industry information.

All the interviews were conducted in English as the author’s capacity of Finnish is elementary level, despite all but one of the interviewees’ native language is Finnish. However, the use of English as the communication language overcame any barrier that might have caused should the author intended to conduct the interviews in Finnish.

After the interviews were conducted, they were transcribed from the recordings attentively so that no important notions were left out. Kowal & O’Connell (2004) asserts the idea of transcription as to bring the characteristics of a specific discussion to a visible form in order to make that permanently usable for scientific analysis. Each interviews were transcribed by the author as soon as possible after the interview was conducted. Transcriptions were also shared with the interviewees who requested to take a look before using it for the study.

Data analysis starts with the process of transcribing, however depending on research goal and strategy analytical techniques may vary. It is ideal to formulate an analytical strategy which will accumulate multiple analytical techniques in the end. Yin (2003) marks examining, classifying, tabulating, testing or combining qualitative and quantitative evidence to address the initial propositions of a study as the data analysis procedure. Interviews in this study were analyzed with such stance against the theoretical understanding gained from extensive literature review.

Yin (2003) also mentions that the preferred strategy in data analysis is to follow the theoretical assumptions and propositions as the research objective surrounds similar aspects in most cases. Since, the theoretical review has been quite extensive in this study and the amount of theoretical logic is quite heavy, it will be ideal to follow those propositions and not extend the width of the study anymore.

In analyzing the dataset gained during the interviews three (3) linear progressive scenarios were designed; short-term future, medium-term future and long-term future. Scenarios are very prominent way when dealing with futures problem as it can be seen
from the futures research arena. Additionally, creating futures scenarios can help prepare an industry digest prospective surprise in a better way.

Very few direct quotes from interviews have been used in this thesis since opinions of interviewees were actually utilized in constructing the scenarios. Scenarios were shared with the interviewees once they were developed which were relevant according to the time frame concerning the specific interviews to make sure there were no disagreement in utilizing their opinion. Though the scenarios were designed basing the interview outcomes, researcher has put keen effort in articulating a detail discussion to a concise scenario and also combining discussions from multiple interviews into one scenario.

CLA as the methodology is employed in a qualitative manner to analyze the interview outcome and in creating three future scenarios of the industry. Empirical data gathered has been analyzed to find out congruency within the whole data set in constructing the scenarios. These scenarios show us different business model elements and how they evolve and change over time in the future. These scenarios are built with the continuity kept in mind and designed as a series of scenarios for the long-term future. Since CLA works better with scenario setting, we designed these scenarios not only as presenting some business model elements but we also go deeper to the systemic, worldview and myth layers to understand the deeper logic in justifying how feasible the projected future is from causal perspectives.

In the following chapter, three linear progressive scenarios will be presented which has been constructed from the interview outcomes with CLA perspective. Following that an analytical discussion on different business model elements’ evolution and additional theoretical issues that has been assumed in the earlier part of the study will be displayed to understand the feasibility of such changes in the future.
6. Findings and data analysis

This chapter exhibits the reflection of collected data and an analytical discussion. The chapter opens with three linear progressive futures scenario about the IoT enabled healthcare sector in Finland. Since the data collection involved a focus on business model elements of the context, each scenarios will present hints of different elements as well. With that being presented, following part of this chapter will discuss feasibility and reasons behind such elements acting in certain ways in the future. This discussion is mainly segmented based on the three core questions of business model wheel; what, how and why (Ahokangas et al. 2014). Besides these three aspects of firm specific business models, additional industry wide issues will also be discussed.

6.1 Futures scenarios

Data collection of this research involved Finnish experts and scenarios presented here are also concerning the future business models of IoT enabled healthcare in Finland. The surface level of each scenario is first illustrated with a CLA perspective, and then the researcher tend to find out underlying logics and relations between them to understand the feasibility of reaching these futures. In the created scenarios, the short-term scenario represents the business-as-usual future for five (5) years from now titled as “the ploughed field”. The medium-term scenario indicates the probable future for ten (10) years in the future from now is named as “the breaking dawn”. Finally, the long-term future scenario is considered as the preferable future called “the ant super-colony” which indicates developments in the market for fifteen (15) years from now. On the litany layer of CLA, researcher tends to identify the business model elements in each scenario and then move deeper to understand the social causes and worldviews. Finally each scenario is summarized with relevant metaphors as it is advised within the CLA framework.

Short-term future: “The ploughed field” scenario

Litany: IoT as an emerging technology will start marking its footprints in patient care industry, wellness and health tech in one way or another. This is because at the moment we are spectating cuts in social sector, thus healthcare expense will rise and an obvious way of saving is through using efficient technology where applicable. Assisted living
and elderly care will provide first big opportunities for IoT services in healthcare for Finnish companies. To grab those opportunities companies need to be ready with proper services through a connected society in a digital way.

Public sector as customers will still be the major payer of services in this industry for the short-term future despite certain cuts in the health sector. However, different wellness services powered by IoT will gain momentum in revenue generating business mostly from the private consumers. A lot of startups are now designing health related solutions and waiting for medical acceptance for their services. In the short-term future some of them will get acceptance and companies will start understanding the requirements better than now to make their products/services medically accepted. Online digital services like MyData and Kanta will gain more visibility and acceptance in the society in the short-term future. Though, the question of transparency and data privacy will remain high as to how the data will be used. As being promised that users will own their own data and have the authority to allow access to others to their personal data. In that case, questions will persist on how companies would operate profitably who design their business models based on big health data and health data mining if mass people reject participating in data sharing.

Startup scene in Finland will be active and operating within the healthcare sector and thus the search for funding will be consistent. Finding sustainable funding solutions will be one of the major operations besides innovation. Technology based product lifetime has already shortened; health service/product providing companies will understand it better and will start designing innovative service based offers to some extent. Basis of pricing for different services will accordingly start changing; a lot of new pricing models will appear for testing in this short-term period. Point of care providing will start shifting from hospital/clinics to other personal domains. But at the same time, the evolution of hospitals in Finland will be slower than the private organizations. Hospitals in Finland have their own digital services, but having all of them under one standardized comprehensive system will be a challenge in the short-term future.

Wellness sector will help in gamifying one’s health and getting healthy by looking at statistics with their value proposition. The care sector will be more concerned in offering digital services for the young digital natives; this will take due to the pull from
consumer needs. The mentality for competing will start changing. Organizations in the sector will realize the need for partnering up and taking part in a network that complements each other’s needs. To keep up and gain competitive advantage, companies need to evolve all the time regardless of their size and functions.

Major cost drivers for this industry on the short run will be the R&D for device innovation itself and the network & infrastructure cost. There is currently a blind spot in the health industry in understanding the extent of network cost, which will likely to come as a surprise. There are network providers in the market with proper readiness for the industry but small companies might find it challenging to meet the expenses for a perfect connected solution when they will need it most.

Systematic/ Social causes: The online social networking paradigm has changed the social practices to a great extent in the recent past. The concept of being connected has evolved over the past few years. People are adapting digital service more than ever, but still there is a group which will stay vigilant about matters like privacy and security. On top of that, we also have the technology available which is improving fast, enabling companies to offer more digital services and offer more jobs in Finland.

Technological advancements is very quick and of supreme quality in Finland if compared to many other countries. However, according to an Yle (2015) report that Finns no longer believe to live in an equal society. With growing inequalities in current market, it might just take a leap in the short-term future during any necessary reforms. IoT enabled healthcare services can play vital role in reducing disparity issues. But, increasing rate of unemployment might as well hamper consumers’ purchasing power for alternative advanced solutions for healthcare.

Worldview: Economic conditions of individuals, societies and countries have major impact when it comes to healthcare. If Finland is still struggling from an economic point of view in the short-term future due to less export activities, increasing rate of unemployment and other policy related issues, then that will have direct impact on healthcare budget. On the other hand, depending on geolocation and economic condition, a person’s choice of healthcare remedies varies. Thus companies will also have to think differently when designing products for international market. The same product will not generate similar revenue in a North American country and a Sub-
Saharan African country due to the difference in social situation. Access to Internet also will play a vital role in the expansion of IoT healthcare services in that sense. IoT enabled products will definitely rely on connectivity to greater extent, but distributing such solutions to places with poor connectivity will likely face challenges when dealing with price competition.

Metaphor/Myth: The short-term future of the IoT enabled healthcare sector in Finland is metaphorized with a field that has been recently ploughed. Seeds were not planted but wind and birds brought different types of seeds to the field which has started sprouting. There are also some very old and big trees to provide shadow to smaller sprouts. But these big old trees will also need to fight for their own sustainability. A good understanding and symbiosis is needed among the new sprouts and the older trees. Some of the sprouts will live longer-term and some of them will die out. There are also a lot of good insects in the field to help trees grow faster and be fruitful. In time, this field of sprouts will be an orchard of various kinds of tasty fruits.

Medium-term future: “The breaking dawn” scenario

Litany: IoT as a technology to boost the healthcare sector has made its mark real in this medium-term future. There will be numbers of business networks working within healthcare, wellness and health tech arena. Businesses will evolve from B2C to more B2B models by then. A lot of products and services which were previously technology based, but did not utilize the real power of cloud and Internet, will start realizing the benefits. Many more health tech and wellness solutions will get medical acceptance to do business as medical solutions. Services will be enabled by different software and applications where we do not see them now. Insurance providers will partner with companies offering different health related services. We will also see more cooperation among companies who have medical certification of their products and hospitals.

Cooperation among companies instead of neck and neck competition will be higher, thus networks will perform better. However, the stride towards something bigger than networks will be taken, which can be referred to as ecosystems. At the moment the concept of an ecosystem is still somewhat abstract. By then, market players and researchers will develop scientific knowledge to define an ecosystem and how to converge more companies in networks and networks into an effective ecosystem.
Since Finland’s strongest link is its technology development, companies will be doing that persistently. Some major business activities will be outsourced to third party service providers. Companies in Finland in this sector will realize the domestic market size is not big enough for globally competitive business. Thus they will start internationalizing more in numbers with their high quality certified IoT enabled healthcare solutions. Product service quality, accuracy, reliability and trust will be the major issues in gaining competitive advantage than fighting with price of other products in the western market. There will be some companies who will differentiate their products in pricing too. Companies differentiating with price are more likely to expand in the Asian and African markets. And companies differentiating with accuracy and reliability are likely to expand in the North American and European markets with higher price margin.

Marketing and sales alongside human resources will likely incur the major share of expenses due to outsourcing of activities. Business opportunities in this era will be endless for IoT enabled healthcare solutions due to the fact that the digital natives will be the drivers of the society. This group of people will be everywhere in this medium-term future, they will be the consumers, and they will be researchers, innovators and legislators. Their understanding of technology will boost the acceptance and mass adaption of such services. The wellness sector will see a massive boom in this medium-term future due to mass adaption.

Pricing models will vary compared to the previous era by going downwards than before. This will happen due to a flourish of numerous products available in the market. Also there will be a price pressure from within the customer groups who will tend to prefer more economic solutions with smart results, however there will be companies with superior product quality or brand who will price their product on the higher end. But the reduced price structure of the market would not likely gain any advantage for a specific organization since the overall price within the sector is expected to be reduced.

Systematic/ Social causes: Numbers of companies look for profitable exits from the market, thus the decision for outsourced activities seem legitimate. Digital natives will obviously have impact in the mass adaption of more digital services. We might start
seeing abandonment of many medical solutions that are still popular at the moment will be replaced by tech based solutions.

On the contrary, the dark side of digital living will make people lazy and will lead them to an unhealthy life. That will eventually encourage people adapting IoT enabled wellness solutions towards a healthy life. Working people will be working more than regular shifts to keep up with the global competition which also increases the need for additional health attention. Finland with an obvious tiny population needs it to be working efficiently all the time and even more during the days when the country will be trying to recover from a crisis. Thus, keeping up a fatigued workforce will be vital for keeping up the country’s economy.

*Worldview:* Global business competition will have direct impact on how the country’s industries will operate. Golden days of the Western countries are long gone. A country with a population of less than 6 million and not a significant group of immigrants will have to work more than ever to keep up with highly volatile global competition in each sector. At the same time, the recent trend in Finland of winding down and minimalistic lifestyle in one’s retirement age will also offer some opportunity to offer simplified multipurpose solutions.

*Metaphor/Myth:* We compare this medium-term future with the summer time breaking dawn. When the dawn breaks roosters crow, birds chirp, birds flap together in groups and we as human beings wake up for another beautiful day. The time of breaking dawn is like a calling or a sign for something good to come. The sense of ecosystem building and stride towards that is such a sign. Similarly, mass adaption and acceptance of digital services in this era will signify as the dawn for a better day.

*Long-term future: “The Ant Super-colony” scenario*

*Litany:* On the long run with better understanding of ecosystems and how it operates, we will see multiple ecosystems working simultaneously in a complementing manner. However, by this time we will see many ecosystems been created and perished due to early trial issues. Preventive care and rehabilitation sector is likely to pose most business opportunities alongside the need to create a single global platform for healthcare services. Different streams of technological advancements in different
countries will offer opportunities, including the developing countries with lower margins.

Finnish IoT enabled healthcare industry as a whole (healthcare, wellness and health tech) will be a big export based industry by this time. The role of insurance companies will change significantly; they can even offer health care solutions to citizens themselves and not only partner with healthcare providers. We will be spectating better cooperation between public and private sector. Public sector as a client to pay for health services will regain its strength through national economic recovery. But to keep the health costs to an efficient level, companies in the private sector will be able to sell through public system.

A lot of startups from today will die by then, but on the other hand the surviving ones will become good sized SMEs even if they are growing slowly over time in the sense of human resources. As there will be better working ecosystems in act, value propositions offered by companies will be complementing propositions of other companies to provide a total solution for citizens. There will be countless products and services for healthcare/wellness powered by IoT, but how many will be of the desired quality? Thus, the real value for money will bring competitive advantage for companies. Almost all of the companies will be offering service based pricing and the pricing will also be more value adjusted.

The earlier blind spot for technology cost in healthcare will be better absorbed by then, companies and industry players will get used to the network and technology cost level and understand the need of such costs. The cost will be relatively lower because the R&D for most devices will reach maturity. However, the cost of human resources is going to drive the biggest share of costs.

Finnish companies will find their place in global value chains. This industry will have a good impact on the overall economic condition of Finland. Thus the leaders from the industry will be better heard by the politicians and policy changes will be possible in a comparatively easier way than now.

Systematic/ Social causes: At this moment there is no global giant originated from Finland in the global business picture. There are a lot of tech based health service
startups in the present market. Some of them will survive for the longer period and many more will be created. To make Finland’s economy sustainable, there will be need for jobs and a good portion can be created in this sector. The country needs a constant balance between taxation, regulation and business in this sector for continuous prosperity. For that, the industry first needs to reflect smart gross production by contributing to the national economy and then can be heard by the politicians for policy changes. All in all, Finland needs a healthy workforce that can work its way out with the limited population of the country.

*Worldview:* A large group of aged population against a consistently very low population growth rate puts the faster economic growth in question. At the same time, all the countries in the world are greedy for power, assets and talents. Finland needs to be competent in these fights to retain local talents and assets. Global competition is multifold; companies need to compete with quality, price or accessibility and trust on a global level. Global competition will surely come from both developed and developing countries. Constant balance is thus required to maintain market position. Since Finland wants to stay as one of the leading wellbeing societies and one of the most equal countries in the world, these issues need to be addressed with proper devotion.

*Metaphor/Myth:* We call it the ant super-colony. According to BBC (Walker 2009) earth news in 2009 scientists discovered an ant super-colony in Southern Europe stretching over 6,000 kilometers and populating several billion ants together happily. Altogether this super-colony nested 33 different populations living in a connected system. We are aware of the team work ability of ants. When that is added to the ecosystem idea, it seems like a justified comparison to be encouraged for global dominance. The overall healthcare sector in Finland will have multiple ecosystems simultaneously. A substantial role of IoT in those ecosystems’ building and growth can be seen.

### 6.2 Analysis of Business Model elements

In this section a comprehensive analysis of different business model elements will be presented against the portrayed futures scenarios in the above section. Business modeling is perceived as an act of putting business opportunity at the heart and then
putting up synergic components to best exploit that opportunity in an ethical manner in this study. Thus, this study uses the business model wheel from Ahokangas et al. (2014) as the conceptual modeling tool. In doing so, the following part of this chapter presents an analysis based on three core questions that the business model wheel asks in the process; what, how and why.

Following analytical discussion will reflect the empirical evidence of this research. With a qualitative standpoint, this analysis will justify the linear progressive scenarios and critically pull out multiple facets about the context of the study which should be significantly usable by industry players.

“What” elements

According to the literature of Business Model Wheel, this section asks questions about customer segments & groups, product offering & value proposition and competition & differentiators. In the following paragraphs, business model elements like customer groups & segments, value proposition and competition is discussed for the short-term future, medium-term future and long-term future.

Customer groups

If we think about future customer groups and segments that will evolve or sustain over time for the healthcare sector in Finland, first and foremost the question comes about the role of public sector as customer. Currently, Finland has a strong social structure where public funds are still heavily invested in population healthcare. This takes place in by insuring citizens to reduced prices for different healthcare services.

Public sector also purchases a lot of healthcare services for the population from the private market. This study sees the public sector being one of the major payer of services in this sector in the short-term future despite cuts in healthcare from government budget. Having said that, the scenario in the longer will change in regards to the contribution of government funds in healthcare. About the longer-term future one of interviewees enlighten us with her experienced thought.

“I believe that the amount that will be used in the future will be similar but that won't be enough. So, there will be more need of funds, so
people will need to use more money from their own pocket or insurance coverage.” (TK)

The amount of contribution by the public sector might sustain to an optimum level till the longer-term future. However, valuation of euro has lost 35% since May 2014 to till date (Guardian 2015) which can impact government participation in this sector heavily in the shorter run as well. Given the ongoing crisis in Eurozone, further devaluation of the common currency or as skeptics of Euro suggests a potential return of an individual currency in Finland at some point of time will play a vital role in the contribution of public funding. On the other hand, Euro as a currency have been valuated at similar rates almost 12 years ago and fought its way back to gain better valuation. If the Greek crisis can be handled with proper scrutiny and given that no other similar stories do not unearth, Euro can fight its way back again in portraying a strong Europe. But this might be a huge task for the EU as a lot of Euro skeptics fear due to the developments in the last few years around the Greece situation. Though the economic crisis in the continent is not the focal interest, but this study perceives it to have impact on the growth and progress of the sector in Finland.

Besides public sector as customers, the healthcare sector will see increase in private consumers. In the shorter run we will see the trend rising, by medium-term future that rising trend is likely to overshadow public sector as customers to some extent. This might happen due to increasing personalized services that are connected to individual’s own cell phones, tablets or phablets. High speed internet and reliable connectivity has attracted people’s interest to many different direction, one of them is using wellness applications in cell phones or other mobile devices. According to JH, “I think there is an enthusiasm around using connectivity and using technology to solve problems”.

About the role of consumers as paying customers SH pointed out;

“For the wellbeing business, it is private business and I believe that in future consumers will be more interested to buy different kinds of services.”

This suggests a sustainable market for wellness solutions within the consumer market. But why would consumers be paying for such solutions if there is any prospect of covering that with public funding? A major aspect of public sector funding is, the fund
is allocated for appropriate medical attention, patient care, prevention, rehab and such cases. But there are currently numerous solutions that are not medically accepted but developed to support or assist public health and daily life by monitoring or sensing. Unless these services get proper authentication, public funds cannot be used in purchasing them, rather consumers will have to spend on their own. According to experienced campaigners bureaucratic procedures in Finland prolongs the acceptance of many different solutions. There might be healthcare products and services in the future market which would be launched with a commercial viewpoint than only a service solution to avoid bureaucratic stretch.

Another viewpoint has come up about customer segments that is likely to take a high in the longer run future; the radical faces of insurance companies.

“In 15 years, the insurance companies will probably have much bigger role. I don't know if that is good or not. There will be a new customer group due to some newer approaches from insurance companies. That might bring a major change in the healthcare sector. … It’s not clear in my mind, but there are for instance some companies already started to do things differently. Like, OP Pohjola one of the insurance companies, they have their own hospital. They are also coming to the occupational health.” (TK)

The rise of insurance companies might be evident in the longer run if the current projects show prospective results for future flourish. If it happens, that will also promote business to business within the sector to higher extent outside the public-private relationships to broader private-private relationships. Such advancements will encourage growth of building operational ecosystems that a lot of industry players are talking about in Finland at the moment. The healthcare sector in Finland being an export based industry will need to sustain and grow on its export figures to stay profitable and strong to be heard by other stakeholders in the overall economic arena of the country as the domestic market is too small to generate enough revenue.

**Value proposition and offering**

For exploiting a certain business opportunity, companies must design suitable value offering and propositions for the end users. Customers need to be convinced when they
are making a purchase, be it for themselves or for citizens in case of public sector as
customer. At the moment we can see some innovative solutions with propositions as
“gamifying health by looking at statistics and feel encouraged to do more healthy acts”
(JH). This might be a very niche method for delivering value to consumers as one of
the interviewees (EK) suggests, but if we look at the bigger picture of the overall
healthcare sector then there will be many other methods and propositions altogether to
deliver values.

To clarify the concept of gamifying health, it does not only include some sort of
gaming applications that help by encouraging healthy activities but also includes
services and applications that creates additional interest in regular wellness apps as a
way gaming with own health. We have already spectated some solutions that target to
hook consumers with some sort of psychological tool. Besides the psychological tools,
these solutions are gaining popularity due to accessibility and connectivity benefits.
Once the capacity of such applications will be further broadened by cloud solutions
and instant connectivity on a mass level, their success will be matter of time.

The generation that born during the early 1990s, meaning when the Internet was born
are now matured youth and much younger ones do not have any idea of a society
without Internet. That makes a society that feels Internet as one of the daily mixes and
without it things might fall apart. According to JH, these digital natives are going to
transform the overall healthcare sector in Finland. Within less than a decade these
digital natives will be everywhere; they will be users, legislators, service developers,
service marketers, healthcare professionals. Once that happens, the industry is bound
to exit from traditional services one by one which avoids the benefits of Internet by
some mean. Thus, we are going to see a lot of Internet and connectivity based value
propositions from the medium-term to long-term future.

One more interesting notion that was picked during that data collection about value
propositions was complementation of propositions. At the moment, different
companies offer different values and compete on them. But the specialists in the
industry think in the future we will see them designing value propositions to
complement a partner company’s proposition in creating a total service package. When
this notion is coupled with the objective of an ecosystem, future looks better where
domestic companies intentionally partners on a global scale to compete against global players.

Competition

Business activities are always about competing in the market for a better share of customer and to be able to sell products and services. Though the healthcare sector is more of a social service industry, private organizations will need to fight for profit to sustainably offer specific values. Without continuous profit services will perish, that is a plain truth. So companies are bound to compete with rivals offering similar value.

Currently it can be observed that in Finland healthcare companies are competing based on price, quality, scale and goodwill mostly with domestic rivals. One of the main reason being here is that there is no giant in this sector in Finland and all the companies are looking at the same population to market their product. However, the good side of the story is realizing the necessity of cooperating on some grounds and to do things together. SH states,

“We have competitors working together in research projects because we do pre-commercial research. The companies believe they can build joint knowledge which they all can use in their own way. I also believe in ecosystems, not only networks. Because companies only participate in networks when they need something. But in the ecosystem they will do something together.”

Her notions suggest that the idea of extended cooperation comes from research activities in doing pre-commercial research. However, cooperation during commercial activities will take deeper commitment and mutual understanding in part of contributors. Important point to be realized by smaller firms or start-ups is that cooperation might reduce the profit ratio for a company for certain time, but it will eventually provide sustainable profitability for the company and also for the industry as whole.

The discussion of cooperation as a face of competition reveals the concepts like networks and extended networks as ecosystems. Competition among companies will stay forever, but for greater betterment companies need to come together and create
networks to benefit in times of crisis or need. As mentioned by SH networks are not always as benefitting as they are proclaimed for, thus ecosystems might be the final resort which are bigger than networks. In networks companies communicate with other companies only when they are in need. But in an ecosystem, companies will be created to support other companies for specific purposes and business to business activities within the sector will foster. Industry players are already talking about ecosystems, but the concept is still pretty vague and underdefined. This study realizes within the medium-term future this confusion will be cleared through extensive research on this and we will see some ecosystems running in the sector. However, due to early phase implementation some of the ecosystems might not work out to its potential and eventually perish. Further scientific knowledge on this ground will make better understanding and in the longer-term future we can expect smoothly performing multiple ecosystems working simultaneously.

The biggest aspect of competition that this study uncovers which lies outside the geographical borders of Finland. Population of the country being so small makes the companies obliged to go beyond national boundary and fight with bigger fishes. Competition from global players are less in margin now because only few companies are participating globally now, but it is going to increase in the coming years and companies need to formulate strategies in fending such cases either single handedly or through an ecosystem.

“How” elements

In this How section, questions regarding marketing & sales activities, key resources, key operations and competitive advantage will be presented. Following paragraphs will portray analytical description on how such things might evolve and causal details will also be presented.

Marketing & sales

For a business entity, let it be small, medium or big, marketing and sales activities are vital to its success and growth. Without proper marketing and sales strategy companies might experience sudden hike in sales performance but in most cases performance will
go south. For that reason, companies need to think about marketing and sales tactics and strategy while designing a business model.

When we are dealing with a complex future market for the IoT enabled healthcare sector, things are definitely more complex than thinking of a marketing strategy for the current market. Future is indefinable and the rapid advancement in technology makes a strategy vulnerable at any given time. In this subchapter few important logics are presented and analyzed for the future of the sector which might turn out to be vital eventually.

At the moment we have some IoT health products & services in R&D phase and some has been launched commercially as well. But have we experienced any aggressive marketing strategies so far? In that light, we can only mention about few from the big names like Apple, Microsoft and as such. But in case of Finland most of the health IoT product developers are small in size as organizations and have limited financial capacity to drive an aggressive marketing campaign at the moment.

If we think of wearable health techs from Finland, only Polar Oy has been driving the most visible campaigns for long-term who invented the first mobile heart rate monitor in the world. They have located their sales channel through sports stores and other sports channels despite their products could penetrate other parts of the consumer sector. Polar’s focus towards customer segment has only benefitted them for long-term business and provided them enough time to research for better products. Polar’s earlier products did not entertain the IoT paradigm, but they have incorporated such positives to their newer products. Polar might be a good example for smaller and younger companies in Finland on how to approach and design marketing strategies for the future market. Aggression in marketing is just an essence, but absence or lack of proper and intelligent marketing strategy will hurt companies in the longer run obviously.

There are few products in the labs now for R&D in Finland which tends to target customers based on certain patient groups or age according to experts. JH expressed her thought on this by criticizing that. A support group is only good for supporting, but not for aggressive or breakthrough selling. Companies can create a community to support a certain patient group but should not focus on that for prime marketing penetration channel.
Though a lot of products in the IoT enabled healthcare construct will be wearable techs and also sometime fashionable products, they should be healthcare or wellness products at the end of the day. So, the promotional activities also need to convey straight message for consumers for clear understanding.

“I think, one of the issue here is "trust", if you want to buy something that is closely related to your health you will decide very cautiously as it’s a very personal thing.” (JH)

JH also mentions about a large number of new companies in Finland in this sector who are interested in data mining and using big health data. In that case a contradiction of interest might arise since citizens are very aware about their personal health information. Services like Taltioni and Kanta in Finland promises data privacy. However, if all the data is private and secured then how companies would benefit who design their business models around big health data, that remains a question for now. A silver lining for this issue might be people’s growing habit of sharing personal information over virtual platforms like Facebook. Health sector needs to find a trustworthy way to mitigate such issues at the same time creating a better playing field for companies who work with patient data.

Startups within the wellness arena in Finland are now targeting to utilize sales channels of bigger corporations within the national boundary and also outside Finland as a part of international operation. This plan sounds legitimate when the company’s own capacity is limited and partnership only brings better results. This sort of approach should be encouraged for other companies too who are not considering them at the moment. Additional to the larger business sales channels, companies might as well sell bulk amounts to hospitals and clinics to widen user base which will work as a marketing channel in the future. However, prior to that companies needs to make sure that their products get medical acceptance from the authority as a medical service or equipment. Regarding selling through public healthcare services, TK noted that healthcare sectors only purchases services, not gadgets and technologies. So, to sell through the public healthcare service companies will need to justify a product’s service value to maximum and prove its necessity.
An important aspect of the era of Internet is that all the companies nowadays tend to choose online storefronts over brick and mortar sales points. This might be a preferable option for some companies in this sector for quick expansion. But for most companies, better networking and B2B marketing can result in better outcomes. NV mentioned about outsourcing marketing activities to parties who are better capable in this field than the people involved in the companies. Small startups in Finland are interested in operating with a lean approach where they hire less people to minimize cost and unnecessary activities. Keeping that in mind and also accepting the fact that marketing and sales is the lesser strong link of these tech-oriented companies, outsourcing these activities can be a very good option.

This study identifies the lack of interest and capacity for marketing and sales activities by Finns as a result of cultural practices. However, that does not make the companies from finding alternative ways to do things. And in reality, there are a lot of Finns who are good at such extrovert promotional activities. Companies need to be vigilant in locating such talents to design and execute outstanding marketing strategies. Some companies are also now hiring international workers for such roles besides outsourcing.

In this research, for the short-term little stifled performance of the companies are observed due to marketing and sales effort deficiency. But on the medium and longer-term things seem to reach a preferable destination by adapting to the global market.

*Key resources and operations*

Once we look into organizational resources and operations, issues of existing strengths and weaknesses arise. This section will discuss some of the strong links of the Finnish tech-enabled health sector along with scopes of improvement opportunities. One of the major findings of this study regarding key resources and operations is the necessity of having smooth functioning ecosystems for the sector in Finland. Professionals believe that is one aspect which can help the Finnish health solution standout in the global competitive market place on the longer run.

For the longer-term future, JH marks the necessity of understanding the concept of a working ecosystem industry wide, while SH stressed the difference between
contemporary business networks and ecosystems. This study identifies continuous research efforts as one of the key operations in the search for coherent understanding and successful implementation. However, a necessary pattern is also identified in the needed research focus. Empirical evidence suggests, on the shorter run more research endeavors are still going to focus on product and service innovation with early stage researches on ecosystem conceptualization. On the medium-term future we will see more mature researches on ecosystems and research on successful formation and implementation of ecosystems will be carried forward. Given that working ecosystems are only visible in the sector in the medium-term future, organizations need to be agile and have open mind for partnering up. Agile networks can be one of the starting points for creating successful and efficient ecosystems for the sector.

Technology readiness is one of the key resources for Finnish IoT enabled healthcare sector. Though a lot of companies are still in the innovation stage, they have access to one of the most skilled group of people in the current world besides the best technological test bed according to TK. Additionally, JH marks the readiness of network and connectivity providing companies are also market ready to support health companies with their products. With newer technologies surfacing, opportunities will keep appearing. In regards to technological innovation, JH mentioned the ability of Finnish players to think about the future and how authorities have been investing in interesting channels of research thus far.

Human resources are realized as one of the necessary form of resources for the sector. The IoT enabled health sector needs well capacitated personnel from health, technology and business for constant growth. A skilled workforce across industries has helped the nation thus far despite having a very small population. However, when it is most needed to take the battle to a global scale, Finland will need bigger workforce with matched capacity. This can be done in two ways, train Finnish nationals & encourage them about this paradigm and hire immigrants with proven track records.

One of the core resources for the Finnish companies in the sector is their understanding and knowledge about the local market and regulations. It is widely accepted that the industry in Finland has many layers of bureaucracy for best interest of citizens. Though it is criticized for some reasons, besides expressing their wishes to see less bureaucratic process bigger companies have found ways to deal with it. However, smaller
organizations, startups and SMEs within the sectors need to adapt to the situation with their limited resources.

Finance and funding is identified as another important resource that the sector will need over time. Because most of the private and semi-private companies are surfacing only in the recent years and more of them are expected to appear in the coming years, sustainable funding solutions are needed for those organizations and solutions so they can survive till their commercial launch. Funding from public agencies has been supporting most of the research efforts in academia and also in business arena so far. But as a part of austerity tactics, current government in Finland plans to reduce such funding and alternative sources of funding will be required. As an alternative companies in private sector should look for international investments. International investments not only funds a project but will keep the organizations on toes to keep things done more efficiently and effectively. It will also open global horizons for new companies.

Internationalization is one of the most important aspect for the companies in Finland in this sector which should be considered as a major key operation in the coming years. Small population of Finland alone justifies the necessity of internationalizing business entities for higher profitability and economic stability. Few companies have already started their international operations and their stories can be used as guiding paves for newer ones. Companies will need to decide which side of the globe they would like to grow first, the Western countries or the less advanced sub-Saharan Africa or the Australasian regions. Selection of where companies will internationalize will also depend on logics like market opportunity, product-market fit, business scalability, margin potentiality, etc.

This research observes market players’ understanding about what the industry is good at doing and what they can improve in. Interesting notions like ecosystem building have surfaced which needs further research efforts on how to conceptualize it across the industry and how to implement them for the betterment.
**Competitive advantage**

This business model element is concerned about how an organization catalyze on resources and competencies during market operations. Every organization have numerous resources and competencies, but only few of them can help them stand out in a competitive market. Competitive advantages are those characteristics of a firm that helps them differentiate from competitors for better performance as an advantageous trait. In literature there are different theories about how to differentiate a brand. In this research, I have identified five stage of how companies in the IoT enabled health care sector in Finland can gain competitive advantages. Each of these are perceived as to be dependent on organizational and firm maturity. These differentiation strategies are:

- Technology differentiation
- Product/Quality differentiation
- Price differentiation
- Customer service differentiation
- User experience differentiation

From a general point of view, the overall Health IoT sector can utilize the *Technology differentiation* strategy at the moment or in the very near future due to technology readiness in Finland which is unavailable to many other producers in other locations. At the moment, the market for IoT enabled healthcare sector is in infancy and growing quite rapidly. The concept of IoT is reaching maturity and being deployed only during the last couple of years. Thus, the products and services which are being offered will need to differentiate them over conventional non-IoT services based on the technology they are using.

Once we are few years in the future from now and global market will see wider adaption of IoT enabled healthcare solutions, additional advantages of using technology utilization will wither. Organizations then will need to innovate products with superior accuracy and with multipurpose usability. Because healthcare is one of the most personal aspect of human life; data accuracy and reliability needs to be constant and consistent for each products available in the market. For this reason, this research considers the result quality as a ‘competitive necessity’ to be accepted as a medical solution rather than bringing market advantages. However, organizations can
exploit more market share if they are able to build a platform supporting multipurpose solutions against competitors’ contemporary solutions.

At this level for gaining competitive advantage, it is important that companies keep their keenness to innovate outstanding products. An outstanding product with the simplest solutions can decipher the strongest profit logic. New product/service innovation will play a vital role in gaining market advantage. Additionally, owning intellectual property rights (IPR) will be key in gripping market competition. This can be done with patenting and later can be licensed out in the process of internationalizing.

This study realizes the next phase of competitive advantage will come from price battles. In the previous years, companies would have to price their product with a higher tag due to R&D investments and early stage organizational and industrial fixed costs. But once the R&D costs reduces and product development reaches an optimum level of maturity, costs will come down and companies will tend to fight with price. Companies that are able to compete with lower price should perhaps try and internationalize early towards markets in the eastern part of the globe. By doing so, in one hand companies will see better profitability and additionally they will gain better perspective on global market acceptance. Companies can then later internationalize in Western countries and also the North American states for superior profit margin. Internationalization is a key for Finnish IoT enabled healthcare companies to make the industry a real participant in the global value chain. These developments can be forecasted to take place during the early stages of the medium-term future.

The final two level of gaining competitive advantage through differentiation will most likely occur during the long-term future. Finland, till date, lacks in art of customer service which needs to improve in order to perform better in a global market. Customer service not only means what services are being provided, but is also combines the art of treating people in a social and warm way while serving. A combination of healthy and strong customer service can differentiate different products and brands in the market. Though the IoT enabled healthcare market is deemed to be well saturated with different small solutions, a customer service solution that is interactive, knowledgeable, courteous, patronizing and accurate can help in differentiation.
On the final layer, according to JH, Finnish solutions often seems to lack when comes to user experience. With superior technological knowledge Finnish companies have offered some of the technological marvels till date, but often some other companies takes out the best of it with superior user experience. To perform sustainably as a leader in the market, companies will need to craft the art of offering easy, understandable, attractive and self-describing user experience for customers.

Interview participants of the study have hinted all of the above ways of gaining competitive advantage. Additionally, they have specified that in order to see Finnish health IoT companies doing well in a global marketplace companies will need to make sure that the goodwill of Finnish technology solutions are maintained throughout even with the lower priced products.

This study perceives the five stages of competitive advantage as a series of strategic changes among companies. From a general level we are likely to observe such trait throughout the sector from short-term to long-term future since most of the services and products are being launched in the recent period or will be launched. For the companies which will be created in the future will most likely forcefully skip one or more stages in order to match the market competition.

"Why" elements

In this part about the business model, an organization is supposed to describe the basis of pricing and the way of charging for a product or service. Besides discussing the ways of revenue generation, this element also discusses the ways of incurring costs. Thus, this section of the business model is mainly concerned about revenue and cost model of the firm. In the following paragraphs I present an analysis on cost and revenue aspects of the IoT enabled healthcare sector Finland.

Basis of Pricing

Pricing is one of the key components for a product/service to be seen as a successful market penetrator. Pricing is important to keep the revenue stream healthy and stable. But if the price of a product is fixed at an uncomfortable range then the sale volume will be significantly hampered. On the other hand, if the product is priced at a suspiciously discounted rate then its acceptability will be in question. Justification of
Pricing a product/service and formulating a successful pricing strategy is as important as designing a marketing strategy. It all becomes even more important for a market segment which is highly dependent on breakthrough modern technologies. Pricing should be strategized in a way that it will encourage and attract more users to get involved by negating all the skeptic issues.

IoT enabled healthcare solutions are already being introduced to the market in Finland and companies are already thinking of different basis of pricing. According to JH, in the digital paradigm we are seeing the trend for charging for services instead of buying a product. She thinks similar kind of pricing strategies are going to be popularized in the IoT enabled health sector too. Similarly, TK uttered about pricing models like “fee for use” and “pay per use” besides membership pricing.

NV admits that currently price for most of the health IoT products are ominously high. Due to this, such products are at the moment unable to compete with existing conventional alternatives with price. NV suggests that when the R&D costs for product development will come down and companies will be able to produce in bulk amount, prices can be pulled down easily to consumers’ comfort zone. One of the key limitations for smaller companies and startups in the current market is their limited financial resources which they need to utilize very carefully.

Another interesting approach is marked by NV for pricing products and solutions, brand value. Despite the fact that the sector is relatively very new, given that a company become an early success then they can capitalize on the goodwill they establish. It can be compared with the pricing strategies from Apple, who always tends to tag their products with higher prices compared to their competitors. But still their sales volume has been a success story over the years.

Imaginably we are not going to see and “Apple” in this sector, but companies can work on additional value propositions to price their products with a higher price and to gain better acceptability from consumers. IoT enabled healthcare sector is expected to origin huge number of wellness applications, products and services within the medium-term future. Critics of such products often complain about their look and call them ugly. One way of offering additional value proposition can be to work on product’s external design and present them as fashion tools integrated in a health wearable.
Considering that each organization has their own product development team, they can work on product design or service design or offer design.

TK also mentioned, “Pricing will be based on the benefit we provide to customers. So, the value that customer gets from using our services, solutions and products”. It means pricing models for this sector should be well thought and value adjusted. Perhaps, futures thinking can also enhance a successful pricing strategy formulation with its tendency to think longer lasting solutions. JH marks additional to service oriented pricing strategies we are going to see some variable models; like freemium, waivered price if permitted to use data for mining and etc. In the future we will see more innovations around business model with the revenue side as a differentiator among competitors.

Cost elements

Opposing the revenue stream of a business model there is the overall cost structure of a company. This part of the business model describes logics how costs will incur for better and profitable running of an organization. In the following paragraphs I discuss some key issues about costs in the IoT enabled healthcare sector in Finland. This research identifies the biggest cost contributors for the sector as production, R&D, connectivity, human resources and internationalization.

Though the health sector is a service oriented industry, IoT based solutions are dependent on minimal visible products which needs to be developed and produced. Production costs thus will sustain as one of the key cost component for this sector. However, this study realizes cost efficiency in production can be improved over time by reaching product design maturity sooner than later. At the moment, most of the products are still in the lab and they are being produced in small bundles from an expensive production site. Once the product design reaches maturity and organizations are able to invest enough cash to produce in bulk amount, production costs will come down significantly. Additional to that, higher cost efficiency can be achieved if production activities are transferred to a lower cost production site.

JH and NV, both admits that R&D costs for health IoT solutions are probably going to be much higher compared to other industries because most of the products will need
medical acceptance. Perpetual sustainability is not an option for any product in a highly competitive market. Product development becomes even more vital when it is supposed to serve for human health. Research efforts for product and solution development will be continuous. However, for small and medium sized organizations and especially for startups, there will be a stage when R&D will reach maturity in regards to initial product development. Organizational R&D also will need to analyze different elements of the market like market trends, market dynamics, market opportunities and etc. From an overall industry perspective, the IoT enabled healthcare sector will need substantial investment to research the potential of ecosystems and how to implement a smoothly functional ecosystem.

Since the context of this research is the Internet of Things aided healthcare, network costs are thus examined. The study identifies a blindspot among current market players in healthcare who tends to use connectivity as a key resource. Internet connectivity for a single mobile phone or home use might be reasonably priced. But once the system is supposed to support thousands of devices’ data and analyze them in the cloud, it will require intensive infrastructural investments. According to JH, network and connectivity providers in Finland are already capable of providing necessary connectivity services for the IoT healthcare solutions. Most of the startups who will later play in the IoT paradigm are still using device processing power for data analysis, thus from an organizational account network costs are still relatively low. Companies will need to understand and estimate potential cost and plan expenses accordingly. Solutions which needs superior computational capacity will require cloud services for seamless performance.

“About the connectivity costs for healthcare, I do not think it will be more expensive than it is now. I think connectivity and network will have a certain cost, I do not see it coming down as well because infrastructure needs to continuously evolve.” (JH)

We observe a potential friendly offer from connectivity providers towards the healthcare providers for utilizing connectivity as a resource. Organizations like Ericsson is interested to see a connected society where social necessities will be dealt with connectivity solutions. It is a win-win situation for the overall market and network providers on the longer run. In a few years we will see commercial
deployment of 5G Networks when connectivity costs are expected to be increase. But, this study projects a not-so-high increase in connectivity cost during transition to 5G Networks for the continuous proliferation of the sector in order to create a future connected society.

TK marks one of the most important resource that the sector needs is qualified human resources from technology perspective, from health perspective and also business perspective. She also notes that human resources are going to be one of the major cost contributors for the sector. Similarly, EK states the importance of hiring proper talents from a global market will be expensive. On the short run future, resourcing proper and enough resources can foster the pace of product development and commercialization from the domestic market. But in the future organizations will need to consider more international hiring, which is more expensive.

Additionally, internationalization of business activities are going to incur significant costs. Costs originating from internationalization will include location cost, human resources cost, bureaucratic costs and early market adaptation costs. Companies from this sector will need to consider all of these potential cost sources when internationalizing.
7. Discussion and conclusions

In this concluding chapter of the thesis, answers to research questions are presented. Separate subchapters will also present theoretical and managerial implications of this research. This chapter also argues reliability and validity of the study in the given context with a futures perspective. Finally, limitations of the study are presented offering further research avenues.

7.1 Answering research questions

The main objective of this study is to find a way to utilize business model as a tool for futures business research. The endeavor was to identify the potential of business models to see the future for better market understanding. In doing so, the context selected for the study is the IoT enabled healthcare sector in Finland for which very few studies has offered the business perspective. The author developed a context specific research question and a generic research question separately to analyze and present theoretical and managerial implications of the study. Following subchapters will present thorough responses to the research questions. First, response to the context specific research question is presented with the empirical reflection of the study. Next to that, response to the generic and more theoretical research question is presented reflecting back to the literature reviewed in the earlier stages of this research.

Response to the context specific research question

How could the Business Models of an IoT enabled healthcare sector probably evolve in the future?

The context specific research question for the study is well articulated and simply put to define and clarify the problem this study is handling. This research question can be segmented in two parts; 1) business models of an IoT enabled healthcare sector and, 2) probable evolution in the future. The first part of the research question is more regarded to what exists in current literature about business models, IoT and healthcare sector. The latter part is more concerned about the research methodology that is used in this study. One of the key words of this research question is the use of the word “probably”, which is derived from the different type of futures from the futures cone
(Voros 2012). Future is perceived to comprise many different possible, plausible, probable and preferable futures.

This study aims to uncover some probable business model elements in order to construct future business models for the IoT enabled healthcare sector in Finland. In doing so, this study has conducted extensive literature survey about the core concept of the study, business models, and also about the context of the study, IoT enabled health care sector. Author has combined theoretical understanding with the empirical data that has been collected to concretize findings of the study.

In responding to the specific research question of this study, summary of the analysis of collected data will be presented in the following paragraphs. In addition to present and discuss different business model elements, the answer will also discuss potential business opportunities that can be explored by companies in future. Once professional opinion was taken into account it seemed like Finland is heading towards a goal with Health innovations. Finland’s economy has been underperforming during the last few years and the health industry seems to be quite vigilant about that. Managing Director of the Finnish Health Tech Association (FiHTA) mentioned the current contribution of health industry in Finland’s GDP being comparatively higher than other neighboring countries; she expressed high hopes on continuing such positive contribution and gain better visibility for policy developments. From the scenarios built, this study attempts to understand the potential business models and business model elements of the futures IoT enabled healthcare sector in Finland.

At a glance, the business model elements for the future IoT health arena seem pretty predictable if we consider each scenario in isolation. Since the elements were gathered based on the opinions of professionals within the industry in Finland, we can find a story underlying. Author observes the role of public sector as customer, being changed over time and again becoming stronger on the long run, which is an exciting stream. Also, the role of R&D as key operation is going to change in different time frames. Additionally, the prospect of IoT being an enabler in the health sector across wellness, care and health tech seems evident and growing over time. Table 8 summarizes the probable business model elements for each scenarios and each time frame.
Table 8: Probable business models of an IoT enabled healthcare sector in Finland

This study observes, the sector in Finland currently lacks somewhat in marketing and sales styles and that reflects in the future as well. It is time that organizations start learning the art of creative marketing and selling. Similarly, on the short run future for better business results for IoT health solutions, Finnish companies need to work on better user experience and usability of services. This early improvement should provide the sector with traction for a longer lasting flight. Having a small population, Finland will need the industry to be export oriented and operate globally. This research foresees, more and more successful internationalization of firms from this sector during the medium-term future and beyond.

I approached the study with a linear sight towards the future and tend to understand the logics that will emerge and evolve. We can see some congruent trends that came up from different professionals’ viewpoint, that, Finland should work for ecosystem environments in the healthcare as a whole, where IoT is a definite part, for the future. The MD of FiHTA, TK, marks that messages from industry players at the moment are too fragmented. This fragmentation needs to be reduced and that can be done when
companies become part of a bigger cluster, larger networks and finally an ecosystem. The MD of Salwe Oy, SH, thinks there will be working ecosystems in the industry by the medium-term future; however she expressed her doubts of seeing a single ecosystem lasting for longer period without wisdom, leadership, navigation and change management & adaptation.

One more major observation of this study is that companies in this sector in Finland are already realizing the needs and benefits of working in cooperation rather than competing while the major competition waits outside the national border. This understanding will help approaching many challenges which would be impossible should the task was left for one individual company. The startup scene in Finland has played vital role in this course. Some products and services that are being developed now are breathtaking according to the Innovation & Business Architect at Ericsson R&D Center Finland. These breathtaking services need a global market for longer profitability and sustainability. However, global digital literacy and connectivity issues stand as obstacles as for now. Given enough time and simplifying these innovations will make it possible to be delivered to any part of the globe, let it be more advanced North American markets or comparatively less advanced Sub-Saharan Africa. The trick for companies will be anticipating proper timing for expansion towards proper direction depending on their own readiness and the market’s readiness in regards to economic condition, digital literacy and network & connectivity standards.

As stated earlier, this research considers business opportunities to lie at the heart of business modeling. So, for each time frame some potential key business opportunities are identified. Finland has a huge group of ageing population who needs proper care. For the short-term future elderly care and assisted living seems to be the most prospective business opportunities for companies to explore. By few years we will have a society full of digital natives who factually never saw a society without computers, mobile phones and the Internet. Thus a huge market full of digital natives will offer wider opportunities for companies to experiment and offer. During the medium-term future we will see extensive adaptation of wellness products and applications globally aided by IoT. For the long-term future, this research identifies preventive care and rehabilitation sector to be the potential flourishers which will be assisted by IoT. Besides, by the long-term future companies in Finland will gain better
understanding about global markets. *Internationalization* will be another aspect of business opportunity during the medium to long-term future.

If we consider the vertical, horizontal and oblique stance for business modeling, we can have deeper ideas how future might turn out to be for the sector. Starak (2014) argues vertical business models can enhance business performance in the internet marketing era significantly with quality content and service. Starak also argued that most of the internet enabled businesses usually settles doing business by concentrating on a vertical business model. Jia, Wang & He (2011) and Ahokangas (2015) argues about tech oriented businesses to create value for specific narrow customer groups and focus on that. This study foresees many different vertical business models will be developed during the short-term future for elderly care and assisted living.

On the other hand, the far future we will go, we will observe more and more horizontal business models appearing where services are sold instead of products. From the medium-term future to the long-term future, there will be few companies with wide base of IoT health solutions in their offering. Each of the products might serve a specific customer group, however due to multifaceted focus their depth in customer groups will be shallow. In such cases, we will see different horizontal business models with varied revenue and profit models. A third type of business models with similar stand point was offered by Ahokangas (2015), oblique business model, where third party resource utilization plays a key role. Oblique business models speaks of complementing others’ value proposition as a part of best promoting own value proposition. For the IoT enabled healthcare sector we are more likely to see business models which will use such stance for ecosystem building.

The table depicting different business model elements for the scenarios provides a conceptual space, as what it could be at that time frame but not exact prediction. This accumulation of business model elements can serve industry players to better model their own business model as a part of the industry. Also, companies can take a look on how things might change from short-term to medium-term to long-term and design their strategies accordingly.
Since this study uncovered the necessity of building business ecosystems for the IoT enabled healthcare sector in Finland, here I present a concept of an ecosystem business model for the specified sector. Following figure offers connection paths among different players and stakeholders within the industry. The figure marks early conceptualization of how and why each stakeholders can be connected in order to create a functional ecosystem.

![Diagram](image)

**Figure 6: Probable ecosystem business model for the IoT enabled healthcare sector**

The concept of an ecosystem business model is deliberated based on the argument stated in an earlier chapter where I combined ideas of SoA (Xu, He & Li 2014) and the 4C model layer (Wirtz et. al 2010). This figure shows the most important stakeholder locations and how value can be created for others. The concept of 4C layer model clarifies the need of different type of business model in each location of the ecosystem. Since the overall sector will comprise different type of stakeholders; delivered values will vary from only being health related issues and will include
infrastructural concerns too. Value creation and delivery among different layers will be different based on the type of business the concerned stakeholders are in.

With a futures perspective, this study intended to uncover different business modelling logics for the IoT enabled healthcare sector. In doing so, three separate futures scenarios were built with a linear progressive attribute from the short-term to the longer-term. Empirical data has been the foundation of the findings of the study supported by literature review. This study offers understanding of the futures market depicting probable business model elements, probable business model patterns and also with a conceptualization of an ecosystem business model.

**Response to the generic research question**

*How could business models be utilized in futures business research?*

The generic research question for this study is designed to keep theoretical contributions of this study visible and instrumental. As stated earlier that the research objectifies to combine one of the major futures research methodology with the art of business modelling, this answer should clarify findings in that regard. In responding to this theoretical research question I will merge discussions presented in the theoretical framework & methodological framework chapter and argue how they have been combined in analyzing empirical evidences of the study.

Tony Judge marks that futures is not just a tool to foresight the upcoming, it is the way to redesign what we do at the present to configure a better future (Inayatullah 1996). Inayatullah (1996) states about many grand ideas being ruined due to the lack of proper management and responses from a futures perspective. Future is vague and elusive, futures studies sometimes seem to be too much abstract and unreliable to general readers (Kuusi et. al 2015). Kuusi et. al discusses the quality issue of futures research and notes that validity of a futures research can be maximized when the created knowledge is based on facts, logical assumptions and analytical & coherent argumentation. Foresighting is the science of logically constructing alternative or linear futures by scientifically analyzing different probable, possible, plausible and preferable futures elements based on the current and past constructs of the society.
Futures studies or forecasting date back as long as the second world war (May 1996). However, due to individual skepticism the use of this research philosophy is underutilized till date. Despite multifaceted skepticism, existing literature argues that foresighting involves active learning and participation, timing of intervention, deconstruction of present in order to construct preferred future, prepare users to consume surprise as an element to battle the uncertain future. The discipline accepts that the future is uncertain and not entirely determinable by the tools due to uncertainties. Instead, with different tools futures study offers a way to look at different possible, probable, plausible and preferable futures. Foresighting help managers and strategizers to design a future oriented action based strategy. Using such tools managers can better understand social and systemic changes and construct a future where they want to reach. To reach the logically targeted preferred future, managers then can create organizational strategy accordingly and rule out unnecessary activities to maintain focus.

In theory there are different viewpoints to see the evolution of Business Models. This study prefers to perceive Business model as a research interest in academy which has evolved through three distinct stages in regards to research focus according to this research; business ideas as BM, business concepts as BM and meta-models as BM. In the earliest era simple business ideas were perceived as BM by different authors (Normann 1977, Timmers 1998, Rappa 2001 & Magretta 2002). During the next phase business concepts, which were wider and deeper than just business ideas, were perceived as BM in the literature (Hamel 2000, Chesbrough 2003 & Lecocq et. al 2006). In the latest era structured meta-models, where multiple business components are accumulated to formulate a holistic business, are perceived as BM (Osterwalder 2004 & Ahokangas et. al 2013).

This perspective of looking at business model evolution in literature allies very closely with the one from Ahokangas et. al (2015b). Ahokangas et. al identifies five stages so far; they are: idea based, model based, opportunity centric and cognition/design based. From existing literature, this study understands business model has evolved to be a dynamic transformational force to help conceptualize the rationale behind overall value creation and value delivery of a business venture or project for extended economic sustainability and maximized profitability.
Ahokangas et. al argues that the next generation of business model research will focus on future centrism of the concept. Despite the fact that there are still no peer reviewed journal paper of doctoral dissertation on futuristic business models yet, research endeavors have started in this avenue. This master’s thesis also tends to open the discussion on that very ground, how can we combine business models with futures research methodologies, in order to finally design business model centric futures business research techniques.

Going through extensive literature about business models, this research identified fifteen business model elements that proves to be crucial in the act of business modeling. Besides that, literature review has offered this study to understand various business modeling tools available which are popular. Most popular business modeling tools are business model canvas, business model wheel, lean canvas, hamel’s business model bridge.

To use business models with a futuristic perspective in research, we need to revisit the pillars of futures research. Since the reliability and validity of a futures research is often in question, it is ideal to make sure that the scientific practices are maintained in a formal and way. Inayatullah (2008) offers detailed discussion on how to look at the future and what are methodical steps. Inayatullah marks six key concepts of understanding for futures research. They are: the used future, the disowned future, alternative futures, alignment, models of social change and the uses of the future. A futurist needs to understand these basic concepts of future and conceptualize them in a way to use them for deconstructing social components. Understanding these concepts and using them in research is often referred to as futures thinking in research.

This study considers the same argument in designing the research and using business model to look at the future. Instead of building alternative futures about the industry, this research built three linear progressive futures scenarios. Based on the scenarios, this study offers three different sets of business model elements for different future timeframes. The depiction of business model elements resembles the concept of alignment of a linear progressive industry.

Additionally, Inayatullah suggests six basic futures questions that every futurist should ask while in act. These questions are going answer about the will of the specific
interested party, fear of the interested party, missing parts in the predicted future, available alternatives in the future, wish of the interested party and actionable steps for the interested party. This research visits all of the stated question in solving the research problem and it does so by using business models with a futures thinking. Inayatullah also mentions six key pillars of futures studies; they are: mapping, anticipating, timing, deepening, creating alternatives and transforming.

The specific futures research methodology that has been used in this study is called Causal Layered Analysis (CLA). CLA enables us to delve into the future with its four different layer of analysis. It is used to analyze future to find deeper understanding and longer sustainable answers to a problem. According to Inayatullah (2003) by integrating empiricist, interpretive, critical and action learning models, CLA unleashes the future. Deeper logics that CLA can uncover makes the future more easily reachable and constructible.

This research has used business models as the business oriented research concept which is coupled with CLA to understand the futures market by locating different business model elements. Contemporary business modeling tools are good meta-models that gather different aspects of a business entity to operate sustainably by focusing on business opportunities, value proposition, product offering, customer group, basis of pricing, business value chain, key resources, key activities, sales channel, customer relationships and also direct financial aspects. This study tended to gather different business model elements for the future IoT enabled healthcare sector.

This study realizes that if we can locate and gather some business model elements of the future, it will provide users with valuable insights about the market and a starting point to design their own business model for the future market. In doing so, author has made sure that scientific practices for futures research are maintained well for this study to maintain validity of the study and results. Foresighting is not just about illogical prediction, rather it involves scientific logics and steps. Keeping that in mind, this study utilized business models with a CLA standpoint in data analysis.

Author have utilized the CLA philosophy in two distinct stages of the study. First, before data collection, the interview framework that has been used for all of the interviews involved in this study is grounded on CLA thinking. Questions were
developed keeping all four layers of CLA. The interview framework (Appendix 2) for this study is a visible example of how author has blended the two concepts. Author has designed a two-dimensional matrix for the interview framework and designed questions accordingly. On one axis of the matrix there were the CLA layers and on the other axis were the different business model element groups from Business Model Wheel. This matrix has made the task of questioning necessary aspects about the future easier, focused, logical and meaningful.

Second, author have used the CLA philosophy when analyzing the collected data. Because the collected dataset were quite well structured for the organized questioning pattern, application of CLA in analyzing was easier. Different researchers who use CLA as a research methodology often seem to be struggling at first with the tool due to its complexity with different layers. The task of decoding an interview with CLA layers require deep conceptualization of the tool. Since interview questions of this study were structured from a CLA point of view, that task was a bit easier. However, a transcribed interview always gives scope to decode a well-structured response to even further concrete points. This study has applied CLA while decoding the interview transcripts from that perspective.

From the collected dataset author has developed three linear progressive futures scenario. Author presented each of the scenario as four different layers of CLA. That means, at the litany layer we can see the surface level of the specified timeframe for the industry. In the social causes layer we can see underlying social reasons. Further, in the worldview layer, we can see global reasons of the potential future. Finally, the metaphor layer compares the future with superficial examples to clarify the logic on a general level.

Methodologically business models and CLA seem to complement each other due to their structural fit. This study has shown a way to bring business model and CLA together. The contextual results are promising and consistent. Futures thinking for business modeling promises to offer additional use of business models as a tool to be used in futures business research. On the other hand, this study shows newer horizon of futures research in business problems.
7.2 Theoretical implications

Theoretical contribution for this study is twofold. First, how much and what kind of literature this study has included in order to offer readers a set of well-grounded research results. It is also important to reflect the quality of studied literature and their validity in current context of disciplines. A well-grounded concurrent literature review provides a valid base that can be used to test empirical data and processed further. Secondly, is there anything novel to offer for the existing literature that can be utilized in further academic purposes? Following paragraphs discusses such ends to justify theoretical implications of the study.

Ahokangas (2014) offers the business model of research to emphasize the focus of the research. This seven element model suggests to identify the core phenomenon, purpose & objective of the study, base theories, research method, empirical context, structure of the research, research process and contribution of the research. This model of research planning has helped the author to construct and plan the overall research, which includes specifying research topic, designing research questions and planning literature review for theoretical concept, external context & methodology.

The research topic for this master’s thesis is multi-disciplinary and have a comparatively wider scope than most other research conducted as a part master’s degree. Business model is identified as the core phenomenon of the study, whereas IoT enabled healthcare sector is selected as the external context. As the vital theoretical basis for the study futures studies or foresighting is identified. Causal Layered Analysis (CLA) is used as the specific research methodology to carry forward the research task at hand. Extensive literature review on all of these aspects were conducted for clear understanding.

The author of this thesis being an early stage business researcher structured the thesis in a way that the text is easily understandable by a non-technical layman reader group. To do that, defining the scope of literature involving the external context of the study was tricky. The literature scope for the IoT enabled healthcare sector is limited to a generalized boundary instead of a technical perspective. One of the key essence of this section was to define the scope and make sure that the text does not end up being full of discussions on complex technical jargons. Finally, for the external context this study
presents generalized discussions on IoT definition, applications of IoT, basic architecture, healthcare sector in general, eHealth, mHealth and a brief discussion of IoT as an enabler in healthcare. The thorough but general structure for the literature on contextual setting of the study will offer readers with a kick start on what this thesis proceeds towards.

Existing literature that were covered about *business model* in this study involved multiple aspects. Opening up with a discussion on how business model originated and how it evolved in literature, it goes in depicting definitional debate about the concept. This study presents three different schools of looking at the evolution of business models. Wirtz (2010) provides a chronological evolution of the term in literature. Similarly, Osterwalder *et. al* (2005) proposes a five stage evolution model for business model research. However, this study offers a slightly different approach to look at the evolution of business models, which aligns more with the perspective shared by Ahokangas *et. al* (2015b). The evolution of overarching business model concept presented in this thesis comprise three eras; they are BM as ideas, BM as concepts and BM as meta-models.

Besides discussing the evolution of business models, in explaining the logic of business model innovation, author has compared the process with Knowledge funnel (Martin 2009), which explains the evolution of a design thinking as a chronological process. The logic of knowledge funnel in design thinking is described as a process towards an end by Martin. But, author considers the process described in the knowledge funnel should be a continuous and cyclic process to be considered as business model innovation and transformation.

Presenting thirteen different definitions from different authors, author generalizes the definitional issue of business models. The definitional debate (Ahokangas *et. al* 2014) which is presented in the thesis help readers conceptualizing the attractiveness of business model in research and in practice (Zott *et. al* 2011). This study considers business model as a dynamic transformational force for practitioners and academicians to conceptualize value creation and delivery logic of a business entity and an industry as well. This study also offers a statistical discussion on different components of business models. Based on studies from Shafer *et. al* (2005), Morris *et. al* (2005), Zott *et. al* (2011) and Onetti *et. al* (2012) author evaluated 59 different definitions of
business models from different studies to identify business model elements. Finally, this study identifies fifteen (15) vital business model components that should be studied for the context of this research.

Since the core phenomenon of the research is business model, conducted literature review is extensive and includes various avenues that are covered in existing literature. A brief discussion presenting different contemporary business modeling tools (Hamel 2000, Osterwalder & Pigneur 2010, Maurya 2012, Ahokangas et al. 2014) offer readers with the concept of how business modeling works. This section also offers a comparative discussion and advantages of using each tool in practice. This study prefers keeping business opportunities at the center of business modelling. Thus, it considers to utilize the business model wheel concept (Ahokangas et al. 2014) as one of the foundation for empirical data collection of this study.

Finally, a concise discussion on business model for IoT and healthcare is presented where issues like vertical-horizontal-oblique business model logics are discussed (Starak 2014, Ahokangas 2015). This portion speculates possible business models types for the health IoT sector based on existing literature. Taking the 4C model from Wirtz et al. (2010) in consideration, author combines it the Service oriented Architecture (Xu et al. 2014) of IoT to lay a ground for an industry wide business model. This concept is further used in developing the ecosystem business model for the IoT enabled healthcare sector in Finland.

The major theoretical basis of this study is futures studies or forestighting since one of the core objective of this study is to check the applicability of business model as a futures business research tool. For this reason detailed review on the state of the art is conducted. Author offers discussions from conceptual level to application level of the research methodology that is used in the study based on literature. This study states the basic logics of futures studies (Inayatullah 2000, Masini 2006, Voros 2012), advantages (Inayatullah 1996, 2004, 2008, 2014, Slaughter 2002) and criticisms (Sardar 1993, 2010, Masini 2010, Tonn 2010) as well. On top of that, a well-structured description on CLA is presented. Slaughter (1997) marked CLA as a bit complex research methodology for early stage researchers, but detailed literature review made it easier for the author to contemplate underlying logic of the methodology and it provides a solid foundation for readers’ understanding too.
Additional contribution to the existing theory of this study is that it opened newer horizons for business researches. On one hand, this study shows a promising way to apply business models in a form of futures business research. On the other hand, using business model with a futures thinking also extends the applicability of futures techniques in business research. Application limitation of futures research was criticized by different authors (Sardar 1993, 2010), but multidisciplinary interest and efforts (Masini 2010, Tonn 2010) are changing the situation by opening up newer horizons (Inayatullah 1996, 2003).

This study applies CLA in combination with business models to understand the futures market. By doing so, this study offers an early conceptualization of how the theoretical concept of business model can be used to look at the future. The findings of this study suggest that if we are able to locate different business model elements for the futures market in scientific ways, we can offer valuable insights as well.

All in all, from theoretical point of view, this study has involved wide base of literature for each of the aspects which are involved with the study. But author has given enough attention to make sure that unnecessary literature is not covered in the thesis. All the literature that are collected are either directly related to definitional concepts or data collection and analysis reasons.

7.3 Managerial implications

From a context specific point of view, this study offers insights about the futures market situation and how the market can develop in the course. Most importantly, by presenting three different linear progressive futures scenarios for different time frames with a CLA perspective, this study provides a very clear and detailed view of the overall market environment where specific stakeholders are going to operate. Additionally, empirical data analysis opens up horizons regarding different aspects which are key for business model designing for companies. The conceptual space created with futures business models in this study will help managers and strategizers develop their own business models to align market potential. Extensive literature review coupled with a high quality empirical dataset enabled author to comprehensively analyze the overall problem of this research.
Implementation of CLA framework in this study has opened different social and global causal variables for the IoT enabled healthcare sector, which from a general perspective might not seem to affect the sector directly. However, some of these causes are having positive impact on the sector and some are impacting in undesirable ways in present and also in future. This perspective will help policy developers to solve deeper social and global issues in order boost the sector for longer run global competitiveness and sustainability. Social matters uncovered during this study includes; the increasingly growing impact of online social networking practices in everyday life, rise of the era of digital natives, available advanced technology, impact of individual’s unhealthy lifestyle, impact of working hours of people, impact of economic condition of individuals, a large group of aged population, workforce diversity, marketing capacity of Finnish companies in general and impact of unemployment on the society and the country’s economy. On the other hand, global matters which were brought up includes; impact of a global giant company, impact of varied economic conditions & poverty issues in different countries, impact of having a common currency on this sector, impact of varied technological situation in different parts of the globe, nutrition and hunger problems, competitive global business environment and value chains and the continuous battle for global power through economic strength. All of the above mentioned issues have impact on the growth and prosperity of the IoT enabled healthcare sector in Finland. Given that policy makers consider these issues and design a detailed strategy for the sector, first of all Finnish companies will be able to build up a strong domestic ecosystem and furthermore they will be able to become more competitive globally by successful internationalization and global expansion.

As for business models, this study discusses probable elements of futures business models which can be used by different stakeholders in the sector. Elements like potential value propositions, product & customer services, sales channels, marketing, key operations, key activities, basis of pricing, key customer groups, cost elements, competition and cooperation are discussed based on the futures market. This study maps the future market by creating three linear progressive futures scenario. Based on the mapping, further it creates three sets of business model elements.
Though the results of the study are not surprising, it offers grounds for managers and policy makers to prepare the market for a more competitive global market and a more cooperative local ecosystem oriented market. Role of public stakeholders as customers of the sector is an interesting stream this study observes. Additionally, how competition will change its face in domestic arena is also an important aspect in order to see a successful sector from Finland within next few years. Developing ecosystems where knowledge is being created together and values are delivered in a complementing manner by different companies are bases of conceptualizing the key for a harmonized futures market.

This study has focused on the IoT enabled healthcare sector’s future and tended to do so by analyzing potential business model elements. In doing so, it has collected high quality data from seasoned campaigners from the industry and analyzed them with a futures research technique. Since this study is the first of its kind to look at the future of the specified industry using business models, results presented in this study should not be considered as exact prediction about the future. Rather the results present us a conceptual space for individual preparation and creativity. Findings of this study can be used as an analyzed futures map, based on which managers and policy makers can design specific strategies to reach to a desirable future for the sector and for Finland.

7.4 Reliability and validity of the study

To justify the acceptability of an overall study and evaluate the findings of a research, it is important to test the reliability and validity of the research process (Kuusi et. al 2015). Kuusi et. al describes the quality criteria for a scientific futures research in their paper and differentiates a general write-up about the future against a scientific futures research based on specific points. Creativity is an integral part of futures research. They mark a research lacking open minded creativity as bones without flesh, on the other hand, a futures research being too much creative but lacking fact based analysis is like flesh without bones. A balance between creativity coupled with fact supported analysis enhances the acceptability of the study.

A valid and reliable research can be trusted with the results it offers to the readers (Shuttleworth 2008). Research validity is earned through creation of knowledge based on facts, logical assumptions and reasons through argued justification. Validity of a
study can be of two types; internal and external validity. Internal validity refers to the internal logic and consistent progress of the study, which mostly includes the construction of the theoretical framework of the study. Based on the internal validity of the study can only it can provide externally valid results which are empirical fact supported.

This study has included wide and relevant base of literature to create a strong foundation of theoretical concept, industrial context and research methodology. This extensive literature review helped the author to include different viewpoints in order to consider a “whole picture” of the studied topic. Kuusi et. al (2015) marks that scientifically valid futures research should always be based on “whole picture” of relevant concepts and context.

External validity of a research considers the relationship between the internal structure of the research and the empirical data and how sound the conclusions are. This also means to test the consistency of results in relation to the empirical dataset. Testing external validity of a study should consider if the study is concluding with findings which does not reflect on the real empirical dataset. This study has gathered all relevant empirical data through individual interviews from five experts in the IoT/healthcare industry from different stakeholder role. All the interviews were transcribed and analyzed with care to remove misinterpretation of expert opinion and thus a mean to maintain external validity.

Kuusi et. al (2015) refers to the six point “task force standards” list suggested by German Netzwerk Zukunftsforschung (NZF) as the most comprehensive way to test validity of a scientific futures research. This NZF list includes the image of the future, modality aspect of the future, argumentative verification, reference to action, interdisciplinarity and transdisciplinarity. From this perspective, this study has presented an image of the future or an anticipation for a connected society supported by well-functioning business ecosystems which will serve the society with healthcare solutions and also contribute to the country’s economy. In regards to the modality aspect of the future, this study proposes three different probable futures scenarios for different time frames with justified argumentation.
Arguments this study makes are based on the high quality empirical data set. Results offered by this study has visible theoretical and managerial implications to significant extent. This thesis opens up a conceptual space for managers and policy makers to design long lasting strategy for the betterment of the sector. Finally, a study can either be interdisciplinary or transdisciplinary if not single-disciplined. This research has described a social interest from a business point view by studying business models of a purely technological industry with foresighting techniques, thus offering an interdisciplinary context.

Reliability of study refers to the repeatability of a specific study without random results. Yin (2003) states reliability as the goal to minimize errors and biases in a research. In qualitative research, maintaining constant accuracy in applying specific methodology can enhance the study's reliability. Consistency in methodology application assures quality data collection and analysis for a reliable set of results. Author of this thesis has done it by planning the overall research process in advance and document each step accordingly.

High ethical standards were in place for this research for data collection, data interpretation and analysis. Every participants involved in data collection procedure were treated with respect. Sincere attention was paid in interview sessions to avoid any negative consequences to the people involved. None of the interviews conducted involved any trade secret or confidential information, which enabled the author to use the whole dataset without omitting any part. Furthermore, as the responsibility of a researcher towards other researchers, this study cites to used literature and IPRs extensively to justify the utilization of previous literature and also to point out this study’s actual contribution.

All in all, considering the theoretical base, quality & quantity of empirical dataset and the relationship between explained results, actual empirical data and maintained ethical standards; validity and reliability of the research can be considered to be of satisfactory level. This thesis thus can be considered to provide a comprehensive description of the studied topic.
7.5 Limitations and suggestions for further research

Just like any other research, this research also has limitations. There were limitations to construct the theoretical framework and also limitations to deal with the empirical part of the study. This subchapter discusses few such limitations which were identified. Additionally, it will present a brief on possible further research in this avenue.

Since the author of this thesis is an early stage business researcher, the topic itself was a little challenging at first due to its interdisciplinarity. Author’s main challenge was to identify, select, study, absorb and properly generalize huge amount available secondary data about business model, IoT, eHealth, mHealth, futures research and CLA from existing scholarly literature. This study has covered a wide range of different sets of literature in order create a solid foundation to analyze empirical data. Challenge in constructing a smart literature review on IoT, eHealth and mHealth was to generalize the huge amount of technology heavy scholarly articles.

Defining the extent of how much technological the study should be was an early limitation for the study. On the business model front, author decided to study the historical development of business model as a research concept besides only conceptual and definitional issues. This is done since the study deals business model with futures research and proposes to use them in combination as a futures business research methodology; thus it seemed valid to understand the history of the phenomenon from multiple perspectives before offering a futuristic application.

Finally, a thorough and susceptibly tedious review is presented on futures research and CLA. But, the fact that futures techniques have rarely been used in couple with business objectives made it necessary. On the other hand, before this study, business model and CLA was never brought together to look at the future. A thorough literature review on both business model and futures research makes this thesis understandable for readers from both business and futures arena.

Since this study involved different theoretical aspects for reviewing, available literature was enormous. There is obvious reason to admit that author might have missed to include some important sources or have used some sources which has been already counter-debated or developed further. However, author has continuously tried
to make sure that used literature are recent and latest if there are multiple editions for specific sources.

Limitations that are directly related to the empirical part are mostly related to data collection and applying CLA in data analysis. Slaughter (1997) marked the possible complexity that CLA might cause for an early stage researcher, however author dealt with such difficulty through extensive reading and looking at other research conducted using CLA. For the empirical data collection, the case was developed solely for the purpose of this research. In one hand it was advantageous that the researcher had freedom and choice on which stakeholders to include in constructing the overall case, but, on the other hand, it was primarily a difficult task to define the scope of the case.

The case used in this research involved participants from startups, from lobbying organization, from healthcare business research organization, from healthcare entrepreneurial coaching stakeholders and also from network & connectivity provider. However, this study did not directly include the customer perspective and governmental perspectives in building the business models which can be considered as a limitation of the study. Critics might as well comment on the use of interviews as the mean to gather empirical data while CLA suits best with workshop setting. This study intentionally took the stance to improve data quality and reliability of the study and considering the fact that CLA is a completely new tool being used alongside business model.

Concerning further research, this study opens up a new horizon for both business research and futures research. It opens the door for further collaboration among business researchers and futurists to inspect the applicability of business model as a potential tool to uncover future industrial developments logically. From a context specific point of view, this study identifies the necessity of further research in defining well-functioning ecosystems for the IoT enabled healthcare sector in Finland. On the other hand, from academic point of view, the business model-CLA duo shows promising features. To standardize the combination, researchers can implement the same combination to other contexts as well to understand futures market. Additionally, this study also exemplifies potential of business model to be used with other futures research methodology. Author recognizes the possibility of developing a standardized futures business research methodology using business model as the core concept. To
see a widely accepted futures business research technique, more studies need to be conducted with similar stances to confirm reliability and validity.
REFERENCES


Atkins & Cullen (2013). Medical Care 51:3 Suppl 1, March 2013, S1-S3.


Mechael, P. N. (2009). The case for mHealth in developing countries. *innovations, 4*(1), 103-118.


Patton, M. Q. (2002). Qualitative interviewing. *Qualitative research and evaluation methods*.


Electronic sources:


Appendices

Appendix 1

Business Modeling Tools

Appendix 1A

*Gary Hamel's business bridge model (Hamel 2000)*

![Gary Hamel's business bridge model](image)

Appendix 1B

*Business model canvas (adapted from Osterwalder & Pigneur 2009)*

![Business model canvas](image)
### Appendix 1C

**The lean Canvas (Maurya 2012)**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
<th>Unique Value Proposition</th>
<th>Unfair Advantage</th>
<th>Customer Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top 3 problems</td>
<td>Top 3 features</td>
<td>Single, clear, compelling message that states why you are different and worth buying</td>
<td>Can't be easily copied or bought</td>
<td>Target customers</td>
</tr>
<tr>
<td><strong>1</strong></td>
<td><strong>3</strong></td>
<td></td>
<td><strong>7</strong></td>
<td></td>
</tr>
</tbody>
</table>

- **Key Metrics**
- Key activities you measure
- **6**

<table>
<thead>
<tr>
<th>Cost Structure</th>
<th>Revenue Streams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Acquisition Costs</td>
<td>Revenue Model</td>
</tr>
<tr>
<td>Distribution Costs</td>
<td>Life Time Value</td>
</tr>
<tr>
<td>Hosting</td>
<td>Revenue</td>
</tr>
<tr>
<td>People, etc.</td>
<td>Gross Margin</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td><strong>5</strong></td>
</tr>
</tbody>
</table>

Lean Canvas is adapted from The Business Model Canvas (http://www.businessmodelgeneration.com) and is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported License.
Appendix 1D

**Business model wheel (Ahokangas et. al 2014)**

<table>
<thead>
<tr>
<th>What?</th>
<th>How?</th>
<th>Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Define your type of customers</td>
<td>1 Describe the way of selling and marketing</td>
<td>1 Give basis of pricing</td>
</tr>
<tr>
<td>2 Define offering</td>
<td>2 Describe mode of delivery</td>
<td>2 Describe way of charging</td>
</tr>
<tr>
<td>3 Define Value proposition</td>
<td>3 Describe basis of your competitive advantage</td>
<td>3 Identify cost elements</td>
</tr>
<tr>
<td>4 Identify differentiators</td>
<td>4 Outline key operations</td>
<td>4 Identify critical costs and scale up as your business grows</td>
</tr>
</tbody>
</table>
## Interview Framework

<table>
<thead>
<tr>
<th>Litany:</th>
<th>Social Causes:</th>
<th>Worldviews:</th>
<th>Metaphor:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What:</strong> Customers, offering, Value proposition, value networks, competition</td>
<td><strong>What:</strong> Customers, offering, Value proposition, value networks, competition</td>
<td><strong>What:</strong> Customers, offering, Value proposition, value networks, competition</td>
<td><strong>What:</strong> Customers, offering, Value proposition, value networks, competition</td>
</tr>
<tr>
<td><strong>How:</strong> Selling &amp; Marketing, service delivery, competitive advantage, key operation</td>
<td><strong>How:</strong> Selling &amp; Marketing, service delivery, competitive advantage, key operation</td>
<td><strong>How:</strong> Selling &amp; Marketing, service delivery, competitive advantage, key operation</td>
<td><strong>How:</strong> Selling &amp; Marketing, service delivery, competitive advantage, key operation</td>
</tr>
<tr>
<td><strong>Why:</strong> Pricing, charging, cost elements, cost drivers</td>
<td><strong>Why:</strong> Pricing, charging, cost elements, cost drivers</td>
<td><strong>Why:</strong> Pricing, charging, cost elements, cost drivers</td>
<td><strong>Why:</strong> Pricing, charging, cost elements, cost drivers</td>
</tr>
<tr>
<td><strong>Where:</strong> Organizational environment (Internal), External organizational environment</td>
<td><strong>Where:</strong> Organizational environment (Internal), External organizational environment</td>
<td><strong>Where:</strong> Organizational environment (Internal), External organizational environment</td>
<td><strong>Where:</strong> Organizational environment (Internal), External organizational environment</td>
</tr>
<tr>
<td>Opportunity</td>
<td>Opportunity</td>
<td>Opportunity</td>
<td>Opportunity</td>
</tr>
<tr>
<td>1. How do you think customers groups can be identified and segmented in the future</td>
<td>5. Why do you think companies would be interested to act like this in the future</td>
<td>6. What deeper reason could be causing the social changes that is likely to interest companies in such a way</td>
<td>26. If you are asked to compare the overall structure of the futures business model of an IoT enabled business model, how would compare it to a metaphorical setting</td>
</tr>
<tr>
<td>2. What might be the different value propositions designed in in the future your opinion</td>
<td>11. Why would companies design such campaigns in future in your opinion</td>
<td>12. why do you think such social changes will take place</td>
<td>21. What might encourage such changes in impact of organizational and external environments on business performance will change over time</td>
</tr>
<tr>
<td>3. Do you think business networks and competition will be different in the future compared to current markets? If yes, how?</td>
<td>17. What could cause such pricing and cost structure changes in the way you mentioned</td>
<td>18. why do you think such cause will take place</td>
<td>22. Why do you think such encouragements arise</td>
</tr>
<tr>
<td>4. What sort of product/service offerings can be there in the future in the health IoT business</td>
<td>10. What will be the key operations and resources in the future in your opinion</td>
<td>19. How do you think the impact of organizational environment on business performances will change over time in the future</td>
<td>23. What could be the business opportunity for in the future in your opinion?</td>
</tr>
<tr>
<td>7. How do you think the selling and marketing activities will change in the future from now</td>
<td>13. How might the pricing model and basis of pricing be changed in the future</td>
<td>14. What sort of current cost elements could be there in the future</td>
<td>15. What sort of new cost elements might come up in the future</td>
</tr>
<tr>
<td>8. What mode of service delivery can take lead in your opinion</td>
<td>16. What will be the major cost drivers for the health IoT business</td>
<td>20. How do you think the impact of external business environment on business performance will change over time in the future</td>
<td></td>
</tr>
</tbody>
</table>