UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

LUISS Università Guido Carli

Master's Degree Project in Innovation and Industrial Management

Master's Degree Project in Innovation and Entrepreneurship

THE IMPACT OF THE INTERNET OF THINGS ON ESTABLISHED BUSINESS MODELS

A multiple case study of Swedish insurance companies

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A multiple case study of Swedish insurance companies

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ABSTRACT

The insurance industry has long been suffering from profitability and growth issues due to the increasing commoditization of insurance solutions, which has forced insurers to engage in destructive "*premium wars*". Digitalization and technology advancements are only set to increase these pressures even further by shifting market boundaries and increasing the level of *"digital sophistication"* expected by customers. Ultimately, these pressures are forcing insurance companies to rethink the business models they have employed for so long and look beyond *"business as usual".*

One technology that might allow for insurers to stand out in this commoditized market is the Internet of Things (henceforth: IoT). This paper aims to study the impact of the IoT on the business model of insurance companies. With the help of the business model canvas, this paper provides the reader with an in-depth understanding of how IoT applications affect the different blocks that constitute the business model of insurance companies. Moreover, this paper aims to provide the reader with an understanding of the challenges and risks related to the implementation of the IoT, and how these might be mitigated. In order to do this, a multiple case design was chosen where semi-structured interviews were held with four different Swedish insurance companies currently working with different IoT-centred solutions. Additionally, the paper follows a qualitative research strategy with an abductive approach to theory generation.

According to the research, the IoT provides insurers with the opportunity to collect and analyse real-time data on insured objects, allowing them to shift towards more dynamic and accurate risk and pricing models that are based on usage, rather than the static indicators conventionally used. Moreover, by detecting damages in their earlier stages or before they even happen, IoT sensors have the potential to reduce the severity and frequency of claims, which stand for 69 % of insurers' expenses. Lastly, insurers are able to provide customers with personalized recommendations on how to take care of their insured objects, thus increasing the frequency with which they interact with their customers, which in its turn improves customer loyalty and retention.

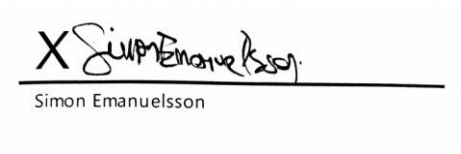
In order to successfully implement the IoT, insurers will need to address external and organisational resistance, as well as disruption threats from competitors. To address external resistance, insurers must increase customer willingness to share data through such incentives as premium discounts. Moreover, with the insurance industry being recognized for its conservatism, insurers will also need to make use of change management and enterprise-wide training to create a corporate culture more accepting of change and business model innovation. Lastly, the IoT also creates opportunities for new players to disrupt the insurance industry. For this reason, first-movers will have to develop data-driven capabilities that are difficult to replicate in order to create a sustainable competitive advantage.

Keywords: *Insurance, Internet of Things, IoT, Business Model, Business Model Canvas, Business Model Innovation*.

ACKNOWLEDGEMENTS

I would like to thank my supervisors Ethan Gifford and Richard Tee, for their feedback and insight on the structure and content of this research. I am also grateful for the inspiration and guidance offered by the supervisors at First to Know, who also helped me to get in contact with relevant interviewees. Additionally, I would like to express my appreciation for the interview participants for giving me their time and energy to assist me with my research. Lastly, I would like to thank my colleagues in the Master's in Innovation and Industrial Management programme for their thoughts and constructive critique throughout this process.

Gothenburg, June 2019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1. Introduction

This section presents the reader with the problem background and empiric setting that led to the research questions identified in this thesis. Moreover, the research purpose, delimitation and disposition of the thesis are presented.

1.1. Background

The world is amid a fourth industrial revolution that is set to alter the way humans interact with one another and their environments. At the centre of this revolution is the Internet of Things (henceforth: IoT), a network of devices and sensors that collect data from the physical world and transmit it in real-time, with the aim of creating more attractive and safe environments, products and services (Talkpool, n.d.).

With more than seven billion IoT devices installed worldwide, there are currently more objects connected to the internet than there are humans on Earth. This number does not take into account smartphones, tablets, computers or other conventional computing platforms. Instead, the IoT allows for traditional non-internet-enabled objects and machines to be connected to the internet (Lueth, 2018).

Even though this subject has become of increasing interest to both academics and industry leaders, the phenomenon of the IoT is nothing new. The first known IoT application was a Coca-Cola vending machine at the Carnegie Mellon University in Pennsylvania, altered by a few engineering students in the early 1980's to monitor the availability and temperature of the beverages in real-time (Teicher, 2018).

So, what has triggered this increased interest as of lately? Lower sensor costs, increased processing power, advanced connectivity and the miniaturization of components, among others (Ammiot, 2015). Many industry leaders, especially within manufacturing, have understood the potential of the IoT and are already experiencing the increased quality, cost efficiency and speed that it brings to their supply chains. Indeed, with an average growth rate of 17 % per year, the number of installed IoT devices worldwide is expected to reach 21.5 billion by 2025 (Lueth, 2018).

1.2. Research Problem

The topic of this paper is an industry generally recognized for its conservatism and static landscape, the insurance industry. Specifically, this paper is concerned with addressing the

impact of the IoT on insurance companies' business model (henceforth: BM), as the increasing adoption of such technologies are set to fundamentally alter customer expectations, and therefore the insurance landscape (Reifel et al., 2014).

The insurance industry has long been suffering from low organic growth and profitability issues. Increased competition and a lack of differentiation have turned insurance into a commoditized product, forcing players to engage in "*premium wars*" (Canaan et al., 2016; Reifel et al., 2014). In fact, during the last ten years, there has been a 10 percent decline in inflation-adjusted car insurance premiums. This number is expected to decrease even further with the development of new technologies such as Car Sharing Services and ADAS (Advanced Driver Assisted Systems), thereby reducing the number of insurable objects and traffic collisions, respectively (Reifel et al., 2014).

The rate of digitalization is not slowing down and will only continue to increase industry pressures even further as entry barriers for outside players are reduced, creating a shift in the market boundaries (Ammiot, 2015; Reifel et al., 2014). Whereas large amounts of risk-related data used to be a big entry barrier in the past, companies like GAFA (Google, Amazon, Facebook, Apple) have now the capacity to gather relevant data at a faster rate and create on-demand value propositions (Ammiot, 2015). As an example, Tesla has recently decided to disintermediate insurers by providing their own car insurance for customers that are unsatisfied with the prices provided by insurers (Lambert, 2018).

These pressures are forcing the insurance industry to rethink the business models they have employed for so long. By leveraging the IoT, first-movers could turn digitalization from a threat to an opportunity. For example, sensors embedded into a buildings' infrastructure have the potential to detect safety breaches such as smoke, toxic fumes, moisture or mould and alert the user before the fire or water damage escalates. This not only allows for insurance companies to adopt an offensive position, shifting their focus from restitution to actual prevention of avoidable damages, but improves upon their value proposition by reducing the risk that the policyholder[1] loses an irreplaceable object or incurs costly deductibles (Reifel et al., 2014; Ammiot, 2015; EY, 2016).

1.3. Research Purpose

In short, insurers cannot afford to be left behind and need to look beyond "*business as usual*". The rate of change is not slowing down, and the connected customer expects an increasing

[1] A person who holds an insurance policy. Also referred to as customer or insured throughout the paper.

level of "*digital sophistication*" from the businesses they choose to engage in. The IoT provides insurers with the opportunity to address the increasing industry pressures by shifting their attention from restitution to the actual prevention of avoidable damages. Among others, the IoT will allow for first movers to differentiate themselves from a commoditized market and improve on customer relationships (Canaan et al., 2016; Reifel et al. 2014).

This paper aims to study the impact of the Internet of Things on the Business Model of insurance companies, providing the reader with an in-depth understanding of how this technology affects the different building blocks that constitute the BM. Moreover, Business Model Innovation, such as the implementation of the IoT, tends to bring forth challenges and risks, especially for such a conservative industry such as insurance. For this reason, this paper also intends to study the risks and challenges related to the implementation of the IoT, and the potential solutions to eliminate them, with the help of Business Model Innovation theory.

Additionally, most academic literature is focused on the technological and technical aspects of the IoT. Whilst managerial research about the impact of IoT on established BMs is increasing, several authors (Dijkman et al, 2015. Metallo et al., 2018) have mentioned that understanding the mechanisms employed to create and capture value are still of critical importance. Among these managerial research papers, most of them focus on the manufacturing industry, also known as the Industrial Internet of Things. For this reason, this paper contributes to academic literature with a novel perspective on the impact of the IoT on the BM of a conservative service-centred industry such as insurance.

1.4. Research Questions

The following research questions summarize the specific goals of this study:

- How will the implementation of the IoT affect the Business Model of Insurance Companies?
- How can insurance companies manage the challenges with the implementation of the IoT?

1.5. Delimitations

This paper seeks to provide the reader with an understanding of the impact of the IoT on the business models of insurance companies, from a managerial standpoint. For this reason, the technological or technical aspects of the implementation of the IoT are disregarded.

Interviews were held exclusively with players in the Swedish insurance industry that have either experimented or implemented IoT in parts of their supply chain. Additional insights were also gathered from an IoT provider, to add an external perspective from a key partner in the development of IoT-centred insurance solutions.

1.6. Disposition

The thesis is divided into six sections that follow the following structure:

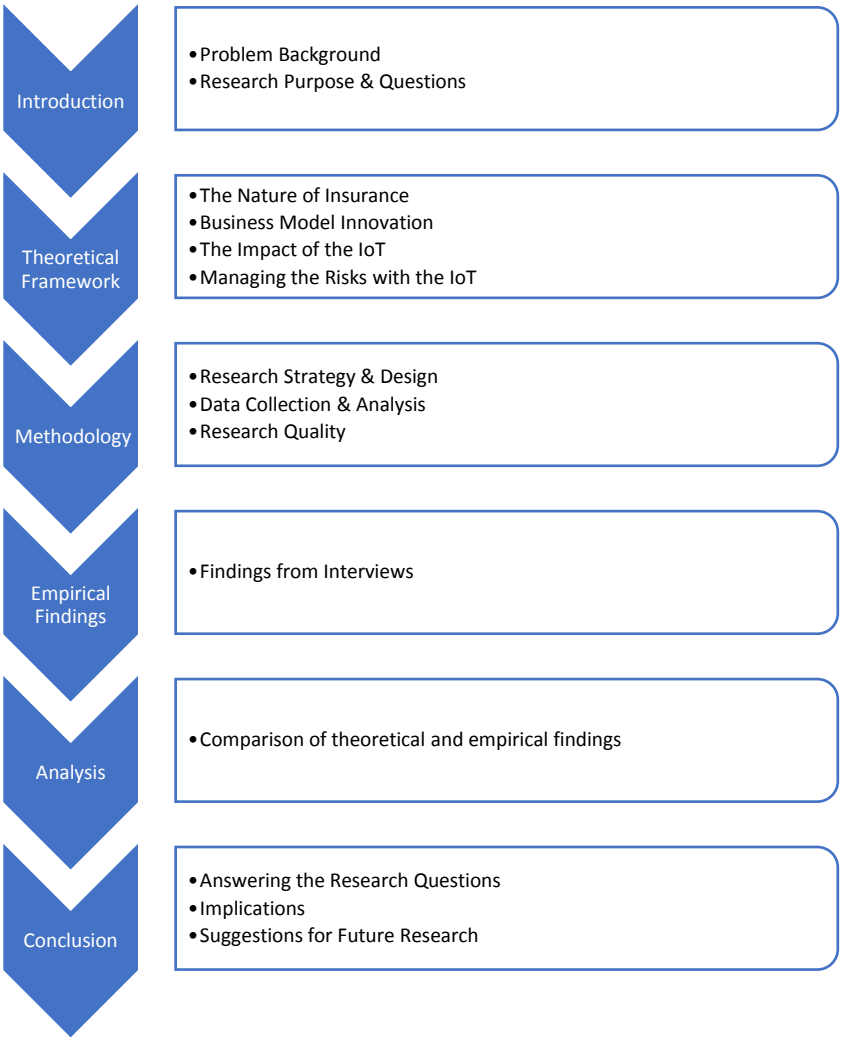

Figure 1: *Disposition of report (own elaboration)*

2. Theoretical Framework

In this section, the theory and frameworks used later in the analysis are explained and discussed. This section aims to give the reader an overview of the previous managerial literature on the applications of the IoT on the insurance industry and its implications. Moreover, the author explains the choice of this theoretical framework by explaining how the Business Model Canvas and Business Model Innovation theory will be used along the thesis.

2.1. The Nature of Insurance

An insurance policy is a contract where the insurance company guarantees to cover the cost of an object or subject in the event of a loss, up to a certain amount. Hence, in exchange for a premium payment to insurance companies, policyholders receive financial security and stability in the case of a loss. These premiums are calculated through actuarial methods of analysing and quantifying risks. Moreover, insurance consists of pooling funds from a large number of policyholders to pay for the damages suffered by some of them. This is because it is far more accurate and less challenging to estimate risk for a group of people, than it is for a single individual (Desyllas & Sako, 2013. Derikx, De Reuver, & Kroesen, 2016).

Insurers' profits come traditionally from two sources: underwriting, which is the difference between the premiums paid by policyholders and the payments made to them for incurred losses and the underwriting expenses; and by investing the premiums into common equities and fixed-income securities (Desyllas & Sako, 2013. Derikx et al., 2016). To help illustrate, Desyllas and Sako (2013) explain that for every 100 USD an insurance company receives in premiums, 69 USD are paid out in claims and 25 USD are spent on underwriting expenses. So, on average, insurance companies profit 5 USD from every 100 USD paid by policyholders.

According to Desyllas and Sako (2013), there are three major ways in which insurers can improve performance, with the first and most obvious one being claim cost reductions. These costs stand for about 69 % of premiums and are defined by loss severity and frequency. Cost savings in this area could be achieved by improving underwriting capability and the subsequent analysis and pricing of risks. However, this solution is limited by the problems of moral hazard and adverse selection.

Moral hazard and adverse selection are both principal-agent problems that arise due to the inherent asymmetry of information in insurance, whereby the insured has more knowledge than the insurer. Moral hazard arises when the insured provides misleading information to the

insurer, such as in the case of insurance fraud. Adverse selection, on the other hand, relates to the issue where the policyholder has more accurate information, resulting in ineffective price signals. A good example of the latter is when the insurance company sets a relatively high insurance premium to make up for the losses of risk-prone customers. This in its turn drives away the risk-averse customers whilst attracting risk-prone customers to whom the premium seems reasonable (Nickolas, 2019). At the same time, policyholders are more likely to be less concerned for losses than they otherwise would have been without an insurance policy. In order to counter this information asymmetry, insurance companies make use of different historical and socio-demographic factors in their risk and premium calculations. In car insurance, for example, insurers look at prior claim experience, demographic characteristics such as age and sex, and car model characteristics such as safety features and crashworthiness (Desyllas & Sako, 2013).

The second way to improve performance includes increasing the efficiency of underwriting process through better policy handling, automation, lower commissions and economies of scale. The third way is through the improvement of return on investment, but this is highly dependent on stock market cycles (Desyllas & Sako, 2013. Derikx et al., 2016). As this paper will show, the IoT has the potential to reduce claim costs, as well as improve the efficiency of the underwriting process.

2.2. The IoT and the Insurance Industry

As previously discussed, digitalization is only set to further increase the pressures the insurance industry is currently experiencing. In short, the IoT allows insurers to collect and analyse real-time data in a dynamic environment, thereby improving risk selection, pricing and monitoring models (EY, 2016; Canaan et al., 2016; Ammiot, 2015).

As a result from increasing competition and pressures to reduce costs for both policyholders and the insurer, some companies are currently offering Usage-based Insurance (henceforth: UBI) solutions (EY, 2016. Baecke & Bocca, 2017. Canaan et al., 2016; Ammiot, 2015). Examples of UBI include pay-as-you-drive (henceforth: PAYD) or pay-as-you-live models, which collect real-time customer behaviour data from IoT sensors embedded in cars or watches. According to an estimation by EY (2016), there are currently 5 million active UBI policies in 35 different countries, with a forecast of a 15 % market penetration by 2020 in Europe, Asia and Americas.

In their reports, Baecke and Bocca (2017) and Derikx et al. (2016) study PAYD solutions, where the policyholder attaches a sensor to their car's On-board Diagnostic (henceforth: OBD) input that collects driving behaviour data such as speed, location, mileage and acceleration. This allows insurers to provide policyholders with more accurate and personalized insurance premiums that rely on dynamic usage-based data, rather than solely looking at historical and socio-demographical factors. For insurers, this allows for a reduction in incurred losses through more accurate risk estimations. Moreover, these services usually allow for extra integrated services such as automatic emergency calls, self-diagnosis, stolen vehicle monitoring and driving suggestions that increase safety and reduce fuel consumption (Baecke & Bocca, 2017. Derikx et al., 2016).

Besides collecting data on customer behaviour, sensors attached to machinery and in-home sensors can detect early signals of fire, wind or water damage, and notify the user at the slightest hint of trouble. This allows insurers to prevent avoidable damages or at least reduce their impact, whilst simultaneously protecting the customer. In short, the IoT allows insurers to move from restitution to the actual prevention of avoidable damages (Canaan et al., 2016. Reifel et al., 2014; Ammiot, 2015; EY, 2016).

Moreover, a better understanding of individual customer behaviour allows insurers to move from generalized offerings to increasingly personalized ones. This move from mass to segmented markets can be seen with the adoption of UBI models. The IoT provides insurance companies with the ability to focus their attention on the most profitable insurance pools, encouraging them to renew policies and reduce their exposure to risk. Better yet, it allows for first-movers to create more attractive and personalized value propositions and leave less profitable customer groups for competitors (Ammiot, 2015; EY, 2016; Reifel et al., 2014). Still, Ammiot (2015) recommends that insurers use caution with this kind of segmentation on risk-prone customers, so that they can still find an appropriate insurance solution.

Another area in which the IoT has potential, is customer relationship management. Currently, customer interaction takes place mostly during claim management, which in certain lines of business can take an average of four to five years. The IoT offers the opportunity for insurers to not only make this process more pleasant and speedy, by having already collected data prior and during an incident, but to interact with customers more often by offering them real-time information on their insured objects.

Additionally, industry experts expect a shift from simple risk insurance to advisory services, creating a new offering among traditional insurance solutions. This could potentially include recommendations on the advantages of proper maintenance and care, thus improving customer interaction, whilst influencing customer behaviour to prevent avoidable damages. Alternatively, insurance companies could use their data to assist customers in purchase decisions and advise them on how to best retain the value of their insured object, such as a house or car (Ammiot, 2015; Reifel et al., 2014).

In summary, the real-time data collected from IoT sensors provides insurers with a better understanding of risk and customer behaviour, reducing the indirect costs incurred from information asymmetry through better fraud detection, segmentation and pricing models (Ammiot, 2015; Reifel et al., 2014; Canaan et al., 2016). Moreover, with a better understanding of customer behaviour, customers might be more accepting of personalized advertisements and relevant offerings. This allows for insurers to provide policyholders with tailored and personalized up-sales (Baecke & Bocca, 2017. Derikx et al., 2016).

This transition will most likely squeeze margins in the short run, in exchange for a long-term sustainable advantage. These short-term costs will come from external promotions to increase customer's willingness to be monitored by IoT sensors, and internal attempts at creating a corporate culture within insurance companies that is more accepting of change and innovation (Ammiot, 2015; EY, 2016; Reifel et al., 2014). Another issue that insurers will have to deal with is finding the right partners and external sources able to provide and maintain high-value data, as security and privacy are becoming bigger concerns in an increasingly digital world (Ammiot, 2015; Reifel et al., 2014; EY, 2016).

Lastly, even though early adopters might get a good head-start, imitators will naturally follow route. First-movers are recommended to develop data-driven capabilities that are difficult to replicate, allowing for a shift from generalized product offerings to improved segmentation and personalization (Ammiot, 2015; EY, 2016).

2.3. Business Model Innovation and the Business Model Canvas

"*A mediocre technology pursued within a great business model may be more valuable than a great technology exploited via a mediocre business model.*" – Chesbrough, 2010.

A Business Model can be defined as a "*consistent and integrated picture of a company and the way it generates revenues and profit*" (Spieth, Schneckenberg & Ricart, 2014). According

to Chesbrough (2010), a Business Model must be able to explain the main value proposition, identify the market segment, the revenue generation mechanism, the structure of the value chain, the cost structure and profit potential.

Spieth, Schneckenberg and Ricart (2014) find three major motivations for engaging in business model research: explaining, running and developing the business. When explaining the business, the target audience are the external stakeholders, and the aim is to explain how a certain company is able to generate profit. When running the business, the target audience are mostly the employees and managers in the company, and the aim is to understand the processes and structures that need to be performed for the day-to-day operations. When developing the business, the target audience is the strategic function, and the aim is to support management in the definition and development of a company's strategy.

In this case, this paper aims to discuss how insurance companies can develop their business and strategy with the help of the IoT. In other words, how insurers can innovate their business models to enhance their customer experience and insurance protection. In order to study the implications of the implementation of the IoT for insurance companies, the author chose to make use of business model innovation theory, which studies the creation and transformation of new and established business models, and can be defined as "*the discovery of a fundamentally different business model in an existing business*" (Markides, 2006, p. 20). This theory was chosen since it allows to look at the common pitfalls and challenges companies face when innovating their business model, and how insurance companies can address them in order to successfully implement the IoT into their business models.

The most popular tool for Business Model Innovation and research is the Business Model Canvas (henceforth: BMC) by Osterwalder and Pigneur (2010). Business modelling and mapping tools, such as the BMC, allow companies to visualize and experiment with alternative business models before fully committing to them (Chesbrough, 2010). This will be the framework used to aid in the construction and visualization of the impact of the IoT on Insurance Companies' BM.

The BMC was chosen since it provides the author with an established structural framework on which to build the theoretical framework, data collection and analysis. Additionally, this framework allows for the study of a single IoT application through multiple lenses, thus providing the author and reader with a better understanding of the impact of the IoT on the different blocks that constitute a business model. The empirical findings and analysis follow

the same structure in order to facilitate the structured comparison of theoretical and empirical findings.

In their framework, Osterwalder and Pigneur (2010) identify nine critical elements to the business model, called the nine building blocks of the Business Model Canvas, that allow managers to understand the critical factors in creating, delivering and capturing value.

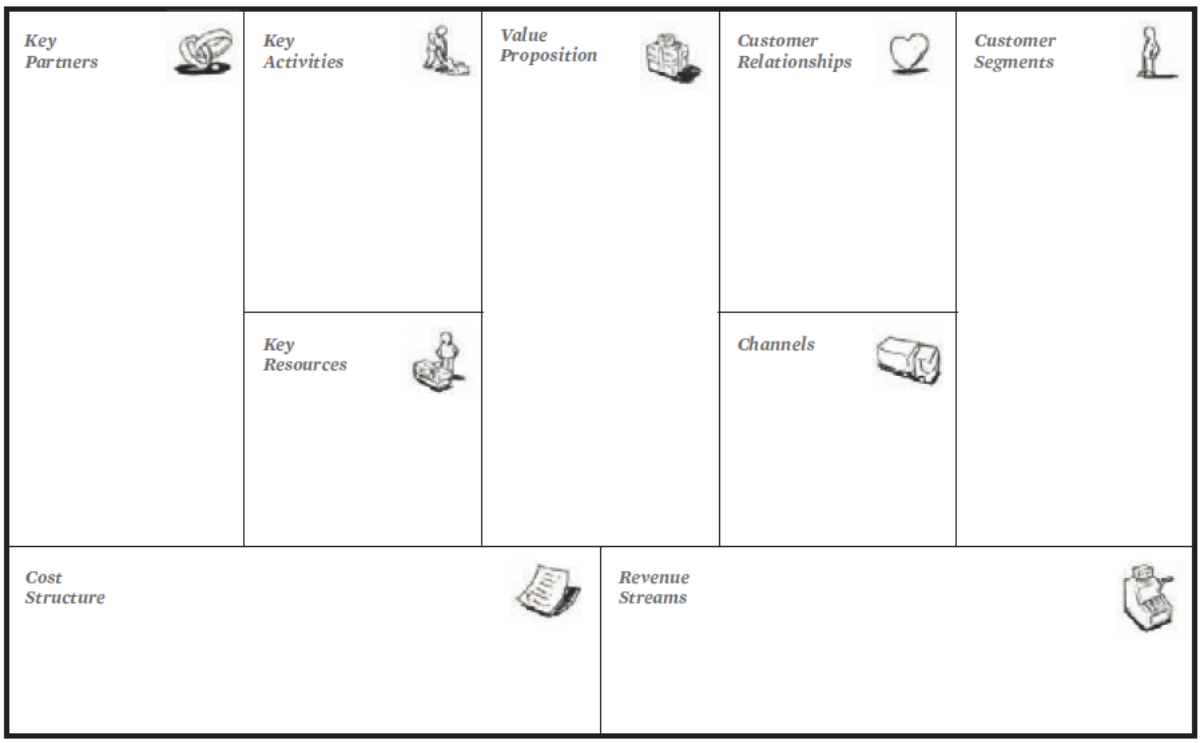

Figure 2: The Business Model Canvas (Osterwalder & Pigneur, 2010, p. 44)

The customer segments, channels and customer relationships constitute the **Customer Interface** and identify who the company is selling to, how they are delivering the product to them and how they build strong relationships with these customers. The key partners, activities and resources, constitute the **Infrastructure Management,** and identify how the network/supply chain should look like, what activities need to be performed, and finally what assets are required for the company to produce and deliver the offering to the consumer. The **Financial Aspects** identify how value is captured (revenue streams) and how much it will cost the company to provide these products (cost structure). Finally, the **Value Proposition** defines what product or service the company is offering, and how it solves the problems of the customer in mind (Osterwalder & Pigneur, 2010).

2.4. The Impact of the IoT on the Business Model of Insurance Companies

> "*The IoT is here to stay, the rate of change is unlikely to slow anytime soon, and the conservative insurance industry is hardly impervious to connectivity-fuelled disruption—both positive and negative. The bottom line: Insurers need to look beyond business as usual. In the long term, no company can afford to engage in premium price wars over commoditized products. A business model informed by IoT applications might emphasize differentiating offerings, strengthening customer bonds, energizing the industry brand, and curtailing risk either at or prior to its initiation*." – Canaan et al., 2016.

The quote above properly summarizes the path the insurance industry is heading for if it continues looking at "*business as usual"*. In this section, the author will discuss the different ways in which insurance companies are able to leverage the IoT to improve on their business, by studying the potential future impact of the IoT applications mentioned in 2.2. on the different blocks of the BMC.

2.4.1. Financial Aspects

2.4.1.1. Revenue Streams

A company can capture value through different revenue streams. A revenue stream can be the result of one-time customer payments. such as asset sales, or recurring revenues from ongoing payments, such as usage or subscription fees, lending/renting/leasing, licensing, brokerage fees or advertising (Osterwalder & Pigneur, 2010).

Each revenue stream might have different pricing mechanisms: fixed menu or dynamic pricing, where the former is predefined and based on static variables and the latter changes based on market conditions. Examples of fixed menu pricing include list price, or can be dependent on product features, customer segment or volume. Examples of dynamic pricing include negotiation/bargaining, yield management (e.g. airplane tickets and hotel rooms), real-time market and auctions (Osterwalder & Pigneur, 2010).

The main revenue stream of insurance companies are the premium payments they receive from policyholders in exchange for insurance protection. Conventionally, these premiums are calculated through actuarial analysis of risk, by looking at historical and socio-demographic indicators related to the policyholder (Desyllas & Sako, 2013). The IoT, on the other hand, allows insurers to receive real-time data on insured objects and customer behaviour, thus improving the accuracy of their risk and pricing models. This can be seen through the development of UBI solutions, where policyholders pay their premiums according to their

individual usage (EY, 2016; Canaan et al., 2016; Ammiot, 2015). This, in its turn, allows for a shift from fixed menu subscription fees towards more dynamic usage-based pricing mechanisms.

Moreover, this increased understanding of customer behaviour allows for insurers to provide policyholders with targeted recommendations and up-sales, which affects revenue streams positively. On the other side, insurers will also have to provide benefits for policyholders to increase their willingness to share data. Such benefits include premium discounts, value-added services, loyalty points, among others (Ammiot, 2015; EY, 2016; Reifel et al., 2014). These incentives, in their turn, constitute a revenue stream reduction for insurers.

Lastly, the IoT allows insurers to provide policyholders with advisory and other extra integrated services (Ammiot, 2015; Reifel et al., 2014). Depending on how the offering is packaged, these might constitute new revenue streams or be included into the offering as a way to increase customer willingness to share their data.

2.4.1.2. Cost Structure

Virtually all processes and activities a company performs bring about costs, which is why companies need to bear this in mind when designing a viable BM. Companies can choose to position themselves as cost- or value driven, where the former one focuses on minimizing costs as much as possible through maximum automation and outsourcing, whilst the latter focuses on value creation through personalized services and customization (Osterwalder & Pigneur, 2010).

The IoT is able to decrease claim frequency and severity in several ways, thus reducing the biggest cost for insurance companies. Firstly, by detecting hazards in their early stages, the IoT has the potential to prevent losses from escalating or from happening in the first place. Secondly, UBI solutions such as PAYD provide lower premiums for policyholders that drive in a responsible way, thus influencing customer behaviour in a way that reduces risk for both parties. The same is seen with the addition of advisory services, that give the policyholder recommendations and tips on how to reduce their risk for losses. Lastly, by moving towards more profitable and risk-averse customer segments, insurers are also able to reduce claim frequency. Ultimately, the IoT allows insurers to move from the restitution of damages towards an increased prevention of avoidable damages (Reifel et al., 2014; Ammiot, 2015; EY, 2016).

Moreover, with little differentiation between insurers' offerings, players in the insurance industry are currently pressured to engage in "*premium wars"*. By helping policyholders avoid damages and moving towards more individualized and frequent customer interactions, the IoT allows insurance companies to move from a cost-driven BM to one that is more value-driven.

2.4.2. Customer Interface

2.4.2.1. Customer Relationships

Companies should attempt to build strong customer relationships to increase sales through customer acquisition and retention. Companies can opt to do this personally or with the assistance of automation, ranging from dedicated personal service to automated self-service (Osterwalder & Pigneur, 2010).

Personal assistance is based on human interaction, where the customer gets help from a representative during their purchase or post-purchase experience. Dedicated personal assistance consists of assigning one representative to an individual customer during a longer period of time. On the other hand, there is self-service, that provides the customer with the tools necessary to help themselves, and automated service, such as chat bots and recommendations. Lastly, companies can choose to create or encourage communities like forums for customers to interact and help one another, or incentivize co-creation (Osterwalder & Pigneur, 2010).

Currently, insurers rarely interact with their customers. By providing policyholders with real-time information on their insured objects and recommendations on how to reduce their risk for losses, the IoT provides insurers with the opportunity for more frequent customer interactions. Moreover, the IoT can potentially improve the customer experience throughout the claims process by having collected data prior or during an incident (Ammiot, 2015; Reifel et al., 2014).

This improved customer interaction, together with the addition of advisory services, allows insurance companies to offer an extra level of personalization to their customers, thus facilitating customer acquisition and retention. This indicates a move from rare occasions of personal assistance to more frequent and individualized automated assistance.

2.4.2.2. Customer Segments

As Osterwalder and Pigneur (2010) mention, "*without profitable customers, no company can survive for long".* Companies need to make an active decision on which customer segments

to focus on and understand how their customers provide them with a solution to a want or need.

Customer segments might be mass or niche market, segmented or diversified, or multi-sided markets. Companies focused on mass markets provide for one large group with very similar wants and needs, without major segmentation, whilst niche markets focus on specific customers, often found in supplier-buyer kind of relationships. Segmented business models provide slightly different offerings to different customer segments with slightly different wants and needs, whilst diversified business models focus on one or more completely unrelated products to significantly different customer segments. Lastly, multi-sided platforms serve two or more interdependent customer groups, as the example of credit card companies or Google (Osterwalder & Pigneur, 2010).

By capturing real-time data on customer behaviour, the IoT allows for more accurate risk and pricing models, as well as customer segmentation. This allows for insurers to shift from mass market to increasingly individualized offerings, whereby the policyholder receives tailored premiums and insurance solutions. This can also be seen through the development of UBI solutions (Ammiot, 2015; EY, 2016; Reifel et al., 2014).

The IoT also allows companies to focus on more profitable customer segments, whilst leaving less profitable ones to competitors. Derikx et al. (2016) found that policyholders that drive longer distances are less likely to choose UBI solutions, since this would mean a higher fee due their higher exposure to risk. This means that usage-based insurance indirectly attracts policyholders with less exposure to risk, which in its turn reduces claim frequency and severity.

2.4.2.3. Channels

Channels include communication, marketing, distribution and sales channels, and these serve to raise awareness, allow for the customer to buy and receive the offering, and provide support and help the customer evaluate a company's value proposition (Osterwalder & Pigneur, 2010).

In order to implement the IoT, insurers will initially need to rely on partner channels to distribute the physical IoT sensors and provide policyholders with relevant information on their insured objects, since this is not their core competence (Ammiot, 2016; EY, 2016). Partner channels have lower margins but allow for companies to provide their offering without spending as much time and resources developing their own channels. Additionally,

partner companies can achieve better economies of scale and scope, thus achieving a cost per unit that a smaller company would not be able to reproduce (Osterwalder & Pigneur, 2010).

2.4.3. Value Proposition

"A good business model yields value propositions that are compelling to customers, achieves advantageous cost and risk structures, and enables significant value capture by the business that generates and delivers products and services" – Teece (2010).

Each value proposition caters to the wants and needs of a specific customer segment, describing how the offering creates value for the customer. According to Osterwalder and Pigneur (2010), an offering can create value for the customer through different elements: newness, performance, customization, "Getting the job done", price, design, brand/status, accessibility, convenience/usability and cost or risk reduction (Osterwalder & Pigneur, 2010).

The IoT allows insurance companies to improve their value proposition on several dimensions. Firstly, by installing sensors onto infrastructures and other non-internet-enabled objects, policyholders can get notified whenever a potential danger or hazard is detected. This allows for insurers to avoid costly restitutions and policyholders to reduce the risk of losing irreplaceable assets, including their own lives. This real-time monitoring also reduces the risk of paying costly deductibles, thus producing an indirect cost reduction for policyholders.

Additionally, with an increased understanding of customer behaviour, insurance companies will be able to move from generalized offerings to increasingly personalized premiums and solutions, as seen with UBI models. This segmentation allows for the improvement of both personalization as well as pricing for certain customer groups. Moreover, by adding new offerings such as advisory and other extra non-risk related services, insurers create a value-added service that increases convenience/usability for policyholders.

All these aspects will ultimately allow for insurers to improve the value-added of their brand/status. By differentiating themselves in a growingly commoditized market, first-movers will be able to position themselves as innovative and responsive to customer needs (Reifel et al., 2014).

2.4.4. Infrastructure Management

2.4.4.1. Key Activities

Key activities describe the actions and processes that a company must perform to create, deliver and capture the value from the customers. These can differ significantly depending on

the business model type, focusing on either production, problem solving or platform/network (Osterwalder & Pigneur, 2010).

Insurance companies are highly dependent on the analysis and understanding of risk. By providing real-time data on insured objects, insurance companies can improve on their risk and pricing models by bypassing the information asymmetry problems and ultimately improve the underwriting process (Ammiot, 2015). Moreover, by extending their offerings to advisory and non-risk related services, insurance companies are developing new activities in their business models.

2.4.4.2. Key Resources

The key resources consist of the critical assets for the success of the business model, these can be either physical, financial, intellectual or human. Companies may choose to develop their own resources, or lease or acquire them from key partners (Osterwalder & Pigneur, 2010).

In order to sustain a competitive advantage as a result of the implementation of IoT-centred insurance solutions, first movers will need to shift their attention from financial resources towards developing data-driven capabilities and intellectual property that are difficult to replicate and allow them to stand out from the competition (Ammiot, 2015; EY, 2016).

2.4.4.3. Key Partners

Companies can choose to expand their network through partners for different reasons: reduction of risk and uncertainty, optimization and economies of scale, or for the acquisition of specific resources. According to Osterwalder and Pigneur (2010), this can be done in four ways: strategic alliances (these happen between non-competitors), coopetition (these happen between competitors that aim to reach a common goal), joint ventures (two or more companies join assets and resources to create a new business) or buyer-supplier relationships (contracts that ensure a certain quantity is supplied to the buyer).

One of the challenges in providing IoT-centred solutions, is finding the right partners to collect and maintain high-value data. Since data collection and sensor development is not the core competence of insurance companies, they will have to acquire these activities and resources from external partners. By building strategic alliances with IoT providers, insurers can get access to specific resources, at the same time as they reduce their exposure to potential cyber risks (Ammiot, 2015; Reifel et al., 2014; EY, 2016).

2.5. Managing the Risks with the Implementation of the IoT

Adopting the IoT brings about some challenges. This section describes the challenges and risks related to the implementation of the IoT in the insurance industry and is divided into three main areas: external resistance, organisational resistance and disruption threats.

2.5.1. External Resistance

One major challenge, according to the literature, is increasing customer willingness to share data. In their study, Derikx et al. (2016) show that even though customers originally prefer conventional car insurance over usage-based insurance, specific privacy concerns about usage-based insurance services can be compensated by offering a premium discount. Other incentives include value-added services, customer loyalty points, and so on

Additionally, when creating a BM, companies need to evaluate their value proposition from a customer-centric perspective, allowing for the creation of a clearer market segmentation and value proposition for each one of these segments (Teece, 2010). Therefore, a deep understanding of customers' needs will be necessary to navigate through the uncertainty that is IoT, as not all innovations will be relevant or profitable (EY, 2016; Reifel et al., 2014).

2.5.2. Organisational Resistance

According to Chesbrough (2010), BMI by itself brings about a challenge, seen as experimentation usually conflicts with the traditional configuration of assets. Mapping tools such as the BMC give managers an easier time visualizing how the current and prospective BM differ, and how their decisions affect the different blocks that constitute their BM (Chesbrough, 2010).

Moreover, the conservatism the insurance industry is known for will most likely make this transition challenging (Canaan et al., 2016). A survey by AT Kearney (Reifel et al., 2014) has shown that insurers lag in the market in terms of their ability to optimize long-term value, collaborate with customers and utilize new insights for long-term benefits. For this reason, insurance companies must start by setting the right governance and corporate culture in place to create a mindset that embraces change and innovation. This will require true leadership commitment to spearhead the transformation, followed by enterprise-wide training and change management initiatives (Canaan et al., 2016; Reifel et al., 2014).

2.5.3. Disruption Threats

For innovators to be able to capitalize on an invention, they need to put mechanisms in place to capture value from each customer segment and hinder competitors from imitating their BM (Teece, 2010). As previously mentioned, insurers will need to develop intellectual property and data-driven capabilities that are hard to imitate, in order to create a sustainable competitive advantage. During this process of change it is still necessary to perform well in the current business, at the same time as leaders need to embrace low cost and small-scale experimentation in real life situations, using these opportunities to learn ahead of competitors (Chesbrough, 2010).

A final concern is the self-disruption that such digital transformation brings about. A shift from restitution to prevention might itself make certain insurance policies obsolete. If the IoT sensors embedded in cars and homes effectively reduce the amount of damages or accidents, then there would be no further incentive to purchase insurance, due to the lower frequency and severity of said losses. This might call for a move from human error to product liability, or low-frequency, high-severity events that are harder to price (Canaan et al., 2016).

2.6. Summary of Theoretical Findings

In summary, the Internet of Things might allow for insurers to move from simple restitution towards the actual prevention of damages. A better understanding of risk and customer behaviour allows for the reduction of information asymmetry through improved fraud detection, segmentation and pricing models. This in its turn will allow for first-movers to move from generalized offerings towards increasingly personalized offerings, focusing on the most profitable customer segments, whilst leaving the rest for competitors (Reifel et al., 2014).

Additionally, the IoT creates an opportunity for insurers to improve customer relationship management by having more frequent advice-led customer interactions that provide policyholders with real-time information on their insured objects, including themselves (Reifel et al., 2014).

The table below summarizes the theoretical findings on the potential future impact of the IoT on the BM of insurance companies:

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
•Strategic alliances with IoT-providers	•Improved fraud detection	•Risk reduction	•Shift to more frequent interactions	•Shift to more profitable segments
•Outsource technical product development	•Improved risk and pricing models	•Increased personalization	•Shift to advice-led interactions	•Shift to personalized offerings
	•Move towards non-risk related offerings	•Increased convenience	•Speedier claim management	
		•Improved brand/status		
	Key Resources	•Improved pricing	**Channels**	
	•Shift to intellectual & data-driven capabilities	•Cost reduction	•Reliance on partner channels	

Cost Structure	Revenue Streams
•Shift from cost- to value-driven BM	•Shift from subscription to usage-based fees
•Shift to more profitable segments	•Shift from fixed menu to dynamic pricing
•Claim frequency and severity reduction	•Up-sale opportunities
	•Premium discounts
	•New offerings/revenue streams

Figure 3: BMC summary of theoretical findings (own elaboration)

As early adopters continue to experiment with Usage-Based Insurance models, a first-mover advantage could be critical, allowing for differentiation in an increasingly commoditized market with long-term growth and profitability issues. First-movers will be able to leverage the IoT to position themselves as innovative and responsive to customer needs (Reifel et al., 2014).

However, the conservatism that characterizes the insurance industry will not make this transformation easy. First-movers have to be prepared for short-term losses in favour of a long-term sustainable advantage, if they are to keep up with an increasing digitalized world. This includes fundamentally changing corporate culture, increasing customer willingness to have their data collected and setting barriers that hinder competitor from imitating their BM.

3. Methodology

Below, the author describes the research strategy and design used to conduct the research, as well as the way in which the data collection and analysis was performed. Additionally, every choice is motivated and thoroughly explained to improve the validity and reliability of the research.

3.1. Research Strategy

The research question was created as a result of the author's general interest in understanding how the IoT affected the established business model of a conservative service-provider, such as the insurance industry. However, due to the author's limited knowledge on the research subject, and the lack of established theories within this area, an abductive approach was chosen. The abductive approach aims to make an unexplored area less puzzling by using previous theory, although limited, to facilitate in the generation of new theory. So, by combining theoretical and empirical findings, this approach provides a more thorough analysis of the impact of the IoT on the BM's of insurance companies. Additionally, the ability to change the literature review after the data collection allowed for a more iterative process that was beneficial for the paper (Bryman & Bell, 2015).

The explorative nature of the research questions and the limited knowledge on the subject call for a certain level of flexibility in the face of unexpected answers and data. For this reason, a qualitative research strategy was chosen. This research strategy is mainly concerned with words rather than the quantification in the data collection an analysis (Bryman & Bell, 2015).

According to Bryman and Bell (2015), a qualitative research strategy is suitable when the research questions investigate "*how*" something is affected by a change, and/or when the researcher is concerned with creating an in-depth understanding of a certain context. For that same reason, quantitative research strategy was deemed unsuitable for this study, since it is usually concerned with the generalization, measurement and testing of previously established theory (Bryman & Bell, 2015). The main problems and critiques related to qualitative research strategies are found in 3.5.

3.2. Research Design

According to Bryman and Bell (2015, p. 40), a research design provides a "*framework for the collection and analysis of data*" and relates to the criteria used to evaluate business research. This paper follows a multiple case study design, looking at different revelatory cases of

Swedish insurance companies that are currently working with the IoT. The multiple case design allows for a cross-case analysis, comparing the similarities and differences between each individual case. Compared to a single case study, this allows for a more robust understanding of the impact of the IoT on the business model of different insurance companies (Yin, 2009).

The multiple case study design is in some ways similar to a cross-sectional design, with the latter usually being employed with quantitative studies, since it aims to collect wide amounts of data from various cases, at a single point in time, in order to analyse the relationship between two or more variables (Bryman & Bell, 2015). However, since this paper is not necessarily interested in one single point in time or statistical generalizations, this design was deemed inappropriate. Moreover, according to Yin (2009), case study designs are suitable for answering "*how*" and "*why*" questions where the contextual conditions are considered highly relevant (Yin, 2009).

A common critique to qualitative strategy overall, and case studies in particular, are their problems with generalization (Bryman & Bell, 2015). However, as previously mentioned, this paper is concerned with the deconstruction and in-depth understanding of the particular context and features of the research subject rather than the statistical generalization of previous theoretical propositions. Still, the fact that multiple case studies rely on multiple sources of data and can benefit from prior theoretical propositions was found helpful in guiding the data collection and analysis (Yin, 2009). For this reason, the paper still manages to create some generalizable findings on the impact of the IoT on the BM of insurance companies and the challenges related to its implementation, as well as potential solutions to eliminate them.

3.3. Research Method

According to Bryman and Bell (2015), the research method refers to the techniques used in the data collection and covers how the interview guide was constructed and the respondents selected. This section is divided mainly in two parts: primary and secondary data collection, where the former is generated from investigation, and the latter is gathered from external sources.

3.3.1. Secondary Data Collection

After having identified the research area, a literature review was performed in order to develop a better understanding of the research area and previously established theory. Due to

the limited knowledge of the author and the limitations of both time and resources, the choice was made to perform a narrative literature review, rather than a systematic one.

The systematic literature review was developed mostly through quantitative research and can be defined as a transparent and highly structured process aimed at creating unbiased and extensive accounts of the existing literature. Narrative reviews, on the other hand, although being more prone to bias, tend to have a wider scope and are therefore more suitable for qualitative investigations, especially when the aim is to generate understanding of the research area rather than accumulating knowledge (Bryman & Bell, 2015).

Additionally, this method was found to provide the author with the possibility to change their view of the theory as a result of the analysis of the collected data. As with the choice of an abductive approach, this method allowed for added flexibility in the face of unanticipated issues or topics (Bryman & Bell, 2015).

The main research objective was to find information regarding the current applications of the IoT in insurance companies, as well as its impact on their business model. The search was initiated by searching on two different databases: Web of Science and Scopus. However, the author found that there was a general lack of existing papers addressing the research area. For this reason, the search was extended to Google, where the literature was mostly dominated by the research of Management Consulting firms. This provided the author with the theoretical framework that describes the impact of the IoT on the BMs of insurance companies and the challenges and risks related to its implementation.

Additionally, some criteria were formed to assist in the literature review. Firstly, the articles had to be related to the application of the IoT in insurance-related settings, from a managerial perspective. For this reason, any articles that focused solely on the technological or technical aspects of the IoT, without taking into account its impact on the Business Model, were disregarded. The most frequently used keywords were: IoT, Business Model, Business Model Canvas, Business Model Innovation, and Insurance.

3.3.2. Primary Data Collection

In order to answer the research questions, qualitative interviews were held with relevant actors working with the implementation of the IoT in the Swedish insurance industry. Qualitative interviewing is able to capture insights that would otherwise not be detected through observation or such quantitative methods as surveys. These were primarily employees at Swedish insurance companies currently working with the IoT, as well as one

IoT provider that has worked with insurance companies to develop IoT-centred business solutions.

The interviews were semi-structured with open-ended questions, thus granting the interviewer the freedom to delve deeper into relevant areas that were initially not part of the interview guide, at the same time as it allows the respondent to answer freely without being cut off or lead to an answer. Additionally, with the interviews being semi-structured, questions could be added or rearranged if appropriate, whilst still providing a path for the interviewer to ultimately get an answer to their research question. (Bryman & Bell, 2015).

3.3.2.1. Selection of companies and respondents

The author chose the interview participants through a generic purposive sampling approach, in order to ensure the collection of valuable and accurate data. In a case study design, the participants should be selected on the anticipation of the opportunity to learn (Bryman & Bell, 2015). For this reason, the interviewees should have prior experience of the research area, that is, IoT-centred business solutions.

The purposive sampling approach is a form of non-probability sampling, meaning that it disallows for the generalization of the findings since they might not be representative of the whole population (Bryman & Bell, 2015). However, as mentioned earlier, this paper is interested in the depth of the particular context, rather than the breadth and generalization that comes with larger samples.

The interviewees were primarily found by searching on Google and LinkedIn for individuals that have worked directly or indirectly with the implementation of the IoT in the Business Model of Swedish insurance companies. The emphasis was on their experience, rather than their specific title. The individuals were then contacted through E-mail and LinkedIn InMail, where the author explained the nature of the research and the purpose of their contribution. All respondents were native Swedish speakers, so the author chose to primarily communicate in Swedish. See Appendix A.

Additionally, the interview guide was sent to the respondents before the interviews so that they could prepare beforehand, or alternatively, refer the author to a colleague they felt was better suited to answer the interview questions.

3.3.2.2. Practicalities

The interview guide was constructed based on the research questions and structured similarly to the Theoretical Framework, as to facilitate the coding and data analysis process later on. The interview guide started with an introduction of the research and the purpose of the interview. During this introduction, the respondents were also asked if they consented to being recorded, and whether they wanted to remain anonymous. Then, the interview guide was split in three parts: the first section asked for the respondent's background and experience with BM and the IoT; the second section was designed to capture the impact of the IoT on the different BMC blocks; and lastly, the third section asked about the risks and challenges related to the implementation of the IoT and what insurers can do to eliminate those. See Appendix B.

Due to limitations of time and resources, and the fact that most Swedish insurance companies' headquarters are located in Stockholm, the author chose to conduct telephone interviews. One of the disadvantages with telephone interviewing, according to Bryman and Bell (2015), is the higher risk for technical difficulties and the ease with which a respondent can terminate the interview. This was not found to be a problem during the course of the data collection. Additionally, the interviewer cannot interpret the respondent's body language. This, however, did not constitute a major issue seen as the research is not interested in capturing the reaction of the individual respondent.

With all respondents being native Swedish speakers, the choice was made to hold all interviews in Swedish, thus making the respondents feel comfortable when answering the interview questions and ensuring the collection of valuable data. This makes it crucial to translate the answers as accurately as possible in the empirical findings, as to avoid linguistic, cultural or methodological problems with their interpretation. For this reason, the author made use of respondent validation, whereby the author provided the respondents with a summary of the interviews, in order to ensure a good correspondence between the empirical findings and the perspective of the interviewees (Bryman & Bell, 2015).

Seven out of eight interviews were recorded, and no respondents requested to remain anonymous. The recorded interviews were transcribed and translated into English as soon as the interviews finished, in order to ensure that all relevant information was captured. The choice was made to perform a partial transcription, based on two major reasons. Firstly, since

they create larger amounts of data, full transcriptions are more time-consuming. Secondly, not all parts of the interview were considered relevant in the context of the research purpose.

The table below depicts the respondent's name, position, company and the date, length and method use to hold the interview. The interviews were on average 57 minutes long.

Company	Interviewee	Position	Date	Length (minutes)	Method
Folksam	Stina Wärn	Product Developer, Car Insurance	03/05/2019	65	Phone
	Kent Lindmark	Business Area Manager, Damage Prevention	18/04/2019	67	Phone
Länsförsäkringar	Johan Nyman	Chief, Property Insurance	26/04/2019	66	Phone
	Mats Arnström	Product Manager, Health Insurance	24/04/2019	45	Phone
	Justus Alholt Tobias Groth	Business Developer Business Developer	23/04/2019	63	Phone
Paydrive	Emma Jändel	Chief Operational Officer	02/05/19	50	Phone
Moderna Försäkringar	Jonas Frid	Head of Business Development	17/04/2019	30	Phone
Talkpool	Stefan Lindgren	Chief Technological Officer	08/04/2019	70	Face-to-face

Figure 4: Interview Respondents (own elaboration)

3.4. Data Analysis

The data gathered from the interviews was coded and interpreted through a thematic analysis. According to Braun and Clarke (2006, p. 79), a thematic analysis consists of "*identifying, analysing, and reporting patterns (themes) within data. It minimally organises and describes your data set in (rich) detail*". A theme, in its turn, represents a certain response pattern in the data, that is relevant to the research (Braun & Clarke, 2006). This process was chosen since it facilitates the breakdown and interpretation of the information gathered during the interviews into the different categories and blocks identified by the theoretical framework. Following an abductive approach, this was then used to perform a structured comparison of the empirical and theoretical findings, which provided a validating effect to the research.

In order to answer the first research question, the data collected from the interviews was organised in the empirical findings according to the BMC structure, which allowed to study a single IoT application's impact on the different blocks that constitute a BM. For each question, which corresponded to a specific BMC block, subthemes were created according to recurring or relevant subjects. In the financial aspects, for example, such subthemes included the reduction of claim frequency and severity in the cost structure, or premium discounts in the revenue streams. The risks with the implementation of the IoT were organised in a similar way without following an established framework, but instead bigger recurring and relevant

themes such as external resistance, organisational resistance and disruption threats, which in their turn had their own subthemes. See Appendix C for coding tables.

With the paper following a multiple case design, the empirical findings aim to present the similarities and differences among the different cases and respondents. Together with the abductive approach to theory generation, whereby the empirical findings are compared to the theoretical, this allowed for a better understanding of the level of impact of every IoT application on the different blocks that constitute the BMC, as well as the challenges related to its implementation.

In order to determine the level of impact of every application, a table (figure 6) was constructed comparing the theoretical and empirical findings. The impact of each factor was designed by taking into consideration the frequency with which a certain subtheme emerged during the interviews (see appendix C), as well as their presence in the theoretical findings. If a subtheme is mentioned by less than one third of the respondents, then the impact is low, whilst if more than two thirds of the respondents mention a subtheme, the impact is high. Finally, if a subtheme is mentioned by more than one third but less than two thirds of the interviewees, then the impact is medium. Moreover, whenever a subtheme is mentioned in the empirical findings, but not in the theoretical framework the impact is also considered low.

3.5. Research Quality

The most normal criteria to evaluate business research include reliability, validity and replication. However, many researchers have stated that these criteria are not as relevant to qualitative research, as they were initially invented to assess quantitative research (Bryman & Bell, 2015). For this reason, these terms have been adapted to fit a qualitative research strategy and are discussed below.

Internal validity is concerned with whether the theoretical propositions developed by the researcher match the researcher's observations. By providing the transcripts of the interviews and research findings to the interviewees, the researcher made use of respondent validation. Additionally, triangulation was used during the collection of both primary and secondary data to ensure that the findings were not influenced by one single source of information. This was done by interviewing more than one representative of a single insurance company and searching for academic literature from multiple databases (Bryman & Bell, 2015).

External validity refers to the degree to which the research findings can be generalized into other contexts. Qualitative research methods are usually employed in smaller samples, which makes generalization more difficult. The case is no different with a case study design, that usually looks at a few cases. However, this choice was made primarily because this paper is more interested in explaining the particular details of a certain situational context, rather than creating generalizable findings (Bryman & Bell, 2015).

External reliability, similar to replication, relates to the degree to which a study can be replicated, that is, if another researcher would reach the same outcome if they were to reproduce the same procedures and processes. Seen as it is impossible to "freeze" a social setting and the conditions in which the research was performed, this becomes a difficult criterion for qualitative business research to meet (Bryman & Bell, 2015).

Moreover, due to the interpretive nature of qualitative research, it is prone to subjective preferences and interpretations of the researcher, who is usually not interested in quantifiable measures. For this reason, the author has avoided including preferential bias or subjective opinions into the research to the best of his abilities. This subjective nature of qualitative research creates further problems with replication, seen as a paper can many times become an interpretation of what the researcher themselves find relevant or interesting (Bryman & Bell, 2015). To avoid problems with replication and transparency, this paper goes into great lengths to describe in full detail the choices and the reasons behind the decisions made during the course of the project.

Internal reliability relates to whether the members of the research team agree about what they see and hear. Seen as this study is performed by a single researcher, the author would regularly seek the advice from the thesis supervisors and other external points of view. Additionally, the use of respondent validation and triangulation also ensured a greater level of internal reliability.

4. Empirical Findings

In this section, the author presents the relevant findings from the semi-structured interviews held with the employees of different insurance companies. This section aims to show what the respondents believed to be the impact of the IoT on the different blocks of the BMC, as well as the challenges related to its implementation and recommendations of potential solutions.

4.1. Cases

Below, the author shortly describes the IoT projects that each case company is currently working with. Eight interviews were held with employees at four different Swedish insurance companies, as well as an employee from the IoT provider Talkpool, in order to provide an external perspective to the results.

4.1.1. Moderna Försäkringar

In 2017, Moderna Försäkringar launched a Usage Based Car Insurance called Enerfy, in partnership with the insurtech company Greater Than. The offering consists of a plug-in sensor that is installed into a car's OBD (On-Board Diagnostic) input, that then measures the driving behaviour of the policyholder. The collected data is then sent to a cloud, where it is analysed with the help of the Artificial Intelligence Greater Than developed to match the policyholder to one of the fifteen different premium levels provided by Moderna. Finally, the policyholder can view all the collected information, including their risk score, through an application on their telephone. Moreover, the service also provides other integrated services such as a fleet management tool, a driving journal, parking assistance, among others (Greater Than, n.d.).

4.1.2. Paydrive

Paydrive started in 2013 with the aim of providing customers with a car insurance solution that allows for drivers to affect their own premiums, with the help of the IoT. The sensor, developed and distributed by Telia, is connected to the car's OBD port and measures the distance and driving behaviour of the policyholder. The policyholder can then view information on their driving behaviour through the mobile application Telia Sense, as well as utilize other features such as car tracking, parking assistance, driving journal and internet connection. Like Enerfy, the customer pays a base premium, that covers the lease of the Telia Sense sensor and application, and a usage-based premium, that depends on the distance and driving style of the insured. Every trip is given a driving score from 0-100, where 70-100 is

calm, 25-70 is medium and under 25 is tough. If the customer receives a 100-point score, then they only pay for the base premium itself (Paydrive, n.d.).

4.1.3. Folksam

Folksam, a mutually owned insurance company, is currently testing a few different IoT applications, with one of them being Köra Säkert, a PAYD insurance solution. According to a study by Folksam, speed is one of the most normal reasons for traffic accidents, and by providing real-time feedback on their speed, customers have been shown to drive over the speed limit less frequently. Like Paydrive, Folksam has partnered up with Telia Sense, meaning that the customer can choose their PAYD insurance solution without having to buy another OBD sensor or changing applications (Folksam, n.d. b).

Customers at Folksam can still choose to buy a traditional car insurance. However, if they choose to subscribe to Telia Sense, they can reduce their car insurance premium by 20 % depending on their average driving speed (Folksam, n.d. b). The user installs a light indicator visible behind the wheel that lights green when they are under the speed limit, yellow when they are a bit above it and red when they are driving too fast. The light indicator itself is developed by Folksam and is connected via Bluetooth to the Telia Sense sensor. So, if the policyholder never drives over the speed limit, they receive a 20 % premium discount (Folksam, n.d. b).

Another area where Folksam is implementing the IoT is property insurance. According to Lindmark, Folksam has partnered up with Anticimex to provide water leakage protection to their policyholders' properties, with the help of IoT sensors. Policyholders can install water leakage sensors in high-risk areas such as bathrooms, kitchen sinks and other water-dependent appliances, that then signal the user if the humidity levels are too high. A water leakage circulation breaker is also beginning its testing phase. These smart sensors would be installed on high-pressure pipes close to the water meter and be able to turn off water circulation in the case of a water leakage, regardless of its extent. In return, the policyholder receives a 10 % premium discount on their home insurance (Folksam, n.d. a).

4.1.4. Länsförsäkringar

Länsförsäkringar consists of 23 local mutually owned insurance companies and is currently working with three separate IoT-centred solutions: water circulation breakers, Ride Safe, and Aifloo.

In an attempt to reduce the damages resulted from over 100 000 yearly water leakages in Sweden, Länsförsäkringar is currently selling water leakage sensors as well as water leakage circulation breakers, as a complement to traditional property insurance. When a water leakage is detected by the sensor, it sends the information to the breaker, that then shuts off water circulation in order to prevent larger water damages in the property (Länsförsäkringar, n.d.).

The second project is Ride Safe, a solution that is meant to reduce phone usage whilst driving and is currently in a pilot phase to measure the demand in private and business segments. According to Ride safe (n.d.), around 30 % of traffic accidents happen due to a lack of attention related to phone usage. Ride Safe consists of a sensor that is attached to the vehicle and connected to the policyholders' phone, so that whenever the vehicle is in movement, all incoming notifications are blocked, including calls, unless the user has a hands-free solution. Additionally, the policyholder can also choose the level of protection, by allowing maps or automatic replies to incoming messages. The phone usage per trip is then used to calculate a driving score, that allows Länsförsäkringar to advise customers on how to become better drivers (Ridesafe, n.d.).

Lastly, Aifloo is the name of a MedTech company that Länsförsäkringar has invested in. Aifloo has developed a bracelet device that, together with in-home sensors and Artificial Intelligence, studies movement patterns and detects if there are any anomalies. For example, if the user has not moved in a relatively long time, the system sends an SOS alarm, which can also be activated manually by the user. According to Arnström, there were two major reasons that Länsförsäkringar chose to invest into this technology. The first one was that Länsförsäkringar noticed a growing elderly customer segment, with a growing percentage living alone in private homes, even though they might suffer from an illness. The second one was to create a service that gives both elderly and their relatives ease of mind and a sense of security.

4.1.5. IoT Expert – Talkpool

Finally, the author found it relevant to interview an IoT provider that is currently working in the Swedish insurance market, in order to add an outside perspective to the empirical findings. Stefan Lindgren works for Talkpool, a global provider of IoT products and services to businesses that want to create smarter buildings, industries and cities. One of the customer segments targeted by Talkpool is the Swedish Insurance industry, where they are currently providing water leakage sensors capable of detecting high humidity levels.

4.2. Impact of the IoT on the Business Model of Insurance Companies

Below, the reader will find a BMC summarizing the empirical findings on the impact of the IoT on the BM of insurance companies:

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
•Strategic alliances with IoT-providers	•Improved risk and pricing models	•Risk reduction	•Shift to more frequent interactions	•Shift to more profitable segments
•Outsource technical product development		•Increased personalization	•Shift to advice-led interactions	•Shift to personalized offerings
•Efforts to improve cooperation		•Increased convenience	•Speedier claim management	
		•Reduced negative impact on environment	•Gamification/loss aversion	
	Key Resources	•Improved pricing	**Channels**	
	•Human labour with digital competence	•Cost reduction	•Reliance on partner channels	

Cost Structure	Revenue Streams
•Shift from cost- to value-driven BM	•Shift from subscription to usage-based fees
•Increased supplier costs	•Shift from fixed menu to dynamic pricing
•Claim frequency and severity reduction	•Up-sale opportunities
	•Premium discounts
	•New offerings/revenue streams

Figure 5: BMC summary of empirical findings (own elaboration)

4.2.1. Financial Aspects

4.2.1.1. Revenue Streams

In general, most respondents agree that there is a trend towards more dynamic pricing mechanisms that are decided on individual usage and behaviour, rather than the traditional historical and socio-demographic indicators that insurers have relied on. This is the case of such usage-based car insurance solutions like Enerfy, Paydrive and Köra Säkert.

Both Paydrive and Enerfy, for example, rely on the mileage and driving behaviour of the individual policyholder, which is collected by the OBD sensor. Specifically, the policyholder pays for a base premium depending on the traditional indicators, which covers the cost of the sensor hardware and software, and a variable usage-based premium, that depends on their mileage and driving behaviour. Folksam and their solution Köra Säkert make use of a similar mechanism to incentivise positive driving behaviour, except that the customer receives a premium discount of maximum 20 % on the normal car insurance premium, if they constantly drive under the speed limit

Nyman, Alholt and Groth, however, argue that it is hard to measure the current demand for UBI. For example, Nyman mentions that most of Länsförsäkringar's customers want a consequent sense of security throughout their lives and have not sensed any real demand for insurance that only covers the insured object for a certain amount of time or when it is being

used. Furthermore, the three respondents argue that insurance premiums have always been adjusted according to usage in one way or another, meaning that usage-based insurance does not save that much money for customers in the long-run. For example, when a customer applies for car insurance, they are required to fill in an estimation of their monthly mileage, which is then included into the risk and pricing calculation. Lastly, Lindmark sees a hard time moving to more dynamic pricing in home insurance, a context in which an UBI solution would not make a large difference in pricing models.

Another area of interest is the creation of new offerings and revenue streams. The IoT's applications in the insurance industry are not limited to risk insurance but extend to integrated solutions that constitute potential sources of revenue for insurance companies. To help illustrate, the water leakage sensors implemented by Folksam are able to detect water leakages, as well as measure water consumption and turn off water circulation. Lindmark mentions how these applications could help insurers develop a dashboard where the customer can view their water usage, recommendations on how to reduce it or even set a consumption level at which the water circulation is shut off. Additionally, Lindmark provides another example where insurers guarantee that a repairman is sent to fix the problem identified by the water leakage sensor. The cost of the service could be covered by the reduced risk provided by the IoT, embedded into the premium or paid as an extra fee. According to Lindmark, this is mainly dependent on how the offering is packaged, the customer willingness to share their sensor signals, and what customers are interested in and willing to pay.

This trend can also be seen in the PAYD market. Services such as Paydrive and Enerfy provide policyholders with several non-risk related functions such as a driving journal, car tracker and parking assistance. Frid mentions that the data collected from the car can also be used for car repair, inspection, maintenance and financing, in ways that would otherwise not be possible. These functions are currently embedded into the premium, which is paid by the policyholder through a monthly subscription.

Moreover, some of the respondents mention that with access to more structured data on the individual policyholder and their situation, insurers have the possibility to become more relevant in their communication and offerings, thus presenting insurers with an opportunity to up-sell to the customer. This would probably not be experienced as negative by customers since insurers will have a better basis for such targeted recommendations, instead of

providing generalized recommendations that have a negative impact on the customer experience.

Lastly, insurers have to address the issue with increasing customers' willingness to share their data and adopt IoT-centred insurance solutions. In the discussions Lindgren has had with insurance companies, the idea has been to primarily reduce the risk that insurance companies take on when they insure their customers. Currently, insurers subsidize fire and smoke alarms when policyholders purchase a home insurance, so they should be willing to do the same for IoT sensors in order to reduce their risks in the long-term. In this case, the policyholder receives a lower premium if they decide to install an IoT sensor and share their data with the insurance company, since there is a lower risk for damages going by unnoticed. Accordingly, this lower premium is one of the main value propositions of PAYD solutions. According to Wärn, this premium discount constitutes a loss of revenue. However, insurers expect to make up for it on the cost side, in the form of reduced claim frequency and severity.

4.2.1.2. Cost Structure

Most respondents agree that the IoT will provide insurers with a better opportunity to detect damages in their early stages, or even before they arise, allowing for a reduction in the number of submitted claims, and thus their following costs. Furthermore, with claim pay-outs being the biggest expense for insurance companies and the IoT being a relatively cheap and accessible technology, Nyman expects it to create a net cost reduction for insurance companies.

As an example, Lindmark and Lindgren mention how water leakage sensors are able to reduce the number and cost of each individual claim. According to Lindgren, a bathroom that has suffered a water damage can easily cost insurance companies about 100.000 SEK, as well as another sum for the property owner in the form of a deductible and value depreciation. By detecting water leakage in its early stages, the IoT helps insurers reduce the frequency and severity of claim pay-outs. Additionally, Lindmark also points out that by reducing the number of claims, the IoT can indirectly reduce the amount of labour necessary to manage them. This can also be done by automating certain parts of the claim process that are captured by the IoT sensors, a priori.

However, both Frid and Wärn hesitate to confirm that their sensors have had a positive effect on cost reduction, since they have not yet seen any objective evidence that their offering has actively reduced the number of claims. This is because it takes time to gather enough data to

compare the results, and that there are several other factors that influence the numbers, making it hard to isolate the cause and effect relationship. Still, both respondents see a logic in how a driver that is rewarded for good behaviour will most likely incur fewer damages.

Most of the respondents explain these cost reductions as a result of an increased focus on the prevention of damages before they happen. However, some respondents describe this effort as more of an extension of the preventive work the insurance industry is already doing. As an example, both Lindgren and Arnström mention how the building regulation for bathrooms in Sweden was largely developed by insurance companies because poorly built bathrooms have a higher risk for water damages. The same can be seen when insurers sell fire alarms in conjunction with home insurance. Therefore, preventing damages, is, according to Arnström and Wärn, built into the "*DNA*" of insurance companies.

Regarding the costs in the implementation of the IoT, Lindmark mentions how the close cooperation with IoT providers increases supplier procurement and monitoring costs. Another cost that is created, depending on the relationship of the insurer and external partner, are distribution costs. Frid mentions how insurance policies differ from IoT sensors, in that the former are easily and cheaply distributed, whilst the latter brings logistical challenges. Folksam, in their turn, took some of the light indicator development in-house, but did however, outsource its production and distribution to an external partner.

4.2.2. Customer Interface

4.2.2.1. Customer Relationships

According to Lindmark and Frid, one of the objectives of insurance companies is to improve on customer relationships in a way that creates customer loyalty. Currently, a customer will only interact with an insurance company when they are looking for an insurance solution, paying their premium or making a claim. Since the aim of insurance is to share risks among a large group of people, most customers do not suffer any damages, which considerably decreases the number of interactions.

Additionally, Lindmark explains that the premium is currently a big factor in the customer purchase decision. Folksam, as well as other insurance companies, must set competitive premiums in order to maintain their market share. This approach is, however, not sustainable in the long run. By improving on customer relationship management, customers might start looking at more than premium pricing when comparing insurance solutions. As will be discussed below, this is an area which the IoT can potentially improve on.

The empirical findings suggest that the IoT allows insurers to expand on this customer interaction and provide almost a daily service to policyholders, by sharing advice and recommendations on how to reduce the risk for losses. For example, both Enerfy and Paydrive's applications provide policyholders with driving recommendations as often as they wish[2]. In this way, the IoT allows for a more supporting and interactive relationship with customers. Alholt and Groth also mention that the IoT can help inform the policyholder that they are about to enter an area with an increased risk for traffic accidents at a specific time of the day.

Another example is provided by Lindmark, who mentions that when a water leakage is detected, the insurer can contact the policyholder to discuss different measures they can take to alleviate or eliminate the problem. Furthermore, Lindgren mentions in his response how customers most likely prefer to receive an offer to purchase a de-humidifier due to a higher risk for dry rot, than simply letting it go unnoticed until the damage is irreversible. No one wants to suffer damages, and if insurers are able to nudge customer in the right direction, Lindgren does not believe they will view it as a "Big Brother community" where they are constantly monitored, but instead, that they benefit from a better insurance protection.

This advice-led interaction is not entirely new for insurance companies. Lindmark explains how Folksam has worked with high-risk customers by informing them of different ways to reduce their risk for losses. According to Lindmark, these preventive recommendations have a positive effect on customer retention and behaviour. Likewise, Arnström states that a customer will most likely prefer the insurance provider that not only provides accident insurance, but that also helps the customer avoid injury in the first place. So, by improving the customer experience and insurance protection, customers might find themselves looking for more than the lowest insurance premium.

Lastly, by providing policyholders with a driving score and active feedback, Wärn and Jändel both discuss how their service adds a gamification effect, whereby the policyholder is more prone to change their behaviour due to loss aversion.

4.2.2.2. Customer Segments

Insurance is a collective product where many are supposed to share few risks. At the same time as the customer experience becomes more individual, insurers want to diversify their

[2] The application provided to Paydrive users is developed by Telia Sense, but is included into the premium payment, and therefore considered as a part of the insurance offering.

risks among a larger group of individuals. Therefore, most of the respondents did not mention any major changes in the way insurers segment their customers.

According to Lindgren, the added individualization brought by the IoT has both advantages and disadvantages. For example, is it reasonable that a healthy person that does not drink and exercise should have a different premium from someone who does not? Or someone that suffers from a certain kind of illness? The respondent did not have a clear answer to these questions but believes that somewhere there is a need for some solidarity. On the other hand, the added individualization can also remove some of the structural unfairness that there is today. Should someone who lives in a dangerous neighbourhood but is very careful with their belongings, be charged more simply because they happen to live there?

Similarly, Alholt and Groth state that a balance is necessary, and that insurers need to make it possible for anyone to insure themselves. The insurance industry is regulated by law and must therefore conduct business in a certain way regarding premium pricing and excluding people from insuring themselves. This includes more risk-prone customers and policyholders that suffer relatively more damages. Insurers can work with such groups, with the help of the IoT, to reduce their risk level.

Furthermore, Lindmark adds that it is dangerous to create a situation where some cannot insure themselves because they are not technically interested. The three PAYD solutions, for example, have attracted a more technology-friendly customer segment that is more willing to engage in digital solutions. Additionally, their service is more advantageous to low-risk customers that benefit from a more dynamic pricing that is decided on individual driving behaviour. By that same logic, those that have a riskier behaviour will not want their data collected. For this reason, insurance companies will face some difficult ethical questions about how to segment their customers.

4.2.2.3. Channels

Most IoT-centred insurance solutions mentioned in this paper include some sort of user interface where the customer can view relevant information regarding their insured objects., allowing insurers to increase the number of customer interactions. For example, the customer might receive a push notification when they leave their house informing them that everything is in order, so that they focus on the day ahead of them.

The Telia Sense and Enerfy application, for example, allow insurers to more easily interact with policyholders by offering them driving recommendations as often as they wish. On

Folksam's homepage, for example, the policyholder can log into their account to see pertinent information and other details relevant to them. However, Lindmark and Wärn both mention the importance of ensuring that only the policyholder can view that information, and that they are not spammed with irrelevant information.

4.2.3. Value Proposition

Insurers will not be able to experience the positive effects from the IoT if customers do not feel as if they benefit from adopting an IoT-centred insurance solution. The empirical findings suggest that the value proposition is the BMC block most affected by the IoT. Below, the author presents the different ways in which the respondents believed the IoT influenced their value proposition.

Most often, there is an indication that something is awry, where an incremental deterioration takes place long before the damage is noticeable. The IoT provides the customer with an active monitoring that detects such indicators in their early stages before the damages takes place. Lindmark provides an example related to water leakage sensors. If the sensor detects that there is mould in the roof, the insurer can very cheaply either inform the customer of a humidity problem or offer to fix it themselves. On the other hand, if the customer lets it go unchecked until infrastructure beams start deteriorating, then it can become extremely expensive for the insurance company, but even the policyholders themselves, in the form of deductibles and value depreciation. Additionally, Alholt and Groth comment on how customers that have experienced a water leakage damage in the past will most likely not want it to happen again, even if their insurance policy covers it.

Frid and Jändel, on the other hand, point to more accurate pricing models as the primary reason for the development of their usage-based car insurance solutions. With PAYD solutions, policyholders receive a better premium that is decided on their individual driving behaviour rather than other traditional external factors insurers rely on. On the other hand, Frid argues that such dynamic pricing has its drawbacks. One of them is that some customers prefer a predictable and steady premium rather than one that fluctuates from month to month.

Nevertheless, there is a close relationship between risk and premiums, as Alholt and Groth discuss. Primarily, insurers get paid for risk and if there is a potential to reduce that risk with the help of the IoT, then the price follows with. For example, if an individual is older, there is a higher risk that they die, and therefore a higher life insurance premium.

Besides reducing the premium and the risk of paying costly deductibles, policyholders' costs are also reduced through the non-risk related functions mentioned in 4.2.1.1. For example, the water leakage sensors can measure the water consumption in the household and turn off the circulation after a certain point. Besides this, Folksam has calculated that the reparation of one water leakage damage can emit an average of 200 kilograms of carbon dioxide. By reducing the risk and therefore the number of water leakage damages, the IoT reduces the negative impact of such damages on the environment.

Similarly, the PAYD solutions have observed a positive effect on fuel consumption by incentivising policyholders to drive in a moderate speed and avoiding harsh accelerations or brakes. Additionally, in their respective applications, the drivers can also view their carbon dioxide emissions and receive recommendations on how to reduce them. Therefore, the IoT-centred insurance solutions allow policyholders to live more sustainably, both economically and environmentally. Furthermore, the PAYD solutions also offer other non-risk related services that improve the convenience for the customer, by having different functions integrated together with their insurance. This includes car inspections, parking assistance, GPS, driving journal, and so on.

Finally, these shifts towards non-risk related services, individualized pricing and recommendations, provide customers with an added level of personalization and convenience. The customer is also able to receive a better insurance protection, since insurance companies can take on new risks and insure more things. For example, Lindmark mentions that it is possible that if the policyholder takes good care of their home, then perhaps insurers will be able to take on new risks such as the façade or the roof.

4.2.4. Infrastructure Management

4.2.4.1. Key Activities

According to the respondents, understanding and valuing risks is the core activity of insurance companies. Today, insurers look mostly at age, geographical location and other external factors for their risk and premium calculations. Hence the big difference in the car premiums for a car that spends most of its time in a garage in the countryside and a car that is often driven around in Central Stockholm.

Most respondents agree on the fact that the IoT has the potential to provide insurers with more detailed and relevant data from the physical world, thus improving risk understanding, which in its turn creates more accurate pricing models. At the same time, both Nyman and

Lindgren explain how insurance companies are currently working with Big Data analysis, meaning that it is already one of their key activities and will most likely not suffer big changes. Instead, the main difference is in the quantity and complexity of the data, which is why insurers need to develop the internal assets to integrate it into their current risk models.

Currently, Länsförsäkringar and Folksam are only using their water leakage sensors to prevent damages, rather than to collect data and develop their understanding of risk. Even though this might grant opportunities to learn patterns and trends in signals, that might later lead to forecasting accidents, managing the data collected from the sensors is challenging for insurers, a topic that will be further developed in 4.3. So, in the short term, the IoT serves more of a preventive role in tracking and monitoring insured objects.

Another key activity that insurers chose to keep in-house involves customer relationship management and business development. It is only when the customer has accepted the offering, that the IoT provider takes over and manages the activities in which they are skilled. The activities of key partners are further developed in 4.2.4.2., but usually include the activities related to the sensors themselves, their development, production, distribution, maintenance and data collection.

Similarly, Arnström mentions that Länsförsäkringar usually does not partake in the base R&D, instead they manage the commercial side, which according to Nyman encompasses customer relationship management and business development. For this reason, Länsförsäkringar enters the project in a phase when the product is ready for pilot testing. Arnström clarifies that this does not mean that the product has to be perfect by the time the insurer enters the picture, but it does need to be functional.

4.2.4.2. Key Resources

It seems that insurers will not suffer radical changes in terms of key resources, but a minor shift towards more digitally competent human capital. Even though insurers already analyse data to understand risks, Nyman mentions that there is a need for human capital with skills in data management and modelling. This is because the IoT provides more sophisticated data that makes it more challenging to integrate it with the risk models insurers are currently working with.

For example, Folksam has recently recruited several IT specialists in order to obtain more in-house IT and digital competence, instead of relying on external consultants. Lindmark mentions that the same must be done in regard to business development and customer

relationship management, to develop the types of competencies that a company needs to be successful in an ever-changing landscape. According to Nyman, this will also require a good understand of customers' behaviour, wants and needs in order to develop relevant offerings.

4.2.4.3. Key Partners

Among the cases chosen for this study, all insurance companies relied on external partners for the development of the sensors and their data collection. According to Lindmark, insurers will most likely never be leaders in technology, but by joining forces with external partners, insurers are able to collect real-time information on insured objects and develop better risk and pricing models.

For example, Talkpool provides insurers with a package that includes the hardware itself, data collection and sometimes, connectivity, if the insurer does not prefer to use an own network. Similarly, Moderna partnered up with Greater Than for the development of the application and the AI algorithm used to calculate the risk score for the individual policyholder.

Both Paydrive and Köra Säkert are made available through Telia, who is responsible for the development and distribution of the sensors, as well as the mobile application. Wärn mentions that one of the reasons for this collaboration, is to allow customers to change insurers without having to purchase another OBD sensor from another insurer. Instead Telia provides the platform for insurers to adopt a standardized technology easily installed by the customers themselves.

According to Lindmark, there is a need to discuss who has the right to manage data and profit from it. If this information is shared with third parties for free, then insurers might inadvertently create new competitors. For example, the IoT provider can have a distributor role where they provide the data to insurers, without being able to use the data in any other way than to distribute it.

Furthermore, part of this relationship with key partners is ensuring that they deliver on what was agreed upon. Lindmark mentions that with the water leakage breakers, Folksam has chosen to procure the IoT providers themselves and set up mutual KPI, to create a closer relationship where the partners learn and develop together. Similarly, Länsförsäkringar and Aifloo have had a couple of mutual workshops to define the content and objective of the test pilot, where Länsförsäkringar noticed some elements were lacking.

4.3. Managing the Risks with the Implementation of the IoT

In this subsection, the author presents the empirical findings from the interviews, regarding the risks and challenges related to the implementation of the IoT, and the potential solutions presented by the respondents.

4.3.1. External Resistance

Most respondents believe that data management and privacy concerns are currently the biggest challenge for insurance companies. Lindmark, for example, discusses how there is a regulatory and ethical question regarding the collection and management of data, and how insurers cannot allow policyholders to feel as if they are living in George Orwell's 1984, being constantly monitored.

Lindgren touches upon the same subject by asking the following questions: Who owns the data? Typically, insurance companies are only able to write one-year contracts for home insurance, so how can they manage data and its transfer from one insurer to the next? How can insurers ensure that end-customers feel they have control over the data and give acceptance to share their data, without experiencing that they are being watched over? Most insurance companies are reinsured, so where does the data trail end? Does it end at the service provider, insurance provider or reinsurance provider?

According to Lindmark, managing this issue in a clever way is a major challenge for insurance companies and needs to be managed in parallel with technology advancements. Insurers must understand how to make customers recognize that they benefit from sharing their data with insurance companies. Most respondents agree that for this to happen, insurers will need to provide premium discounts or a value-added service that is enticing enough to warrant data-sharing. Specifically, Lindgren predicts that this will happen mostly through premium discounts, a little bit varying on the kind of data. For example, the data collected from water leakage sensors in the bathroom floor is not that sensitive. On the other hand, there is the kind of data that shows where the user is and how fast they are driving. By discounting premiums, customers have a bigger incentive to share their data with their insurers.

In the end, according to Lindgren, it is up to the wallet of the policyholder. But more importantly, Lindmark states that the customer needs to trust the insurer and the way in which they manage data. When a company loses trust, customers become sceptic to future offerings, which negatively impacts the business in the long run. For this reason, Jändel and Lindgren

believe it is very important for insurers to clearly communicate on how the data will be used, analysed and shared.

Similarly, Arnström, Alholt and Groth believe that the key to increasing customers' willingness is communicating to them how they benefit from the offering, otherwise they have no real incentive to share their data with insurers. In summary, insurers need to find a good balance, without making the customer feel like they or their property is being controlled by guaranteeing that the data will not be used in an inappropriate or controlling way, but that it adds a sense of security.

Technology can also play a role in solving this issue. For example, Arnström mentions that in many cases, it is not a person that is actively monitoring an individual customer's movements, but an AI engine. Additionally, Wärn mentions that Köra Säkert only collects data on an aggregate level, so Folksam cannot pinpoint where and when exactly the driver was over the speed limit. Regarding the customer data transfer from one insurer to another, Talkpool is currently looking at a blockchain solution to ensure that the policyholder owns the data and can transfer it when they change insurance companies.

Another external challenge mentioned by Lindmark is getting other parts of society to be a part of the transformation. One of the groups that must be willing to accept these changes are the craftsmen that insurers currently rely on to fix damages. The increased focus on prevention might reduce the demand for their services. Instead of going in to rip open a floor and repair a damage that has already occurred, repairmen will then go in to make sure that the damage never happens in the first place. That in its turn might create indirect resistance due to a decrease in labour hours and subsequent revenue streams. Additionally, Lindmark thinks of Government authorities as a part of the supply chain, since they can heavily influence the adoption of IoT solutions. As an example, in the future, all buildings might be required to have smart water sensors installed, since it has such an impact on damage reduction.

4.3.2. Organisational resistance

The conservative nature of insurance companies is another of the major challenges this industry must tackle. Lindmark compares insurance companies to a hangar ship, where one does not simply turn the wheel and change the navigation curse. Instead, it takes quite a few sea miles before the course is changed, and with that, time.

Currently, Folksam has an older IT infrastructure that has shaped the way in which they work and organise themselves. Changing to a newer infrastructure with a new way of working

might influence different groups of employees, which might create some internal organisational resistance. Some will have to change the way they work, whilst some tasks are created, and others eliminated. For this reason, both Nyman and Lindmark point out the importance of finding the right kind of competence and working with change management, in order to address digitalization and improve the customer experience. So, it not just the IT infrastructure and algorithms that need to adapt, but the intellectual resources as well.

According to Lindmark, insurance companies have faced similar problems in the past, but perhaps in different contexts. So, by being aware of these hinders, insurers will be able to think of new solutions. Moreover, the respondents stress the need to understand customer insights and demand before jumping onto a business proposition.

4.3.3. Disruption threats

Lindgren believes that insurers can be easily disrupted from different directions. Such disruption threats include servitization, where more people are choosing to lease their products rather than owning them; new types of insurance, that come from the development of new technologies such as blockchain; and lastly, manufacturers taking a stronger position and weakening that of their distributors, which can also be witnessed in the insurance industry. For these reasons, Lindgren means that insurers should feel the pressure to change.

Furthermore, with the increased focus on prevention, the risk is continuously disappearing from the market. For this reason, Frid recommends that insurers shift their focus towards businesses, rather than private consumers. In a business landscape, the IoT has more to offer such as product monitoring and tracking. Frid also sees the increasing disintermediation of insurers as a challenge, whereby insurance solutions are increasingly being offered directly by car manufacturers. In order to address this and maintain their market share, insurers must search and build new alliances.

According to Nyman, there is also a question of how much data product manufacturers are willing to share with insurers. There is a trend where more customers choose a service over owning a product, which creates a demand for a new kind of insurance that is not necessarily targeted at the subject, but the object. When an insured object is shared among different subjects, it makes more challenging to calculate the risk.

Ultimately, there is not much insurers can do to prevent technology advancement. The only thing companies can do is to try to adapt to the forces that rule the market. One part of the solution includes getting in direct contact with product manufacturers and distributors, whilst

another part is excelling within advisory, prevention and customer experience. Ultimately, insurance companies need to change their role and be more frequently involved with both their private and business customers, rather than coming in contact once a year through a yearly renewal letter.

5. Analysis and Discussion

This section aims to provide the reader with a structured comparison of the theoretical and empirical findings, ultimately leading to generation of new theory on the impact of the IoT on the business model of insurance companies, and its challenges related to its implementation.

5.1. Impact of the IoT on the Business Model of Insurance Companies

Below, the reader can find a structured comparison of the subthemes mentioned in the theoretical and empirical findings, which was used to aid in the analysis. See 3.4. for more information on how the following table was constructed.

The Impact of the IoT on the Business Model of Insurance Companies			**Theoretical Findings**	**Empirical Findings**	**Impact**
BMC Block		**Factor**	**Mentioned**	**Mentioned**	
Financial Aspects	**Revenue Streams**	Shift from subscription to usage-based fees	✓	✓	Medium
		Shift from fixed menu to dynamic pricing	✓	✓	Medium
		New offerings/revenue streams	✓	✓	Low
		Reduced revenues from premium discounts	✓	✓	High
		Up-sale opportunities	✓	✓	Medium
	Cost Structure	Claim frequency and cost reduction	✓	✓	High
		Shift from cost- to value-driven BM	✓	✓	Low
		Increased supplier costs	×	✓	Low
		Shift to more profitable segments	✓	×	Low
Customer Interface	**Customer Relationship**	Shift to more frequent interactions	✓	✓	High
		Shift to advice-led interactions	✓	✓	High
		Gamification/loss aversion	×	✓	Low
		Speedier claim management	✓	✓	Low
	Customer Segments	Shift to personalized offerings	✓	✓	Medium
		Shift to more profitable segments	✓	✓	Medium
	Channels	Reliance on partner channels	✓	✓	High

The Impact of the IoT on the Business Model of Insurance Companies			Theoretical Findings	Empirical Findings	Impact
BMC Block		Factor	Mentioned	Mentioned	
Value Proposition		Risk reduction	✓	✓	High
		Cost reduction	✓	✓	High
		Increased personalization	✓	✓	Low
		Increased convenience	✓	✓	Medium
		Improved pricing models	✓	✓	Medium
		Improved brand/status	✓	×	Low
		Reduced negative impact on environment	×	✓	Low
Infrastructure Management	Key Activities	Improved risk and pricing models	✓	✓	Medium
		Improved fraud detection	✓	×	Low
		Move towards non-risk related offerings	✓	×	Low
	Key Resources	Shift to intellectual & data-driven capabilities	✓	×	Low
		Human labour with digital competence	×	✓	Low
	Key Partners	Strategic alliances with IoT-providers	✓	✓	High
		Outsource technical product development	✓	✓	High
		Efforts to improve cooperation	×	✓	Low

Figure 6: Comparison of theoretical and empirical findings (own elaboration)

5.1.1. Financial Aspects

5.1.1.1. Revenue Streams

Both the empirical and theoretical findings (EY, 2016; Canaan et al., 2016; Ammiot, 2015) confirm a general shift in the insurance industry from fixed menu towards more dynamic pricing mechanisms based on usage, rather than the traditional indicators insurers have relied on in the past. UBI solutions, such as those applied by Paydrive, Köra Säkert and Enerfy allow policyholders to pay an individual premium that is based on their driving behaviour, rather than solely on age, geographical location, car model, among others. Yet, these factors still play a role in risk and premium calculations, even for UBI solutions.

However, UBI solutions seem to be more relevant in some insurance lines, rather than others. For example, Lindmark mentions that UBI models are not that as relevant for in-home insurance, since customers would most likely not experience any noticeable difference in their premiums. This might explain why most UBI offerings are found in car insurance,

whereas in-home sensors are mostly implemented in order to prevent damages from escalating or taking place.

During the interviews, some of the respondents questioned the demand for usage-based insurance. One of the arguments was that insurance companies already ask policyholders to provide an estimation of the usage of their insured objects in order to set an appropriate premium. In this sense, insurance premiums have always been partly usage-based. Another argument is that the dynamic nature of such solutions creates fluctuations in the premium payments from month to month. This might be undesirable for customers that prefer a stable premium that covers their insured objects no matter what. For this reason, it is important, as Jändel, Alholt and Groth mention, to understand customer insights and do small experiments in the real world, to ascertain the demand for a specific insurance solution, before implementing it in full-scale.

Another area in which the empirical and theoretical findings agree is in the creation of new offerings. Among others, the IoT provides insurers with more detailed and relevant data that allows them to send targeted recommendations to policyholders on how to take better care of their insured objects and prevent avoidable damages (Ammiot, 2015; Reifel et al., 2014). Moreover, Reifel et al. (2014) state that insurance companies will increasingly move towards services not directly related to risk insurance, such as assisting customers with purchase decisions. In the PAYD cases, for example, the insurers provide different extra services such as a driving journal, a car tracker, parking assistance, and so on, as an added convenience to policyholders. Similarly, Lindmark also mentions that the water leakage breakers could be used to regulate water consumption in the household, as well as send a repairman at the first sign of trouble.

The way in which customers pay for these value-added services is, according to Lindmark, dependent on how the offering is packaged, their willingness to share data and willingness to pay. In the case of the PAYD solutions, Paydrive and Enerfy cover the cost of the mobile application and sensor lease into the premium, whilst with Köra Säkert, the customer must first get a separate subscription from Telia Sense, that provides them with the mobile application and car sensor.

Still, most of the insurance solutions covered in this paper, on top of these value-added services, provide some sort of premium discount in exchange for the customer reducing their risk, by installing an IoT sensor and sharing their data with the insurer. This premium

discount constitutes a revenue stream decrease, but insurers expect to make up for it by reducing their claim frequency.

Finally, by having access to more relevant and detailed data, the IoT also facilitates up-sale opportunities, whereby the insurer can make targeted recommendations to the customer, rather than relying on generalized ones. Lindgren and Lindmark both mention that customers also want to avoid damages, and if insurers are able to help in this front with appropriate recommendations, this will not be experienced negatively.

In summary, the IoT allows for a shift towards more dynamic pricing mechanisms and usage-based insurance, rather than relying solely on the static indicators insurers have used for so long. There is however a need to understand the demand for such solutions depending on the business line and customer base, before implementing it in full-scale. Moreover, new offerings are created by moving towards advisory services and other non-risk related integrated services. Still, most companies can expect to have to provide a premium discount in order to entice customers to share their sensor signals with insurers, thereby reducing the risk for damages.

5.1.1.2. Cost Structure

With the IoT becoming increasingly cheaper and accessible, insurance companies are now able to offer them to customers in conjunction with their insurance policies. This allows for a move from restitution to prevention, whereby the IoT sensors are able to detect early indicators of future damages and thus reduce the biggest expense for insurance companies: claim pay-outs (Reifel et al., 2014; Ammiot, 2015; EY, 2016).

However, the respondents describe this move towards preventive services as an evolution of their prior work, rather than a major innovation, with Wärn and Arnström describing it as part of the "*DNA*" of insurance companies. For example, insurance companies already provide smoke alarms together with home insurance and work intensively with Government authorities in order to improve building regulations, among others.

Moreover, Frid and Wärn hesitate to confirm that their IoT solutions have had a positive effect on claim frequency and severity, since it hard to isolate and measure the cause and effect relationship with other factors influencing the statistics. There is however a logic in that customers rewarded for responsible driving behaviour would most likely suffer less damages in the long run. At the same time, PAYD solutions inherently attract risk-averse customers that are aware they will benefit from individualized pricing. This by itself might

reduce claim frequency and severity in comparison to other traditional car insurances. Still, there is an uncertainty whether the added individualization brought by the IoT has a positive effect on cost reductions. This topic is further discussed in 5.1.2.2.

Most of the respondents point to the cost reduction as the major reason for their IoT adoption. However, this seems to be highly dependent on the purpose of the IoT solution. Even though UBI solutions indirectly lead to cost reduction by rewarding good behaviour, the main value proposition is to give the customer a better premium that is based on their individual behaviour. Water leakage breakers, on the other hand, were developed in order to detect humidity levels and turn off water circulation before damages become irreversible. For this reason, the author has chosen to divide the solutions studied in this paper into two major groups, UBI solutions and preventive solutions, where the main goal of the former is to provide the policyholder with an individualized insurance protection, and the latter is to reduce risk for damages.

An inherent consequence of the reduction of the number of claims is the decreased labour costs used to manage them. Moreover, both the empirical and theoretical findings mention that the IoT sensors can improve the claim process by having collected data prior to the incident, thus making the process speedier and more convenient to the customer as well.

Even though the IoT is becoming increasingly inexpensive, it will still not come free of cost to insurance companies. According to the literature (Ammiot, 2015; EY, 2016; Reifel et al., 2014), the implementation of the IoT will require short-term investments to reduce internal and external resistance, among others. Such efforts include change management, premium discounts, among others. Other costs included by the respondents include increased supplier procurement and monitoring costs, as well as added distribution and product development costs, depending on the relationship with key partners.

Ultimately, a move towards advisory and more preventive insurance solutions allows insurers to move away from a cost-driven BM and their consequent "*premium wars",* towards a value-driven BM. According to the respondents, the premium is currently a big factor in the customer purchase decision, and with customer interaction rarely taking place, insurers have a hard time building customer loyalty. Lindmark and Arnström state that this approach is not sustainable in the long run and that customers will most likely prefer an insurer that helps them in the prevention of damages over the insurer that only provides traditional risk insurance.

5.1.2. Customer Interface

5.1.2.1. Customer Relationships

Insurance companies aim to improve on customer relationships and loyalty by increasing the number and quality of customer interactions. Other than the yearly renewal contract, policyholders will get in contact with an insurer when they initiate a claim process. Since the aim of insurance is that many share few risks, the average customer makes a claim every four to five years. At the same time, claim management is a critical moment in customer relationship management, seen as it is the point in which customers test the benefits of their subscription to the insurance provider. The IoT offers insurers the opportunity to make the claim process speedier and more convenient by collecting the sensor signals prior to the incident.

Both the empirical and theoretical (Ammiot, 2015; Reifel et al., 2014) findings point towards a shift towards more advice-led interaction with policyholders, which in its turn allows for a more frequent and supportive relationship. The data collected by the IoT provides insurers with a basis for targeted recommendations, as well as up-sales, that help the customer prevent avoidable damages and their consequences. On this front, UBI solutions seem to have the edge, seen as they add a gamification effect on their customers. Since users are able to influence their own premiums, they are more prone to adapt their behaviour to avoid losing the premium discount.

The respondents add however that this shift towards more advice-led interaction constitutes an extension of their work with prevention, rather than a major innovation. Länsförsäkringar, for example, already works with risk-prone customers by giving them advice on how to properly take care of their insured objects. According to Lindmark, this effort has had a positive effect on customer retention.

In summary, the IoT allows insurers to increase the number of interactions with their customers through increasingly personalized recommendations that influence customer behaviour in a way that benefits both parties. Ultimately, this allows for the shift from infrequent personal assistance to a more frequent personalized automated service, thus improving on customer loyalty and retention.

5.1.2.2. Customer Segments

According to the literature, a better understanding of individual customer behaviour allows insurers to move from generalized offerings to increasingly personalized ones. Additionally,

the IoT allows insurers to focus on the most profitable insurance groups, whilst leaving less profitable ones to competitors (Ammiot, 2015; EY, 2016; Reifel et al., 2014).

Even though customer interaction will become increasingly individual, the respondents did not agree on how the IoT will affect the customer segmentation. As previously mentioned, the aim of insurance is to spread the risk among a large group of individuals and at the same time, the insurance industry is heavily regulated to ensure that almost anyone can insure themselves. For this reason, there is a regulatory and even ethical issue with choosing to focus insurance solutions on particular customer segments.

On the other hand, UBI solutions are tailored for customer segments that benefit from individualized premium pricing. So, risk-prone customers are more likely to opt for traditional insurance solutions that do not require them to share their data. For this reason, UBI solutions inherently attract low-risk customers.

However, the IoT can also help to improve the behaviour of more risk-prone customers. Alholt, Groth and Lindmark mention that insurance companies already work with more risk-prone policyholders that suffer relatively more damages and mention that this usually has a positive effect on customer behaviour, as well as retention. Additionally, Lindmark mentions the IoT might remove some of the structural unfairness by allowing insurers to take on new risks.

In conclusion, insurers must pay attention in applying insurance solutions and ensure that customer segments that are known to be particularly risk-prone can still find an appropriate insurance solution at a reasonable price.

5.1.2.3. Channels

Both the empirical and theoretical findings show little change on this BMC block. Insurance companies mostly rely on partner channels in order to distribute the IoT sensors. Whilst insurance policies are easily and cheaply distributed, the distribution and installation of physical objects such as IoT sensors are not the expertise of insurers.

Moreover, most IoT-centred insurance solutions also rely on partner channels to reach their customers with relevant information on their insured objects. Examples include Telia Sense or Enerfy's mobile application. Furthermore, Lindmark emphasizes the importance of avoiding spamming the user with generalized recommendations, and the importance of confirming that it is indeed the user viewing the sensitive information.

In summary, the distribution, communication and marketing channels will not suffer major innovations. Since the distribution of physical objects and development of digital user interfaces is not the core competence or focus of the insurance industry, insurers will initially have to rely on partner channels to provide the IoT sensors to customers, as well as relevant information on their insured objects.

5.1.3. Value Proposition

Below, the author discusses the different ways in which the IoT allows insurers to improve on their value proposition, thus enhancing the customer experience and standing out in an increasingly commoditized market.

By detecting potential or occurring damages in their earlier stages, the IoT allows for an increased focus on the real-time prevention of avoidable damages, thus reducing their size and extent. This in turn reduces the risk that policyholders suffer any harm or inconveniences as a result of something that could have been detected by say, a water leakage sensor.

Due to the nature of insurance, a risk reduction is closely related to the cost and premium. By reducing the risk of a damage taking place, policyholders avoid costly deductibles and other similar value depreciations. Additionally, premiums are calculated based on risk, so the higher the risk, the higher the premium, and the other way around. For this reason, a reduction of risk calls for a lower premium for the policyholder, which can be seen with the premium discounts offered by most of the cases in this study.

In this area, there is also a difference between the main unique selling points of UBI and preventive insurance solutions. On the one hand, PAYD offerings such as Paydrive, Enerfy and Köra Säkert focus their communication around an improved and fairer pricing model based on usage, rather than conventional static indicators. On the other hand, preventive IoT solutions such as water leakage sensors, focus on risk reduction. Still, since risk and premium are tightly related, both present the policyholders with the opportunity to reduce their risk and subsequent insurance premium.

Additionally, by shifting towards more frequent advice-led interactions, insurers can influence customers' behaviour in a way that benefits both parties, thus reducing risk even further. This move from generalized to increasingly individualized interactions are also an improvement in personalization, whereby the customer receives information tailored to their particular situation.

Furthermore, as mentioned in the empirical findings, IoT applications are not limited to risk insurance. The IoT makes it easier for insurers to develop complimentary and integrated value-added services that improve convenience and overall customer experience. Other than the addition of individualized advisory services, the sensors can measure resource consumption, such as water or fuel, which in its turn allows insurers to provide recommendations to the policyholder on how to reduce their consumption and live in a more sustainable fashion. Another example of an integrated service found in the PAYD solutions include driving journals, car tracker, parking assistance, among others.

This reduction of the negative impact of damages on the environment is not found in the theoretical findings. As Lindmark mentions, the average water damage reparation emits about 200 kilograms of carbon dioxide. By detecting humidity levels and stopping water circulation, IoT sensors can considerably reduce the risk of severe water damages, thus reducing their negative impact on the environment.

In summary, the IoT allows for an increased prevention of avoidable damages. Due to the nature of the insurance market, this risk reduction calls for a premium and cost reduction for policyholders. At the same time, policyholders experience an increased personalization and convenience through more frequent individualized interactions and integrated non-risk related services. Although not explicitly mentioned during the interviews, these effects on the value proposition, allow first-movers to differentiate themselves in a commoditized market. This allows for the shift towards a more value-driven mentioned in 5.1.1.2., and an improved brand/status effect on their offerings, by positioning themselves as innovative and responsive to customer needs.

5.1.4. Infrastructure Management

5.1.4.1. Key Activities

Analysing and understanding risk is the core competence of insurance companies. According to the literature (Ammiot, 2015; Reifel et al., 2014; Canaan et al., 2016), the IoT provides insurers with an increased understanding of risk by integrating vast amounts of structured and detailed data from the physical world into the segmentation and pricing models that insurers use today.

However, according to the interviewees, insurance companies are currently using the IoT for improved pricing models and prevention efforts in the short-term, rather than using it to develop risk models that can learn data trends and patterns that allow to forecast damages

before they actually arise. Additionally, another area that respondents did not mention was the improvement of fraud detection. This is either because the respondents did not see that the IoT allowed for this, or that it was not one of the key concerns among Swedish insurance companies. However, the author finds UBI solutions to allow insurers to rely on real mileage, rather than trusting on the estimation provided by the customer when they fill out their insurance application.

Other than that, no major changes are observed in the key activities that insurance companies perform today. The major difference, according to the respondents, is in the quantity and complexity of the data, that needs to be integrated into their current risk models. This is most likely because in order to provide IoT-centred insurance solutions, insurers rely to a great extent on external IoT providers that manage the hardware and software development part of the offering, including the non-risk related services mentioned previously. Meanwhile, insurers continue to focus on their competencies: customer relationship management, business development and data analysis. The impact of the IoT on the Key Partners will be further developed in 5.1.4.3.

In short, the key activities insurance companies perform will not suffer big changes. Currently, the IoT is mostly being used by insurers to improve on their preventive efforts and develop more dynamic pricing models. In the short term, insurance companies will most likely continue to rely on external IoT providers to develop the technical activities necessary to provide these IoT-centred solutions. Accordingly, insurers will continue to focus their efforts on their core competencies: risk analysis, pricing models, business development, customer relationship management and so on.

5.1.4.2. Key Resources

In order to create a sustainable competitive advantage, Ammiot (2015) and EY (2016) both recommend that first-movers develop more data-driven capabilities and intellectual property that are difficult for imitators to replicate.

Insurance companies are already working with big amounts of data. Still, technology such as the IoT creates extensive and rich data that needs to be integrated into the risk and pricing models insurers use today. For this reason, Nyman and Lindmark mention the importance of acquiring the right competence in the form of human labour. These competences are mostly centred around digitalization but include customer relationship management and business development as well.

To sum up, by relying mostly on external partners for the development of the technical processes of the supply chain, insurers will not suffer major changes in the key resources either. Instead, insurance companies will continue to focus on their key competences. In the long run, however, by relying less on external consultants, insurance companies will develop the skills needed to adapt to an ever-changing landscape.

5.1.4.3. Key Partners

Developing hardware and software is not the core competence of insurance companies. For this reason, insurers are largely dependent on third party IoT providers to supply their customers with their IoT-centred insurance solutions. Accordingly, all of the companies in this study have chosen to partner up with an external company to develop the more technical components for the IoT sensors.

Insurance companies usually enter the picture when the IoT sensor is ready for pilot testing, and do not partake in the base R&D. Instead, as previously mentioned, insurers choose to focus on analysis of risk and the commercial side, which includes business development, customer relationship management, among others. This form of cooperation resembles what Osterwalder and Pigneur (2010) define as a strategic alliance, where the two parties work together towards a common goal, but without joining equity.

According to the literature (Ammiot, 2015; Reifel et al., 2014; EY, 2016), in an increasingly digitalized world, it is of critical importance to find the right partners able to collect and maintain high-value data. At the same time, there is a need to discuss what role IoT providers play in the data collection and distribution. According to Lindmark, if customer data is shared with third parties for free, this might inadvertently create new competitors. One solution is that IoT providers have more of a distributor role where they do not have the right to manage or use the data in any other way than to distribute it to the respective insurance company.

Another area of interest is how to increase partner commitment and collaboration. One of the reasons to enter a joint venture, where the two parties join equity to form a new entity, is that both parties have a stake in the business that keeps them committed to making it successful. For this reason, it is important that insurers utilize mutual workshops and Key Performance Indicators in order to improve communication and create common goals and targets.

In summary, insurance companies will have to rely on external IoT providers for the development and distribution of the IoT sensors. Moreover, in order to boost the productivity

of this strategic alliance, insurers will have to find ways to communicate their expectations by using mutual targets and workshops, among others.

5.2. Managing the Risks with the Implementation of the IoT

Below, the author summarizes and analyses the major challenges with the implementation of the IoT, and the potential solutions to mitigate them provided by the theoretical and empirical findings.

5.2.1. External resistance

One of the biggest challenges in implementing the IoT is related to data privacy and integrity concerns. There are some ethical and regulatory questions that need to be addressed: Who owns the data? How can insurers ensure that policyholders feel that they have control over their data? How can insurers manage transferring data from one insurer to the next? And, where does the data trail end?

There is not a clear answer to all these questions, but there are steps insurers can take to reduce the impact of data privacy and integrity concerns on the adoption of IoT-centred insurance solutions. Both the empirical and theoretical findings show that insurers have to increase customer willingness to share their data through such incentives as discounted pricing, value-added services, customer loyalty points, and so on (Canaan et al., 2016; EY, 2016; Reifel et al. 2014). In this study, most cases were found to utilize premium discounts to reward the customer for reducing the risk in insuring them.

As mentioned in the empirical findings, insurers cannot allow policyholders to feel like they are part of a "Big Brother" community, where they are constantly monitored and controlled. Another measure insurers can take to avoid this, is communicating clearly what insurers intend to do with the customers' data, and how they can manage it in a secure manner. This becomes increasingly important depending on the nature of the insurance protection, seen as data from water leakage sensors is not as sensitive as the driving behaviour of an individual policyholder.

This is an area in which technology advancements might be of help. For example, Lindgren mentions how Talkpool is currently looking into a blockchain solution to allow the safe transfer of policyholder data from one insurer to the next. Additionally, Wärn mentions that policyholders are required to identify themselves in order to view more sensitive information

on their application. Wärn also mentions that a solution to this is gathering data on an aggregate level, so that policyholders do not feel like insurers can track their every move.

Furthermore, one area not addressed by the literature is the external resistance from other parties different from the customers. One such party includes the craftsmen that insurers rely on to repair the damages their policyholders incur. By preventing damages from happening, the IoT reduces the demand for such work, thus negatively impacting the revenue streams of said companies. For this reason, it is important to build strong alliances and work alongside companies that see this change as inevitable.

Another party includes Government authorities, that can truly influence the adoption of IoT-centred insurance solutions. By working together with other insurance companies, the insurance industry might be able to influence regulation in their favour, as well as increase the protection provided to the end-customer. An example includes requiring all bathrooms to have a water leakage sensor installed, since it can have such positive effects on damage reduction.

In summary, in order to benefit from the risk reduction the IoT brings, insurers have to increase customers' willingness to share their data by ensuring that they benefit from their insurance solution. Currently, this is mostly done through premium discounts. Additionally, insurers must communicate clearly on how the data is going to be used, shared and managed, and how that in its turn benefits the customer. Finally, insurers must also monitor and work alongside Government authorities and other affected industries, to make sure that there are no unexpected external barriers to the adoption of IoT-centred insurance solutions.

5.2.2. Organisational resistance

Digitalization brings along opportunities such as the IoT, as well as threats, including servitization, disintermediation of insurers and new types of insurance. And although incumbents have an advantage in customer awareness and trust, insurers can still be disrupted by new entrants with innovative BMs. The conservative nature of the insurance industry also brings along a major challenge in the implementation of the IoT, especially in the case of bigger and older companies that might face incumbent inertia. Nonetheless, BMI is challenging in of itself for most companies, since it challenges the traditional configuration of assets (Chesbrough, 2010). For this reason, insurance companies need to become more adaptable to their ever-changing landscape. This section discusses different measures insurers can adopt in order to successfully implement the IoT in their BMs.

The IoT has the potential to alter the way in which insurers organise themselves. By reducing the number of claims, and potentially automating some its components, some tasks might be eliminated or altered. To avoid creating organisational resistance, insurers must set the right corporate culture in place to embrace BMI. As mentioned in the theoretical findings (Canaan et al., 2016; Reifel et al., 2014), such efforts include leadership commitment, enterprise-wide training and change management. Additionally, the respondents point out the importance of finding the right kind of competence to address digitalization and customer experience issues.

Secondly, insurers need to perform low cost and small-scale experimentation in real life customer segments. Mapping tools, such as the BMC, allow insurers to visualize the implications and impact of innovations on the different blocks that constitute their BM (Chesbrough, 2010). This in its turn allows for first-movers to learn ahead of competitors, as well as develop a better understanding of customers' wants and needs. Seen as not all IoT applications will be relevant, experimentation allows insurers to avoid getting caught in trends, and instead focus on a problem-solving approach.

Ultimately, insurance companies must accept that the rate of digitalization is not slowing down and that the BMs they have relied on for so long, are not sustainable in the long run. For this reason, insurers will need to develop a corporate culture that embraces change and BMI, in order to survive in a changing environment. Such initiatives include change management, enterprise-wide training, leadership commitment, low-scale and low-cost experimentation, BM mapping tools and working intensively with understanding customer insights.

5.2.3. Disruption threats

By positioning themselves as innovative and responsive to customer needs, first-movers will be able to stand out in a commoditized market. However, if first-movers are unable to set mechanisms in place that hinder competitors from imitating their BM, this differentiation will be short-lived (Teece, 2010).

In the past, large amounts of risk-related data used to constitute an entry barrier for new entrants. Now, the IoT provides insurers as well as other companies, like GAFA (Google, Amazon, Facebook, Apple), the ability to gather relevant data at a faster rate and create on-demand value propositions (Ammiot, 2015). Furthermore, insurers are currently highly dependent on external partners for the development of these IoT-centred solutions. Therefore, in order to create a sustainable competitive advantage, insurance companies must develop

their own data-driven capabilities and intellectual property that is difficult to replicate (Ammiot, 2015; EY, 2016). An example could be moving towards value-adding integrated services that are not necessarily risk-related.

Lastly, a shift from restitution to prevention invokes a sort of self-disruption to certain insurance policies. With other words, if water leakage and driving sensors are able to effectively reduce the risk of a damage taking place, then this will in turn reduce premium prices and negatively affect insurers' revenue streams. However, by adopting a more flexible and innovative corporate culture, insurance companies will be better equipped to handle these issues. Moreover, Canaan et al. (2016) recommend that insurance companies shift from human error to product liability, or low-frequency, high-severity events that are harder to price. Alternatively, Frid recommends that insurers focus on business-to-business insurance solutions and start building alliances with manufacturers, in order to decrease the disintermediation of insurers.

In summary, the IoT brings opportunities to insurance companies and new entrants alike. In order to create a sustainable competitive advantage, insurance companies need to develop their own data-driven and intellectual competencies that hinders imitation and allows them to stand out from a commoditized market. Moreover, by reducing the risk and severity of individual damages, insurers can expect decreasing revenue streams. Some different recommendations to lessen these threats include moving towards business settings, product liability, low-risk high-severity events and non-risk related services.

6. Conclusion

The aim of this final section is to summarize the results of the analysis and discussion, thus answering the research questions this paper set out to answer. Additionally, the author ends with the implications of the research for different stakeholders and provides suggestions for future research.

6.1. Answering the research questions

This paper set out to study the impact of the IoT on the business model of insurance companies, as well as the challenges that its implementation brings, and how these might be eliminated. Previous literature has mostly focused on the technical or technological aspects of the IoT, or its application on the manufacturing industry. For this reason, this paper provides to the academic literature with a novel managerial perspective by looking at the impact of the IoT on the business model of a conservative service-provider. Below, the author presents the main findings related to the following two research questions:

- How will the implementation of the IoT affect the Business Model of Insurance Companies?
- How can insurance companies manage the challenges with the implementation of the IoT?

In order to answer these research questions, a multiple case design was chosen where semi-structured interviews were held with four different insurance companies currently working with different IoT-centred insurance solutions. In total, eight interviews were performed, with one of them being an IoT-provider, for an added external perspective. The business model canvas is the framework used throughout this report to study the effect of different IoT applications on the different blocks that constitute a business model. Moreover, business model innovation theory is used to study the challenges related to IoT adoption as well as their possible solutions.

6.1.1. Impact of the IoT on the Business Model of Insurance Companies

In summary, the findings suggest that the IoT has the biggest impact on the value proposition, where customers will experience an improved insurance protection, primarily as a result from a risk and subsequent cost and premium reduction. By reducing the risk for losses, the IoT also has a great effect on the financial aspects. Even though insurers can expect to have to provide premium discounts to entice customers to reduce their risks, insurers can also expect a reduction in the frequency and severity of claims, which currently stands for about 69 % of

revenues. In the customer interface, the IoT seems able to greatly improve the personalization and frequency of customer interactions by providing policyholders with individualized recommendations on how to reduce their risk for losses and properly take care of their insured objects. In order to achieve this, insurers will have to rely to a great extent on partner distribution, communication and marketing channels. Lastly, insurers will also have to rely to a great extent on external IoT providers and other key partners for the development and production of the sensors and its software, which is why insurers will not suffer bigger changes in their key resources or activities.

6.1.1.1. Financial Aspects

Starting in the revenue streams, there is a noticeable shift towards dynamic pricing models that rely on usage-based data, rather than the static factors insurers have relied on for so long. This is, however, not apparent in all business lines such as housing, where there is no real demand for such UBI solutions. For this reason, it is important that insurance companies implement low-scale and low-cost experiments in real customer segments to assess customer demand for any IoT-centred solution and their willingness to share data. Moreover, insurers can expect to have to implement some sort of premium discount so that customer are more willing to share their data with insurers. Lastly, by moving towards advisory and other non-risk related services, the IoT allows for the creation of new offerings. The way in which insurers capture value from these extra services is dependent on how the offering is packaged, by either reducing the severity and frequency of claims on the cost side or offering it as an add-on or complementary service with an extra fee on the revenue side.

In the cost structure, the IoT has the potential to reduce claim frequency and severity on several fronts. First though, it is important to differentiate between the purpose of UBI solutions, such as PAYD, and preventive solutions, such as water leakage sensors. By detecting potential hazards in their earlier stages, preventive solutions can reduce the frequency and severity of claims for insurers, whilst UBI solutions mostly focus on providing customers with more accurate and dynamic pricing models. However, by rewarding responsible behaviour with premium discounts, UBI solutions also have the potential to reduce claim severity and frequency. Furthermore, by reducing the number of claims and even automating certain parts of the claims process, the IoT also indirectly reduces the labour costs related to their management. Other than that, insurers have not taken on many new costs other than supplier procurement and monitoring costs, since they mostly rely on IoT providers for the development and distribution of the sensors.

Ultimately, the IoT will allow insurers to stand out in a commoditized market and shift from a cost-driven BM, where the insurer with the lowest premium wins, to a more value-driven BM, where the customer perceives that they receive an improved sense of security from the insurance company that positions themselves as innovative and responsive to customer needs.

6.1.1.2. Customer Interface

With the help of the IoT, insurers can also view and provide policyholders with real-time information on their insured objects, as well as recommendations on how to take better care of them and avoid costly damages. This gives insurers the opportunity to improve on customer loyalty and retention by increasing the frequency and individualization of customer interactions. Ultimately, this allows for a move from rare occasions of personal assistance to more frequent dedicated and automated interactions by using, for example, automated push notifications with recommendations tailored to the policyholder.

At the same time, insurers must make sure that even more risk-prone customer segments can find appropriate insurance protection at reasonable prices. However, it was found that UBI solutions inherently attract low-risk customers that know they will benefit from dynamic pricing models. At the same time, the IoT also allows insurers to take on bigger risks and actively work with more risk-prone customers to reduce the risk of insuring them, rather than solely focusing on more profitable customer segments.

Lastly, in order to provide customers with the IoT sensors and frequent and dedicated automated assistance, insurers will have to rely to a great extent on external partners. This is because the distribution of physical objects and development of user interfaces is not the core competence of insurance companies.

6.1.1.3. Value Proposition

By detecting potential hazards in real-time and influencing customer behaviour through rewards and recommendations, the IoT reduces the risk of the customer suffering any harm or inconveniences as a result of avoidable damages. This also means a reduction in the risk of a customer incurring costly deductibles or similar value depreciations. Moreover, costs are further reduced through improved pricing models, that are based on actual usage rather than estimations, as well as premium discounts, since the risk of insuring an individual customer is decreased.

Additionally, the shift towards advisory and other non-risk related services increase the convenience and personalization customers experience. For example, resource consumption measurement allows customers to live in a more sustainable fashion, both economically and environmentally. Ultimately, this will allow for the shift towards a value-driven BM previously mentioned, which in its turn will improve the brand/status effects on first-movers' insurance solutions.

6.1.1.4. Infrastructure Management

In the short-term, insurers have built strategic alliances with external partners for the development of the technical parts of the IoT sensors, whilst continuing to focus on what they do best: developing risk and pricing models, business development, customer relationship management and so on. Of these key activities, the risk and pricing models have suffered the most change by relying on vast amounts of real-time usage-based data, rather than historic and socio-demographic risk indicators. Hence, the biggest difference is in the quantity and complexity of the data being integrated into their risk and pricing models. In the long term, it will be interesting to see if insurers are able to use data to learn patterns and forecast future damages before they arise. Currently however, this is hard to implement in a heavily regulated industry.

The key resources are the area in which the author found the least change. In the long term however, finding the right competence to address digitalization and customer experience issues will be of critical importance to adapt to an ever-changing landscape.

Lastly, insurance companies have for a long time used strategic alliances in order to help policyholders purchase fire extinguishers, smoke and security alarms, and other objects that reduce the risk for losses. The same can be observed with IoT-centred solutions, which is why there are no major changes in this area either. However, for these alliances to be successful, it is important that insurers develop mutual goals and targets, as well as boost communication through mutual workshops or cross-functional teams.

6.1.2. Managing the Risks with the Implementation of the IoT

This paper identified three major challenges with the implementation of the IoT: external resistance from partners and customers, internal organisational resistance and disruption threats within and outside of the insurance industry.

According to the research, the biggest challenge is increasing customers' willingness to share their data with insurers. For this to happen, customers need to feel that they benefit from IoT-centred insurance solutions. Other than through marketing the value propositions mentioned previously, insurance companies need to reward customers for reducing their risk through premium discounts, value-added services, loyalty points, among others. It is also important that customers trust the way in which insurers manage and utilize data. For this reason, insurers need to clearly communicate how data is collected, transferred and utilized, and how that ultimately benefits the end-customer.

Additionally, insurers should monitor regulation and work alongside Government authorities in a way that improves insurance protection for policyholders and decreases risks for insurers. Insurers also need to monitor and work alongside other external partners whose businesses are affected by the implementation of the IoT, such as the case of craftsmen and repairmen.

Another major challenge relates to the conservative nature of the insurance industry. In order to keep up with an ever-changing landscape, firms will have to develop a corporate culture that is more embracing of change and BMI by making use of BM mapping tools, low-cost and low-scale real life experimentation, leadership commitment, enterprise-wide training, change management and customer insights.

Eventually, with the help of the IoT, first-movers will be able to stand out in a commoditized market and move away from premium wars and towards a more value-driven BM. However, the insurance industry is not the only one to benefit from the IoT. New entrants will have an easier time to collect vast amounts of risk-related data and create de-modularized and niche value propositions. For this reason, insurance companies must develop their own data-driven and intellectual property capabilities that are hard for imitators to replicate.

Lastly, by preventing damages from escalating or happening in the first place, the IoT will increasingly remove the risk from the market, thus reducing premium and subsequent revenue streams from certain business lines. For this reason, it is again important that insurance companies develop a culture that is adaptable, at the same time as they shift their attention towards non-risk related services. Moreover, insurance companies may want to move towards product liability and other low-frequency, high-severity events that are harder to price.

6.2. Implications

In conclusion, the rate of change is not slowing down, and digitalization is only set to increase the long-term growth and profitability issues the insurance industry is facing. By allowing for individualized pricing and recommendations, integrated non-risk related services and preventing damages before they happen, the IoT provides the opportunity for insurers to improve on the customer experience as well as their economics. For first movers, this means an improved brand image by positioning themselves as a responsive and innovative company, allowing them to stand out in a commoditized market and move away from destructive premium wars.

One important thing to mention is that many of the findings in this paper, related to the impact of the IoT on the BM of insurers, are a result of the increased prevention of avoidable damages, which could be achieved through other methods than the IoT. However, the prevention of avoidable damages is a consequence of the IoT, and therefore included in the scope of this paper. Moreover, many of the IoT applications in this study, are dependent on parallel technology advancements in other areas such as connectivity, big data management, cloud and artificial intelligence, among others. Nevertheless, it is the IoT sensor that allows for the collection of data from the physical world by connecting the insured object to the internet.

With most academic literature today being focused on the technical aspects of the IoT or its applications on the manufacturing industry, this paper provides a novel managerial perspective on the impact of the IoT on the established BM of a conservative service-provider, such as the insurance industry. Moreover, this study provides insurers and managers alike with an improved understanding of the mechanisms used to create and capture value with the help of the IoT, as well as potential solutions to mitigate the major challenges in the implementation of this digital transformation.

For IoT providers, this paper provides a business case with which to study the impact of their offering on the BM of insurance companies, as well as the implications of its implementation. With this knowledge, IoT providers can potentially develop solutions for some of the barriers to IoT adoption that insurers and end-customers are experiencing.

6.3. Suggestions for Future Research

This paper investigates the impact of the IoT on the BM of insurance companies. For this reason, the paper does not consider the effect of external factors on the implementation of the IoT to a great extent. For future research, it would be interesting to see how macroeconomic, market and industry factors and trends play a role in the development and implementation of the IoT in the insurance industry. As a suggestion, this could be done through a longer longitudinal research where interviews are held with Government authorities, customers, suppliers, partners, competitors and other parties that play a role in the adoption of the IoT or are affected by its implementation.

Moreover, this paper chose to not consider the technical or technological aspects of the implementation of the IoT. However, the author observed that many of the IoT-centred solutions studied in this paper, were developed and interplayed with other technologies. For this reason, it would be interesting to understand how the development of complementary technologies such as 5G, AI, blockchain and the Cloud, among others, have facilitated the adoption of the IoT. Conceivably, this could fit into the scope of the first research recommendation.

Lastly, it was found that insurance companies are highly dependent on strategic alliances with IoT providers for the development of their digitalized insurance offerings. For this reason, it could be helpful to investigate the nature of these alliances, and the common steps and pitfalls that dictate the success or failure of such projects. As a suggestion, this could also follow a longitudinal design where interviews are held with employees at insurance and partner companies, capturing the nature and management of the relationship through time. Alternatively, due to limited resources, a case study can also potentially provide valuable insights on how insurers can build successful strategic alliances with external IoT providers.

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8. Appendixes

Appendix A – Contacting Respondents

The following message was sent to relevant respondents through E-mail and LinkedIn InMail. If the respondent did not reply within a week, the message would be re-sent once more.

Hej XX!

Jag heter Simon Emanuelsson och studerar nu mitt sista år av min "Masters in Innovation and Industrial Management" i Handelshögskolan i Göteborg. Jag skriver för närvarande min uppsats om" The Impact of the Internet of Things on the Business Model of Insurance Companies". Jag söker mig till dig eftersom du arbetar med innovation och digitalisering inom försäkringsbranschen.

Jag vill gärna intervjua dig angående vad du upplever är de största utmaningarna som försäkringsbranschen står inför som IoT skulle kunna lösa, genom att titta närmare på hur ni arbetar med dess implementationen. I korthet, vill jag skapa en bättre förståelse för hur IoT påverkar de olika pelarna som utgör en affärsmodell, samt vad du upplever är de största utmaningarna med sådana digitala transformationer.

Skulle du ha tid för en intervju någon gång under de nästkommande veckorna? Skulle du trotts allt känna att du inte har tid eller att jag borde prata med någon annan, skulle jag vara väldig tacksam om du kunde hänvisa mig vidare.

Bifogat finner du intervjuguiden med frågorna jag tänkte ställa dig.

Med vänlig hälsning,

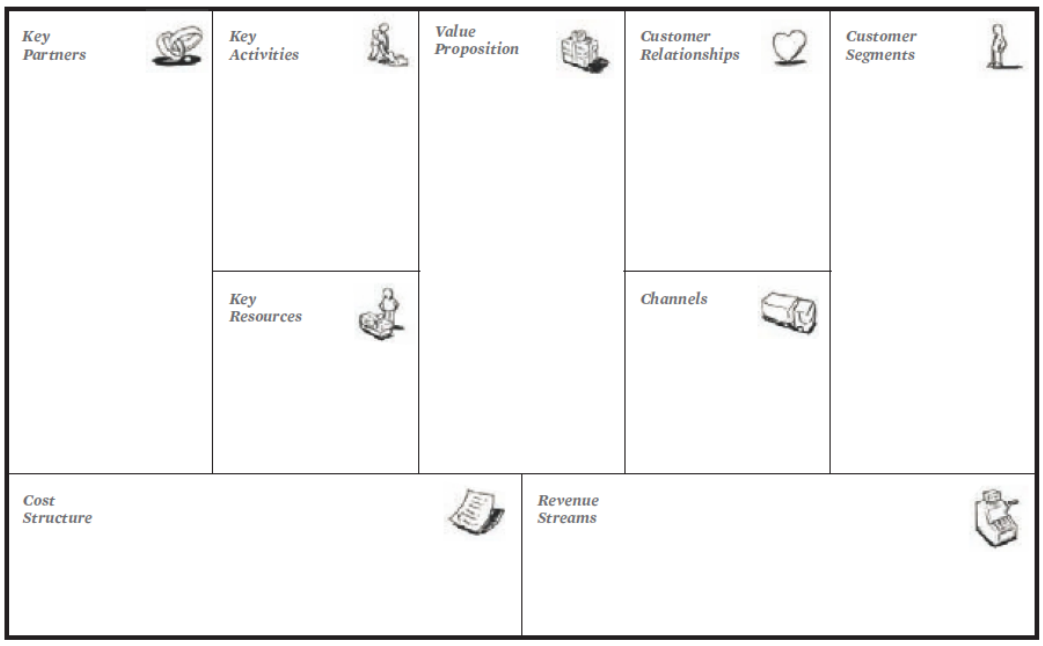
Simon Emanuelsson

Appendix B – Interview Guide

Every interview would begin with a presentation of the author and the topic of the paper, followed by a visualization of the Business Model Canvas and finally, the interview questions.

Introduction

Thank you again for your time. As we discussed earlier, I am currently studying the impact of the Internet of Things on the Business Model of insurance companies. So, I would like to ask a few questions how the IoT will transform the different blocks that constitute your Business Model, with the help of the Business Model Canvas. You can opt to remain anonymous if you wish to. Would it be alright with you if I recorded this interview?



Background

1. Name, role in the company?
2. What is your experience in working with IoT?

Impact of the IoT on current BM

1. How will the IoT transform the:
    a. Customer segment
    b. Value proposition
    c. Cost structure
    d. Customer Relationships
    e. Revenue streams
    f. Key activities
    g. Key resources
    h. Key partners
    i. Channels

Managing the risks with IoT

1. What are the biggest challenges with implementing the IoT in the insurance industry?
2. How can insurance companies mitigate these risks/challenges?

Appendix C – Empirical Findings

Below, the reader will find two tables summarizing the themes and subthemes found throughout the interviews, as well as the number of respondents that mentioned each subtheme. The first table relates to the first research question, the impact of the IoT on the BM of insurance companies, whilst the second table relates to the second research question, managing the risks with the implementation of the IoT.

Themes		Subthemes	Times mentioned
Financial Aspects	**Revenue Streams**	Shift from subscription to usage-based fees	3
		Shift from fixed menu to dynamic pricing	5
		New offerings/revenue streams	1
		Reduced revenues from premium discounts	6
		Up-sale opportunities	3
	Cost Structure	Claim frequency and cost reduction	8
		Shift from cost- to value-driven BM	1
		Increased supplier costs	3
Customer Interface	**Customer Relationship**	Shift to more frequent interactions	8
		Shift to advice-led interactions	8
		Gamification/loss aversion	2
		Speedier claim management	1
	Customer Segments	Shift to personalized offerings	3
		Shift to more profitable segments	3
	Channels	Reliance on partner channels	8
Value Proposition		Risk reduction	7
		Cost reduction	7
		Increased personalization	2
		Increased convenience	4
		Improved pricing models	3
		Reduced negative impact on environment	5
Infrastructure Management	**Key Activities**	Improved risk and pricing models	4
	Key Resources	Human labour with digital competence	2
	Key Partners	Strategic alliances with IoT-providers	8
		Outsource technical product development	8
		Efforts to improve cooperation	3

Themes	Subthemes	Times mentioned
External resistance	Clear communication on data management	4
	Use tech to solve data integrity issues	2
	Monitor and influence regulation	1
	Monitor and influence external partners	1
	Create incentives to share data	6
Organisational resistance	Setting right corporate culture	3
	Understand customer insights	4
	Low-scale, low-cost experimentation	1
	Finding right competence	2
Disruption	Improve customer relationship management	4
	Build new alliances with manufacturers	2