How Belgian insurers can benefit from IoT technology to enhance risk prevention and client protection?

Mémoire présenté par

Jolan Martin

pour l'obtention du diplôme de

Master en Gestion de l'Entreprise- MIBM-120

Academic year 2018–2019

Promoter :

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Introduction

The world has arrived in a period of intense change. Each day, we can see new technologies coming to market, new services, new opportunities for both consumers and businesses. Every day, technology astonishes us or worries us a bit more. Capabilities are becoming growingly unbelievable. Our phones can hear us, watch us, they can even chat with us. It is the same for our cars, our watches and soon it will be identical for so many objects of common life. The development of advanced systems being part of the Internet of Things has further amplified this feeling of improvement and permanent new features. All sectors are impacted, some more than others. For years now, people have been thinking about how these new aptitudes could be used but also how to regulate and enrich security around these technologies to avoid undesirable drift.

One industry whose development appears faster than others through digitization is surprisingly the insurance. An industry that we could call prehistoric as its administrative system seems old and deep-rooted. We are entering in a new era where insurers no longer only want to be an external player in people's lives, they no longer want to be the payer in the event of sudden damage, they want to be a real partner. The insurers' goal is moving from payers to partner. But how can they become a partner for the customer? This sector is increasingly thinking about how it can integrate itself into everyday life. Additionally, insurers are developing risk prevention insurances giving the customer more protection. Instead of protecting its financial interests via terms that are incomprehensible to ordinary mortals, the insurer invests in prevention to limit the threat of claims for its clients. How did this become possible? Again, thanks to the development of technologies such as embedded technology in cars, or sensors which are used to detect leaks or damages in an engine, for example. Improvements in computer networks are increasingly efficient to process larger amounts of data every day.

Nevertheless, to perform in this digital world, the insurer must understand how to use these technologies and understand how it works. What are the possibilities brought about by these new objects and which opportunities are open to insurers? But that's not all! The insurer must also assimilate the cost and the risks of using such technologies. What challenges lie ahead to create something relevant and effective. What should the insurer do to successfully give birth to an insurance service that appeals to the customer but by the same token, and above all, prevents risks and protects this customer, sometimes from its own failures. It is mainly this question that we will try to answer during this thesis. In addition, we will also outline a service idea that can help the insurer preventing risks and saving money. That will be the way to show how Belgian insurers could benefit from IoT technology to enhance risk prevention and client protection.

Part 1 – Understand the Basic Elements

1. Presentation of the Internet of Things

'In ancient China a man came to the emperor and demonstrated to him his invention of the game of chess. The emperor was so impressed by the brilliance of the man's invention that he told the man to name his reward. The man asked for his reward an amount of rice – That one grain be placed on the first square of the chessboard, two on the second, four on the third, and so on – doubling the number of grains on each subsequent square.

Not being a very good mathematician, the emperor at first thought the reward to be too modest and directed his servants to fulfil man request. By the time the rice grains filled the first half of the chessboard, the man had more than four billion rice grains – or about the harvest of one rice field. At that point the man was rich. By the time, the servants got to the sixty-fourth square, the man had more than eighteen quintillion rice grains ($18x10^{18}$), or more than all the wealth in the land. But his wealth and ability to outsmart the emperor came with a price – he ended up being decapitated.' (Erik Brynjolfsson and Andrew McAfee, referenced of the fable of the chess and rice grains in 'Race Against the Machine', 2011).

This fable shows that the exponential power is incredible. It is important to understand that a technology mostly grows exponentially until it reaches an unimaginable size. That's exactly what happens with the IoT, there is more and more connected devices around the world and so more and more collected data. This data permits a lot of improvement in different technologies as AI (artificial intelligence), machine learning, VR (virtual reality), AR (augmented reality), and so on. Soon, all this data will allow a big digitalization of the world and serious upgrading in almost every industry or even in the ordinary life.

Let's start with a presentation of this curious technology, from the beginning to the future of its development.

1.1.   The technology of IoT

The history of IoT can be traced back to early telemetry and telematics solutions, delivering the inaugural examples of connected devices to monitor usage, condition, and performance, and through alerts and messages, improve overall management of different operational processes. This could range from monitoring production lines, to drilling equipment at oil and gas sites, to being embedded in defence and space vehicles, and in monitoring the long stretches of pipelines, networks, and remote weather stations (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017).

The term 'Internet of Things' is first mentioned in 1999 by Kevin Ashton, co-founder of the Auto-ID centre at MIT, during a presentation for Procter&Gamble (P&G). Kevin Ashton from MIT is largely credited with coining the term and has been a key driver since then. During the same year, MIT Professor Neil Gershenfelds' book 'When things start to think' provides a clear

vision of what the evolution of this technology could allow some years later. The IoT began to really see life around 2008 to 2009. By 2011, it picked up steam. Some called it 'the Semantic Web', some called it 'Machine-to-Machine Communication', some called it 'The Internet of Things' (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017). Companies began to work on this new intelligence. One of the most prominent was IBM and their 'Smarter Planet' initiative. From 2012 to 2014, we saw the likes of Cisco, GE, Siemens, Ericsson, PTC, and numerous others going all in on IoT (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017). Also, in 2010, the technology knew a real expansion and interest while the Chinese government wanted an IoT strategy in its 5-years plan. But we will not speak about all the IoT history, that doesn't have a big interest for this thesis.

Now, IoT is everywhere, even if we don't know it yet. Thanks to the evolution of wireless technologies; micro-electromechanical system (MEMS); micro-services and the Internet, the IoT technology became what it is. The evolution of M2M (machine-to-machine) communication also helped a lot the propagation of IoT, connecting the devices to the cloud, managing it and collecting data (TechTarget, 2019, website).

If I had to give a definition of what it is, I will use this one:

The IoT is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring Human-to-Human or Human-to-Computer interaction (TechTarget, 2019, website).

We also sometimes referred as the IoE (the Internet of Everything), which consists of all the web-enabled devices that collect, send and act on data they acquire from their surrounding environments using embedded sensors, processors and communication hardware (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017). Which is not so different, actually.

But enough technical details, what is IoT properly?

Actually, the Internet of Things is a pretty simple concept. It means taking all the physical places and things in the world and connecting them to the Internet (Leverege, 2018). The IoT system is made of four distinct components: **the Devices** composed of different sensors as, for instance, micro, cameras …; **the Connectivity**; **the Data Processing**; **the User Interface**. All these things are relied by an IoT platform. This IoT platform is a critical component of the IoT ecosystem, but for many people, that is not clear, they don't understand what it is. IoT platforms are the support software that connects everything in an IoT system. An IoT platform facilitates communication, data flow, device management, and the functionality of applications (so, IoT platform help to: connect hardware; handle different communication protocols; provide security and authentication for devices and users; collect, visualize, and analyse data; integrate with other web services) (Leverege, 2018). The device 'talks' to the cloud through some kind of connectivity, by sending data, information. The data processing analyses this data and summarizes the relevant information to send to the user interface

which could be for instance a simple smartphone's application. The analysis could even bring the device to act automatically. That technology gives real-time information at a better level than ever. That's a long-term and powerful approach that all businesses will need to use in the future (Leverege, 2018). IoT will disrupt all industries and enterprises. It isn't a question of if but of when, and enterprises need to be prepared for these changes (Don DeLoach, Emil Berthelsen, and Wael Elrifai 2017). Nevertheless, currently many IoT deployments fail. Not because the underlying technology isn't good enough, but because the sheer operational burden makes the ROI not worth effort. This is also why it's so critical that you have a clear, measurable impact you're trying to achieve with your solution (Leverege, 2018).

Figure 1: IoT Architecture
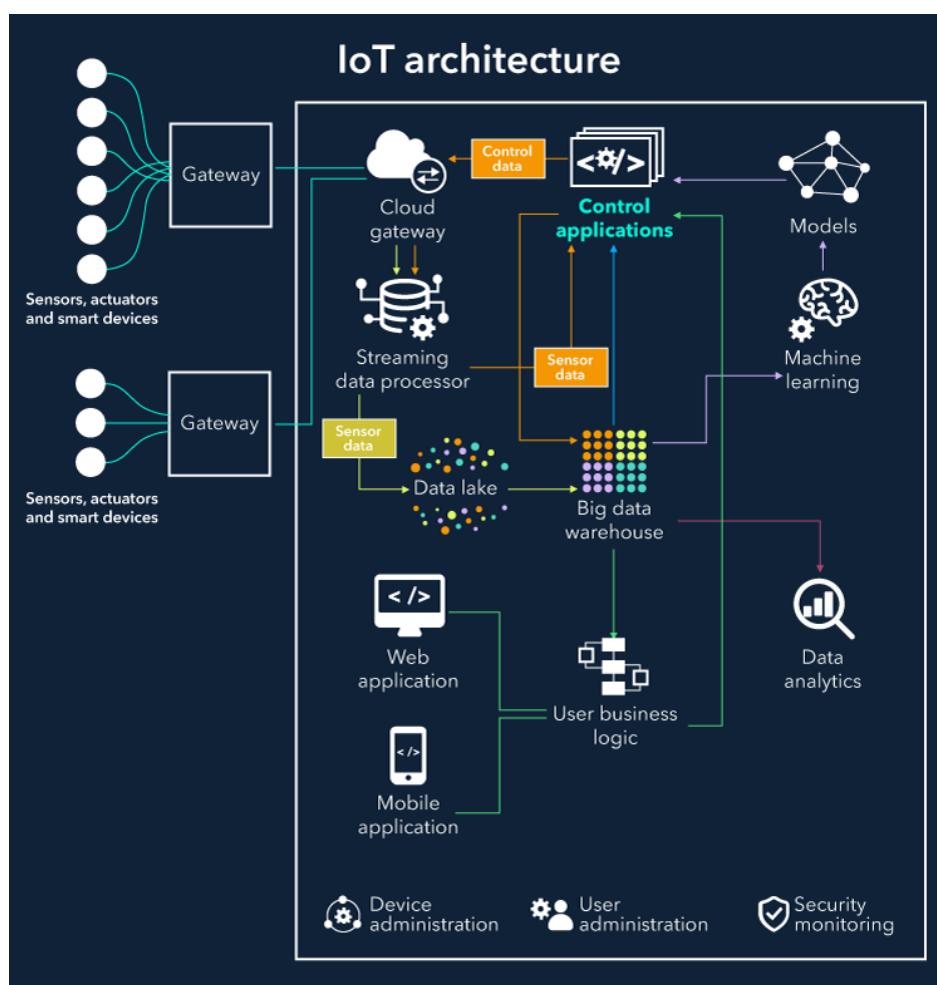
Source: IoT Architecture Explained: Building Blocks and How They Work. (n.d.). Retrieved 17 July 2019, from https://www.scnsoft.com/blog/iot-architecture-in-a-nutshell-and-how-it-works

1.2.   Where can we see the IoT applications?

IoT will influence our lifestyle from the way we react to the way we behave. For instance, the applications could be in smart cars, some wearables, smart appliances, smart buildings, smart home, smart TV, smart farming, smart health or even smart city. We should also make the difference between consumer IoT and enterprise IoT: Consumer IoT refers to things like wearables, smart home devices, etc. (All what one is talking about previously), so all of which are marketed directly to consumers; In contrast, enterprise IoT refers to the use of IoT in improving an organization's existing systems and processes and enabling organizations to increase operational efficiency or unlock entirely new value (Leverege, 2018). We will be less focused in this last part of IoT in this thesis. Nonetheless, to have a good overview of the IoT situation we will talk about industry utilization in some parts.

As the thesis is focusing on the applications of IoT for insurers to help in risk prevention and in clients protections, one gives there a specific example. You maybe already know that some connected wearables, as watches, can be used to know some different things about our health. But you maybe ignore that those could even save you in certain situations. These devices can be used for public safety: improving first responders answer times during emergencies by providing optimized routes to a location or by tracking construction workers' or fight fighters signs at life-threatening sites (TechTarget, 2019, website). That's just an example out of many.

And what would be the advantages to use this technology for professionals? According to a broader perspective, the good utilization of the technology in companies could enable organizations to (TechTarget, 2019, website):

- Monitor their overall business processes
- Improve the customer experience
- Save time and money
- Enhance employee productivity
- Integrate and adapt business models
- Make better business decisions
- Generate more revenues

In the insurance case, all these benefits are attainable (but here, we will not be focus on the things as the employee productivity and the business processes).

'Examples of consumption-based pricing include user-based insurance by Progressive Insurance in the US or Pay-Per-Horsepower for Rolls Royce airplane engines as part of their TotalCare package. For value-based pricing, companies such as Pirelli and Michelin can go one step further by embedding sectors in the tires of customer cars, and provide data about "the drive, his habits, his style of driving, the places where he/she more frequently goes etc.'' (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017. Chapter 1).

Let's talk now about the 5 C's of IoT (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017. Chapter 3). With Big Data in mind, it is useful to dive deeper into the elements of IoT to understand the implications.

First, the smart **connections**: this point is important because that's the link between the physical world, what we can touch, smell, see, etc. And the cyberworld which will treat the information and analyse it to give results. Because so much of the world is becoming connected, the amount of data will continue to grow at a massive place.

Then we have the **conversions**, which are most of the time simple 'IF-THEN-ELSE' statements. If we take a thermostat for instance, we have a sensor which determine the temperature perhaps as many as 12,000 times per second (12,000 Hz). The basic analysis would be something as simple as 'IF <current temperature> EQUALS <previous temperature> THEN <don't transmit the data>.' But at this level we don't have information because that's just data. But now that can be used to keep the temperature comfortable. The device does not only transmit the information but act in function of it.

After this comes the **centralization**, as the processing continued to be greater in power and at a lower cost, and the storage kept getting cheaper and cheaper, some companies have been able to propose efficient services of data centralization. The ability to combine and analyse this data is at the heart of where value is driven from IoT.

Next, the **cognition** – 'It's not what you look at that matters, it's what you see'. The fourth C is about deriving knowledge from information.

Finally, the **continuous improvement,** which is, in some ways, the key to IoT. With sensors constantly collecting data and the computational capabilities associated with processing that data, the ability exists (and will continue to become more sophisticated) to utilize machine learning[1] techniques to create truly adaptive systems (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017. Chapter 3).

Nevertheless, some issues appear with IoT too. The Internet of Things poses a risk to critical infrastructure including electricity, transportation and financial services. The technology, strongly present in these infrastructure, should be particularly securitized or some attacks as Mirai (a malware[2] that turns networked devices running Linux into remotely controlled 'bots' that can be used as part of a botnet in large-scale network attacks and which primarily targets online consumer devices such as IP cameras and home routers) will happen (MISP Galaxy Cluster, 2018, website). These problems must be solved and managed to ensure the data privacy and the security of users.

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[1]Machine learning is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead.

[2] Software that is specifically designed to disrupt, damage, or gain unauthorized access to a computer system.

'The technology is there, but the human conditions suggest a reluctance to let go what's known and provide comfort. But that will change' (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017).

1.3.   The Current Situation

The Internet of things is now one of the most promising technologies. Technical IoT ecosystem is growing, and improving, daily and more and more industries are using it. We could speak of an explosive growth with an exponential evolution (as most of the technology diffusion which often starts slowly with the early users and then grow exponentially, that's what we were talking about during the presentation of this chapter with the Chess and Rice's fable). Nevertheless, the technology is still unknown by most people and another part has ever heard about but doesn't understand what it really is.

According to Greenstein, VP of IBM's Watson IoT Consumer Business (2018): '2018 is the year that understanding of AI role as the brain running IoT system will spread'. Before, you could do IoT in your home in a lot of different ways and there were a lot of wires and a lot of hard code. Then, the mobile app came but it was still an isolated experience that doesn't really feel connected. It's only recently, with the enhancing of AI and machine learning allowing other technologies to grow up, and finally micro-sensors, that IoT became a thing to be considered seriously.

'AI is helping to bridge the gap, suddenly there are cameras that can not only see, they can understand the image, and microphones which can listen' said Greenstein, (2018).

Currently, if the IoT is such an important technology envisaged for the future and now, it's because the last innovations allow a greater and greater performance of the system. Every industry is being disrupted by the IoT. The improvement and the growth of technology make the connectivity of things better. The products, homes, warehouses, vehicles and such other things are now connected and able to use the IoT system.

As said in the previous part, the technology could allow to increase efficiency, improving health and safety, creating better experiences for consumers, etc. However, the cost of it is still too high, or the profits are considered as unclear and some business decision maker still hesitate to invest. Furthermore, as we are in the early age of the system, people are still afraid of risk.

Because of some issues, and even if new companies try to offer new services to solves those, some company's responsible argued that the technology is not mature enough (Vanson Bourne's report, 2017). They don't want to take the risk.

Though, most organizations are still in the early stages of their IoT implementations and most of responsibles believe that their organization needs to improve their plans for IoT. They judge

that their IoT strategy is not developed enough. These are really optimist and confident about this tech (Vanson Bourne's report, 2017).

A Vanson Bourne survey, made on 800 senior IT and Business Decision Makers found that 98% of the respondents stated that they are already generating some level of return from their IoT investment and most of them said they are achieving specific business benefits from their early IoT implementations with 35% citing production capacity increases and higher customer satisfaction and 38% making better informed business decision (Vanson Bourne's report, 2017).

Most of them use a 'Hybrid' implementation approach. They contract with some IoT professional to use an already existing platform, they customized it in order to adapt the platform to their own business and clients.

Still according to this survey, which are the biggest barrier to effective IoT implementation now?

- Lack of internal expertise and skills (for 31% of respondents)
- Inability to manage & process large volumes of data (29%)
- Integration issues (28%)
- Too many legacy systems (28%)
- Inability to scale the network to meet IOT demands (26%)
- Cybersecurity challenges (25%)

Even if we will be more customer focus in this thesis, it is important to understand what the challenges for companies are because insurers will have to manage the technology to be able to implement it in their customers services.

Until 2016, most insurers used a 'wait and see' attitude. Now, early adopters have a clear position and IoT strategy. They can establish a value proposition around IoT and the former sceptical are falling behind. Data-in-home, automotive sensors, wearable technology, drones, GPS, mobile phones, and multiple other sources can help to improve risk assessment and prevention. Before, the reality was that data was inaccurate and subjective. It was hard to use it. But now, with the expansion of IoT, there is a growth in the universe of accessible data and accordingly, an enhancement of advanced analytic capabilities.

1.4.   The Development Forecasting

'Business is going to change more in the next ten years than it has in the last fifty' Gates, B. (1999). This citation could seem old (that was 20 years ago, that's a lot of time in the past for someone born in the nineties). Nevertheless, it's never been so current and relevant than now.

According to IDC[1], the worldwide technology spending on the IoT could already reach $750 billion in 2019 and $1.2 trillion in 2022, attaining a CAGR2 of 13.4% over the 2017–2022 forecast period (HelpNetSecurity, 2018).

Ericcson is forecasting the number of cellular IoT connections is expected to reach $3.5 billion in 2023, increasing at a CAGR of 30% (HelpNetSecurity, 2018). If these numbers are finally true, one can expect an exponential growth of the technology, and so also an improvement of its efficiency. Once again, the fable of the chess and rice grains' shadow is still present and remind us than the development of a technology as the IoT is exponential, and so can take huge proportion.

Now, we can already see a strong improvement in AI, machine learning, etc. Every day, we see information about these technologies in the news, in the papers, on Facebook, Linkedin and one could go on. Thanks to the real-time data streams delivered by sensors and networks, the IoT business becomes compelling in 2019. This business turns relevant and it's only the beginning of its ascension. The intersection of multiple technology domains is a key to successfully understand and develop a supply-side product and market development strategy (IoT Expo, 2018, website).

The growth of sensors, connected devices, the enhancing of applications, and so on, is possible thanks to the incredible ability of humans to adapt. Furthermore, a limitless creativity and ingenuity. There are always new problems to solve, and new way to resolve it. Nevertheless, the human has limits, and these limits are often reach when these humans must accept some new things. In the next years, and already a bit today, people should be able to delegate some decision-making to the machine. That delegation will probably grow a lot during the next few years, if the human acceptance allows it. Actually, with the improvement of information technologies, this delegation will allow a more accurate and quicker job. The mistakes made by machines will be reduced more and more thanks to the big gathering of data and to the big data system to conserve it. Sensor information and information from the cloud allow the machines to be constantly updated and to enhance their own performance by themselves.

Peggy Smedley[3] said that she believes machines are going to do an increasing number of decisions, thanks to the improvement and sophistication of applications, and also to the complexity of algorithms, amplified by the constant flow of new data.

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[1] International Data Corporation is an American provider of market intelligence, advisory services, and events for the information technology, telecommunications, and consumer technology markets.
[2] Compound Annual Gross Rate ((End Value/Start Value)365/days - 1).
[3] Most influential IoT podcasts engaging, educating and entertaining listeners about relevant digital tech trends.

A lot of different experts in the evolution of technology have a lot of hope about the future of machines. Today, they can see what tomorrow will be, because the evolution is so quick that we are already in the future.

For instance, Dr Sanjay Sarma[1] of MIT (2013) said, 'we will accept that the connectivity across entities is inevitable. My cell phone should be able to talk to my car, my car should be able to talk to my home, and so on.'

Nonetheless, at the moment, some people don't even know how to use their Bluetooth to pair two devices. There is therefore evolution and adaptation of the human being that is still necessary in order to optimize these M2M operations. It's not easy because the development is going really fast and is amplified all the time by an exponential effect which accelerates everything more and more. As the Dr Sanjay Sarma said (2013) 'the Internet of Thing is not just adding one percent of information, it's adding one hundred times more information'.

In the future, and already today, thanks to the development and expansion of 3D printers, the manufacture of components made more and more accurately and faster will allow very interesting electronic developments. It will be used in the marketing of M2M devices, and therefore, will further improve the growth of the IoT's power. Astro Teller[2] (2013) believes the future of hardware in M2M is not going to be much different from what has happened in the past with PCs and mobile phone.

However, there is still a lot of significative challenges for the future. For instance, the security (one knows that it's secure, but is it secured enough? And indefinitely?), the people acceptance, and so on. We will come back later to the different challenges of IoT implementation.

A key to allow a good and efficient development of the IoT system is to open it. 'The more open a system, the more innovation will be possible as other discover the value of information and build applications around it' (Kellmereit, D. and Obodovski, D., 2013). But to reach it, we also need structure, more security and clear and detailed rules.

We could also notify the impact of 5G for IoT. According to Gerardo Giaretta (2019), through the 5G the owner of a company could deploy its own network. That will allow more security and less risk of data theft because companies will not be mandatory to have partners and so there will be no need to share internal data. The security being currently a big breach, the 5G could be the solution to the final true IoT expansion.

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[1] Professor of mechanical engineering and VP for Open Learning MIT. He is credited with developing many standards and technologies in the commercial RFID industry.
[2] American entrepreneur, scientist, and author, with expertise in the field of intelligent technology.

2. The World of Insurance

2.1. Definition of Insurance company

The insurance is a business that provides coverage, in the form of compensation resulting from losses, damages, injury, treatment or hardship in exchange for premium payments. The company calculates the risk of occurrence then determines the cost to replace (pay for) the loss to determine the premium amount (BusinessDictionary, 2019).

2.2. Presentation of the Insurance World

We know that the main goal of the insurance subscription is to obtain coverage in case of claims. That's why people take insurance, to insure their financial and legal security. Nevertheless, if we dig a little, for instance in the big Belgian insurers' websites, we see that the goal of insurance companies seems to be the risks prevention and to protect their clients. Actually, that's obvious because the biggest cost for the insurer is the coverage. If they can prevent and avoid the risks, there is no need of coverage anymore, and insurers make more profits. Furthermore, we cannot neglect the fact that this kind of 'purpose' is to enhance the image of a business which seems focus on profit (as almost every business actually but the 'traps' on most insurance general conditions give them a bad image for the public. Very often, they play on words to avoid paying for claims).

We can see, in the presentation of AXA insurance, that in addition to protection and prevention, there is also a social conscience that allows them to restore their image. The first three focus for next years is:

- Climate Change – Contributing to the transition to a low carbon economy.
- Prevention – Help our customers reduce their risks by our health prevention action.
- Data for good – Protecting our customers' data. Sharing our data for the common good.

In their corporate responsibility, they even say: 'we have a responsibility to help build up a stronger and safer society' (AXA Belgium, Corporate presentation, 2018).

That's an example of how an insurance company communicate what they do. As said before, beside this, there is a goal of profit and that's obvious because every lucrative purpose business must do some benefit, or it just disappears.

So, now we see that insurance companies come in a world where they must enhance their image continuously. A lot of work is realized in marketing and communication to allow insurers to present a good image to the consumer.

Another point which is now imperative is the pragmatism of the insurance. We are in a time where people don't want to be confronted by a big administration, with tons of paper to fill out and keep somewhere. Things must be done quickly; things must be efficient. That's why

a lot of companies invest in a new digital transformation. Insurers want to take their place in this digital world. They don't want to be an old dinosaur industry anymore.

If we take the case of AXA, again. We can see that the horizon 2020 is focus on a better customer experience, *from payers to partner* (AXA, 2018). The transformation of the company is not only focus on a digital strategy. The goal of the digitalization is to be closer to the customer and to provide a better experience, at the end of the day, to improve the satisfaction and so the number of contracts' renewal.

In the future, the key for insurers will probably be the quality of their digital strategy. The customer experience is in the centre of the interest and the achievement of these new utilization of things could seriously improve the image of insurance.

Let's take an authentic example to illustrate a need in insurance. According to a report of Ernst&Young, an Italian insurer attracted 100,000 new customers in a little more than a year by allowing consumers to design and build their own policies based on 13 specific 'building blocks' from P&C[1], life and health insurance lines. Consumers can see exactly what each component costs and how much coverage each provides. Telematics devices are used for automotive insurance, and the streamlined process for sharing information eliminates a significant customer experience issue. The keys to success? According to company executives, it was 'revolutionizing the product architecture and pricing techniques and integrating P&C and life insurance components'.

That example shows that there is a need of renewal in the insurance world, and companies which understand it will be the top insurers of tomorrow. Some enhancement as using IoT to provide a better and more personalized service for the client is an opportunity for each Belgian insurers (and others).

The IoT allows insurers to move more quickly and make powerful data-driven decisions. According to the Insurance Information Institute (2017), about 30% of all home insurance losses in 2016 were due to water damage and freezing, making it one of the costliest claims. Creating a technology that helps decrease or even prevent such disasters caused by water damage is a great idea for insurers. IoT presents a great opportunity for tech companies to help mitigate damage to the home proactively and give better coverage and better customer service. By looking at weather predicting technologies, insurance companies could help homeowners stay informed on both damaging weather and their current homeowner's policy.

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[1] Property **insurance** and casualty **insurance** are types of **coverage** that help protect the stuff you own

2.3.   The Organization in Insurance

If we take the example of AXA, insurance services are classified in three main parts (Cfr appendix IV; V and VI): Life; P&C Retail and P&C Corporate, and each part is split in different subparts.

Life services are split in four targets: retail; self-employed; SME and Large enterprises. In each of those, there are three main parts: Pension; Protection and Health.

- Pension plans: A pension plan is a retirement plan that requires an employer to make contributions into a pool of funds set aside for a worker's future benefit. The pool of funds is invested on the employee's behalf, and the earnings on the investments generate income to the worker upon retirement. In addition to an employer's required contributions, some pension plans have a voluntary investment component. A pension plan may allow a worker to contribute part of his current income from wages into an investment plan to help fund retirement. The employer may also match a portion of the worker's annual contributions, up to a specific percentage or dollar amount (Investopedia, reviewed by Kagan, J., 2019).

- Credit insurance (protection): Credit insurance is a type of insurance policy purchased by a borrower that pays off one or more existing debts in the event of a death, disability, or in rare cases, unemployment. Credit insurance is marketed most often as a credit card feature, with the monthly cost charging a low percentage of the card's unpaid balance. Credit insurance can be a financial lifesaver in the event of certain catastrophes. However, many credit insurance policies are overpriced relative to their benefits, as well as loaded with fine print that can make it hard to collect. If you feel that credit insurance would bring you peace of mind, be sure to read the fine print and compare your quote against a standard term life insurance policy (Investopedia, reviewed by Kagan, J., 2018).

- Health: Health insurance is a type of insurance coverage that pays for medical and surgical expenses incurred by the insured. Health insurance can reimburse the insured for expenses incurred from illness or injury or pay the care provider directly. It is often included in employer benefit packages as a means of enticing quality employees. The cost of health insurance premiums is deductible to the payer, and benefits received are tax-free (Investopedia, reviewed by Kagan, J., 2018).

P&C Retail are split in three main parts: Mobility; Home and Lifestyle.

- Mobility is for instance an Auto insurance: An auto insurance is a policy purchased by vehicle owners to mitigate costs associated with getting into an auto accident. Instead of paying out of pocket for auto accidents, people pay annual premiums to an auto insurance company; the company then pays all or most of the costs associated

with an auto accident or other vehicle damage (Investopedia, reviewed by Kagan, J., 2018)

- Home is for instance fire insurance: Fire insurance is property insurance that covers damage and losses caused by fire. The purchase of fire insurance in addition to homeowner's or property insurance helps to cover the cost of replacement, repair, or reconstruction of property, above the limit set by the property insurance policy. Fire insurance policies typically contain general exclusions, such as war, nuclear risks, and similar perils (Investopedia, reviewed by Twin, A., 2019). **[Important: While homeowners' insurance includes coverage for fire damage, fire insurance provides extra coverage to offset any additional costs to replace or repair property that surpasses the limit set by the insurance policy.]**

- Lifestyle is for instance Family insurance: Family coverage is an insurance policy that covers an entire family. Often, employers offer it as a benefit for their employees. Family coverage can include dental insurance, health insurance, life insurance, accidental death and dismemberment insurance, and more. Such plans may also be purchased outside of an employer network (Insuranceopedia, 2019).

The P&C Corporate could be split in different kinds of coverage. The protection of goods, the protection of people inside the company, the third-party liability, the protection of electronics and cyber risks, and the protection of the car. Nevertheless, for this thesis the corporate part is less relevant and will not be analysed.

Part 2 – Exploration of the range of opportunities and analysis

3. The Scope of Possibilities

The IoT provides a new world of possibilities for insurers. According to Accenture, the scope could be extended to six main offers.

Figure 2: The Internet of Things Scopes of Possibilities
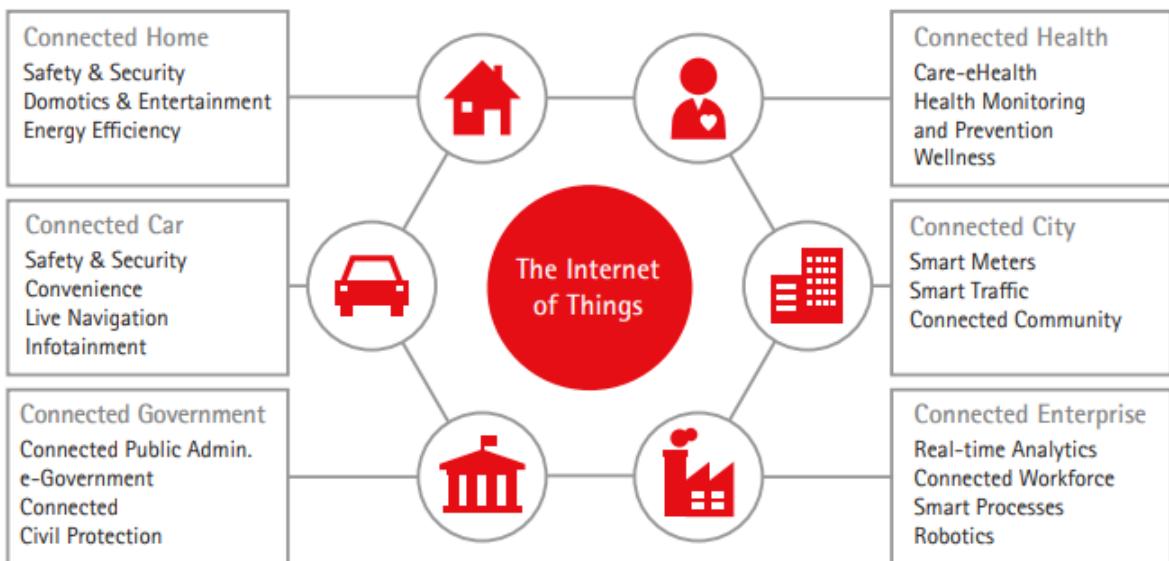
Source: Tedeschi, G., Della Vecchia., A. (2015). *Are you ready to be an insurer of things?* Retrieved July 19, 2019, https://www.accenture.com/_acnmedia/Accenture/Conversion-Assets/NonSecureClients/Documents/PDF/1/Accenture-Are-You-Ready-To-Be-An-Insurer-of-Things-2.pdf

In this thesis, the work is focus on offers for private individuals. So, the attention will be only put on the Connected Home, the Connected Health and the Connected Car/Mobility.

3.1. Connected Home

In 2016 already, we could see that the connected house market was growing. The global connected home market reached around $240 billion, including home security, smart utilities and home entertainment. According to Statista, the evolution of this market from 2016 until 2022 should follow this path.

Thus, you can see that by 2022, the size of this market will have doubled. It's an important information for insurers because if people invest more and more in connected home, the potential market for 'Insurers of things' is bigger and bigger.

Figure 3: Forecast market size of the global smart home market from 2016 to 2022
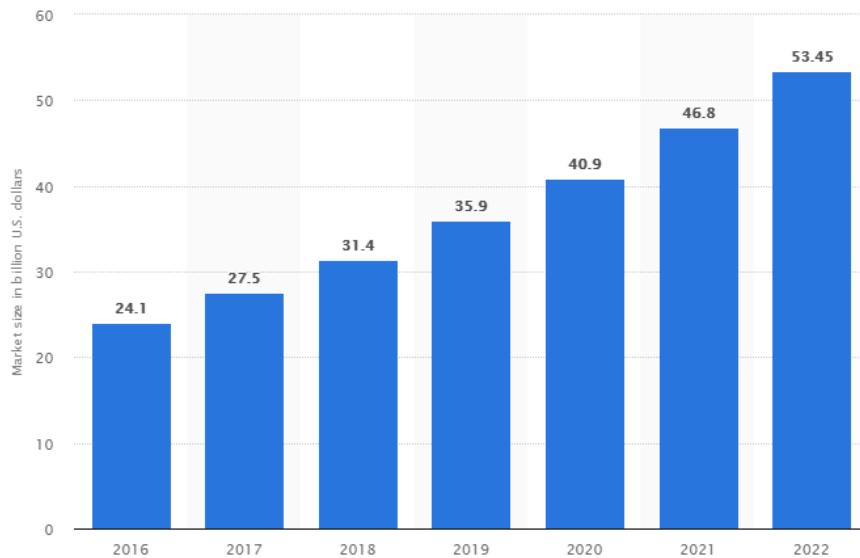
Source: Shanhong, L. (2019). *Forecast market size of the global smart home market from 2016 to 2022 (in billion U.S. dollars). Retrieved June 5, 2019.* https://www.statista.com/statistics/682204/global-smart-home-market-size/

Furthermore, the connectivity is popping up everywhere, 'from smart refrigerators that can monitor food consumption to smart carpets that can provide notification of unauthorized entry' (Accenture, 2015).

The new challenge for the insurer is to be able to deliver value in this connected home market while being able to adapt to the different players governing this market. Utility companies, home security providers, telecoms companies, and the must-have ones such as Google.

Figure 4: Home Insurance Scope and Partners
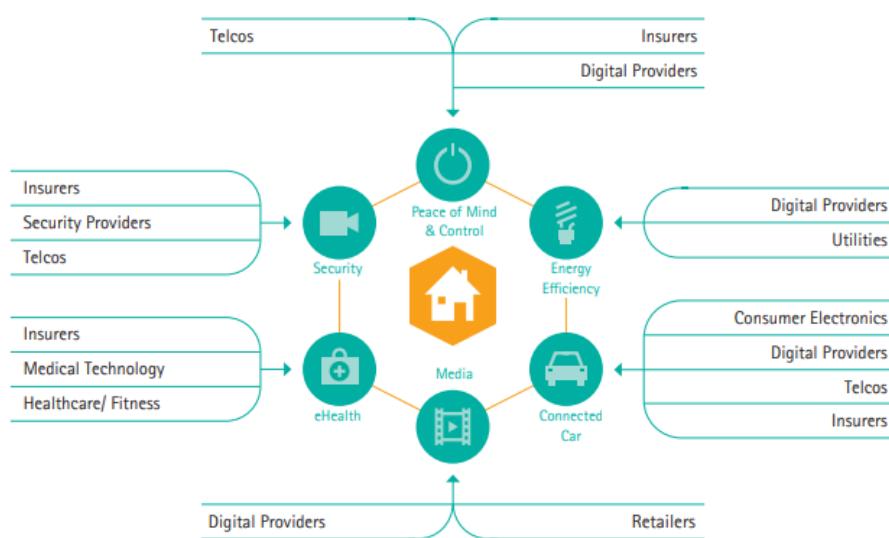
Source: Tedeschi, G., Della Vecchia., A. (2015). *Are you ready to be an insurer of things?* Retrieved July 19, 2019, https://www.accenture.com/_acnmedia/Accenture/Conversion-Assets/NonSecureClients/Documents/PDF/1/Accenture-Are-You-Ready-To-Be-An-Insurer-of-Things-2.pdf

'The connected home represents a significant opportunity for insurers in a number of areas, including: better risk management and risk mitigation, through claims avoidance and better claims handling; better underwriting, based on increased data flows and a keener understanding of risk factors and behavioural elements; new product offerings, including value added services delivered in partnership with other providers; closer customer relationships, as a result of more frequent and personalized interactions.' (Accenture, 2015).

As you see, for insurers the advantages are significant, but maybe there are even more for customers. With these new offers, the customer gets more security, with a lower insurance premium. He leaves his house for a moment without caring about anything because the technology will detect troubles and the insurer, with the collaboration of its partners, will do the necessary in the event of a problem. In a nutshell, the customer can benefit, not only from lowered premium resulting from better risk management and quicker action in case of an adverse event, but from increased security and peace of mind. Nevertheless, there are still some resistance from customers. The indifference or the lack of understanding of new offerings, but also the regulatory and privacy concerns. People are afraid to be spied by their insurer or by anyone else and if the communication campaign is not well managed, the service will never be sold.

According to an Accenture study (2016), 78% of respondents would be willing to share such information; 59% would share energy consumption information; 55% would share smoke or carbon monoxide detector information; and 32 to 38% would share light-sensor information, security video camera footage, motion detector information and thermostats.

So, we can see that even if there is some resistance, people tend to desire this kind of service and when most of them will be aware of all the benefits, the market of smart home insurance will expand.

But what IoT and smart home could provide, actually. According to Accenture, again, here is the main 8 proposed solutions:

- Security – Increasingly sophisticated alarm systems not only detect intrusions and call contact centres or law enforcement authorities; they can trigger photographs or video footage (which may be viewed remotely by customers on their smartphones, allowing them to determine whether there is real cause for alarm) and enhancing the likelihood of apprehension and loss recovery.
- Energy Management – New systems controlling individual homes can reduce utilities' aggregate peak load requirements and can help customers reduce their own energy costs by automatically managing demand to take advantage of peak load pricing.
- Lighting – Lighting can not only be controlled from outside the house, it can also be set through apps to manage home and travel schedules.
- Water – Alarms can now contact homeowners about water leaks from tanks or appliances and can shut off the water supply if necessary.

- Thermostats – Smart thermostats have moved beyond mere programming; they can now track residents' activities and routines and control temperatures in response.
- Weather – Sensors now track temperature, wind speed, humidity and vibration.
- Appliances – Refrigerators can alert homeowners to power outages, while washers and dryers can start or stop automatically and send notifications if problems arise.
- Smoke and Fire – New detectors not only distinguish steam from smoke but have the ability to shut off stoves and other appliances that may be causing the problem.

In conclusion, the smart houses are a big chance for insurers. Nonetheless, there is a lot of challenges to successfully deliver this service. Find the right partners and create a long-term and peaceful collaboration. Generate the right communication and convince the prospects. Manage the flow of data, the privacy of each client and the cybersecurity. And finally, probably the most important for insurers: to be profitable.

3.2. Connected Health

'The future of health will likely be driven by digital transformation. Health will revolve around sustaining well-being rather than responding to illness. By 2040, we expect the consumer will be at the centre of the health model' (Deloitte Luxembourg, Batra, N. and Betts, D., 2019).

With the evolution of all the IoT technologies, a lot of different possibilities emerge, and new tech devices and services try to make their place on the medical market. From the connected patch to know if an injury is healthy or infected, to the connected diaper to know when it's time to change the baby, everything is possible with these new technologies and companies try to make easier every aspect of our life.

'These days, L'Oreal is experimenting with creating wearable patches to detect pH levels. The DFree non-invasive device uses ultrasound to monitor bladder function. Alphabet subsidiary Verily is even rumoured to be developing prototypes of a shoe that can detect falls. And Abbott's FreeStyle Libre continuous glucose monitor (CGM) can monitor blood sugar via a smartphone app with a wearable applicator without the need for finger-stick-based calibration. The Dexcom G6 offers similar functionality. The increased ease in monitoring blood sugar could make CGMs a staple for the majority of diabetics while also opening the doors for patients without the disease to begin tracking their blood sugar' (Buntz, B., 2019)

Let's see some examples of CES 2019. Telemedicine, AI, self-testing kit and some robots, many technologies which could improve the way we care and the way we live.

Omron's HeartGuide blood pressure watch – *Medical wearables have gone beyond fitness. Companies are now trying to help people prevent and manage complex health conditions and Omron has just raised the bar with itsHeartGuide Wearable Blood Pressure Monitor. Available for $499 on preorder, this smart watch allows users to test their blood pressure in the same way they would in a clinic.*

Omron creates a device that gives a clinically accurate reading in as little as 30 seconds. Its tiny pumps and pressure sensors are able to expose hidden conditions such as heart and kidney

disease. The watch also tracks steps, calories burned and sleep patterns, all of which can be wirelessly uploaded into app called HeartAdvisor and later shared with a doctor via automatic PDF export (Healthcare Weekly, Ciulac, A., 2019)*.*

Sameday Security's virtual assistant for seniors – *With over 10,000 baby boomers retiring every day, the caregiving industry is turning to technology to meet the growing demand for better care. Contrary to popular belief, elderly people are more well-versed in smart devices than ever before. Four-in-ten seniors own smartphones and 67 percent of adults ages 65 and older say they go online. Having a virtual assistant in their homes doesn't sound that futuristic, but rather as a necessity.*

Enter Sameday Security's virtual assistant, Addison.

A conversational speech interface featuring a combination of artificial intelligence and augmented reality, Addison was built using Amazon Sumerian, a service provided by Amazon Web Services (AWS) that helps organizations build virtual reality (VR) and augmented reality (AR) applications. Engineered to sound affectionate and empathetic, Addison is a companion, a nurse and a fitness instructor all in one. The assistant shows up on a screen to remind seniors to take their medication, tell them what foods to choose or guide them through an exercise routine. It does so while monitoring vitals using Bluetooth devices and gait parameters to analyse the risks of falling and thus prevent emergencies (Healthcare Weekly, Ciulac, A., 2019).

An AI-enabled skincare diagnostic device from Lululab – *Their Lumini device, which won a 2019 CES Innovation Award, uses artificial intelligence, real-time face detection and illumination correction technology to diagnoses skin conditions in only ten seconds. The device's connected multispectral camera looks for six potential issues including acne, pores, redness and wrinkles and recommends personalized cosmetic treatment. 'Lululab will make the first AI trailblazer in the beauty industry so that anyone can easily use our beauty AI solution and experience the next chapter of the beauty industry,' said Yongjoon Choe, CEO of Lululab* (Healthcare Weekly, Ciulac, A., 2019).

A medical robot by New Health Community – *In an era where physicians are overworked to the point of burnout, there's little energy or time left to soothe patients' concerns or answer their questions.*

Controlled via a smartphone, tablet or a PC, Charlie allows patients to contact their doctors via video conference and talk to them without having to leave their hospital room or for the doctor to be there in person. The robot can easily adapt to the needs of people with hearing disabilities, speech disorders, autism or those in wheelchairs.

What's more, Charlie is equipped with Sophrology applications. Sophrology is a self-help method popular in European countries, including France, that combines meditation, breathing and relaxation techniques. And because it can get lonely in a hospital, the robot entertains patients with video games, documents, videos and other interactive elements. It will even play videos showing them how ambulatory procedures work, thus lowering anxiety levels. A digital

tensiometer, an oximeter and a stethoscope hidden in Charlie's 'belly' enable patients to perform self-check-ups under its watchful eye (Healthcare Weekly, Ciulac, A., 2019)*.*

Wearable pain relief technology – *The FDA's recent program meant to accelerate the innovation of medical devices targeting opioid addiction was a clear sign that government and health officials see tech as the last resort to end this deadly epidemic.*

NeuroMetrix went above and beyond to deliver. Selected among the CES 2019 Innovation Awards Honoree, their Quell 2.0 is a wearable 100% drug-free technology to bring relief from chronic pain. The device, which is 20 percent more powerful and 50 percent smaller than their first generation Quell, wraps around the upper calf and triggers the body's natural pain blockers by via electrical stimulation.

Quell 2.0 automatically starts therapy when it is placed on the leg. It is more effective when used for at least three therapy sessions per day for the first 30 days. While it can be worn during the day, it's the only over-the-counter pain relief device that is FDA cleared for use while sleeping. The device comes with an app making it easier to calibrate Quell to specify individual needs and chose a variety of customization features. A Quell 2.0 starter kit costs $299 (Healthcare Weekly, Ciulac, A., 2019).

As you can see, many different innovations could come soon in common life. They are already existing. It will allow to solve some issues as: elderly people care; unbearable pain relief; the need to move from a patient to another for doctors; etc. The evolution of these technologies is allowed by the enhancement of AI, data management, IoT which is more and more integrated in everyday life. On the one hand, some of these services or devices are quite clearly 'gadgets', so things which could slightly make your life easier, but which are not objectively useful. On the other hand, some of those could be very useful.

The utilization of more basic technologies as smart ring; smart finger; smart bracelets; smart pants; smart socks; smart belt; and so on, could be a solution to manage the growth of elderly people population (and other medical issues). It could help to keep an eye on lonely elderly and prevent some serious issues without a necessity of someone being there all the time (which is one of the biggest costs in healthcare).

We know that the share of the elderly in the total population of the EU-28 is projected to increase from 19.2% (or 97.7 million elderly persons) at the start of 2016 to 29.1% (or 151 million elderly persons) by 2080 (see next figure). So, the need of new services and devices to solve this potential issue is crucial, and the technology is there to help the population to overcome it. Machine-to-machine (M2M) communication enables wearable healthcare devices to communicate autonomously with monitoring systems for both real-time decision-making and data gathering for future analysis. All these systems will allow to develop more prevention and more people protection. One of the core reasons for wearables in healthcare is to transmit information for medical support from a licensed professional.

That's this flow of information and this acceleration in the transmission of information which will allow to improve the way we prevent diseases and the way we manage healthcare and post-operation cares. Furthermore, we are moving towards a system where of DiY (Do it Yourself). Thanks to these technologies, people will be able to take care of themselves without having to go to a doctor for regular check-ups and doctors will be able to control the health of their patients remotely.

Figure 5: Population pyramids, EU-28.
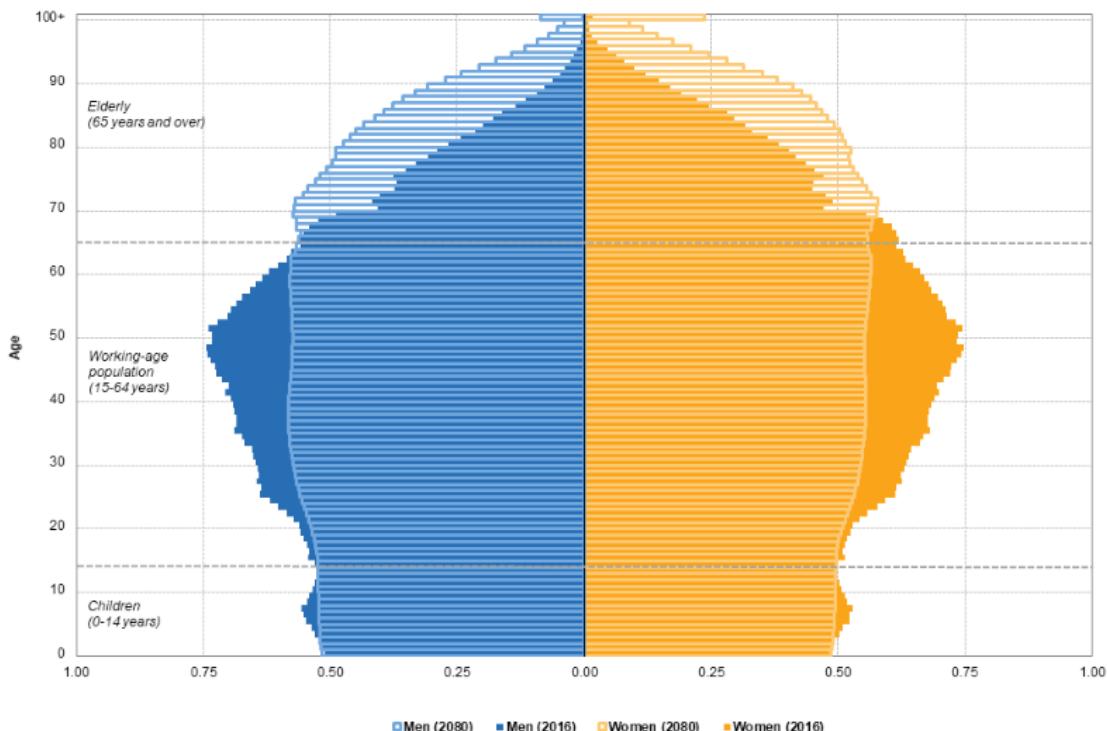
Moreover, let's have a look at some key information of an important report about connected devices for healthcare (Eastern standard time, 2019):

- The healthcare-related skin patch market will reach $630M by 2024, growing at 20.2% CAGR
- Wearable devices for vital signs monitoring will be $980M market by 2024, growing at 21.7% CAGR
- Areas of concern are data security and privacy as well as opportunities for advanced data analytics
- One of the key growth areas for wearable healthcare devices integration is implantable medical technology
- Remote data collection solutions will substantially enhance the operational efficiency of healthcare services

- Wearable devices and IoT will reduce human intervention in healthcare, enabling context-based automation

The market is in expansion, the devices are improving every day, new ideas emerge, the technology allows to go further and further, and to be more efficient than ever. Thus, we are in a situation where some challenges exist and must be solved, but also in a time where everything is tested and where we build the healthcare system of tomorrow.

We will see later, what are the opportunities for Belgian insurers, how they can use those, why the development of this digital world could be so profitable for them.

3.3.   Connected Car/Mobility

The last field of possibilities we analyse in this thesis is the connected car and more globally the connected mobility environment. The technological evolution allows to have more control on the road. We have safer cars, increasingly autonomous, incrementally connected. As for the house market and health market, more connection means more accurate data, and so the opportunity for miscellaneous industries to offer more personalized services.

Definition – *the presence of devices in an automobile that connect the devices to other devices within the car/vehicles and or devices, networks and services outside the car including other cars, home, office or infrastructure. Internet access is usually connected to a local area network. Many experts are saying that connected cars are part of the giant Internet of Things.* (Autoconnectedcar, 2019)

The automotive industry has seen monumental changes in recent years as the Internet of Things has infiltrated early every function of cars, from in-vehicle entertainment systems to performance monitoring and drive features (ConnectedSupplier, 2017).

According to the Strategy&Digital Auto Report by PwC (2017), 65 million connected cars will be on the road by 2025, and the global connected market will reach a value of $292 billion by 2025 (PWC, 2017).

This world of connected cars leads us to new possibilities in the consumer experience. For instance, the mobility services platforms (MaaS – Mobility as a Service) aim at providing passenger transportation that is more convenient and at a better price than traditional offers through more efficient asset use and/or better orchestration of ecosystem partners (PWC, 2017).

Those new services allow, for instance: trip planning and routing; booking and ticketing; driving/transportation; extended travel services; billing and payment. All of this is permitted by the new connectivity technology (as 5G), the enhancement of mapping and traffic management, the evolution of sensors inside the vehicles, the steady increase of technologies in the everyday life of consumers (smartphone, etc.)

If we take the example of the 5g. The true potential of electric cars is not possible without that technology which will allow a better quality of transmission M2M and so a better efficiency in the proposed services. The importance is the 'always-on' capacity of connected services. Even today, most new cars are available with some level of connectivity intelligent on board, telematics, in-vehicle personal calling, infotainment, or via a tethered connection. Also, the availability of a connected highway will vary greatly from country to country, as no two countries have the same approach to 5G development and investment. For instance, a Brussels Times' article said that 'Belgium risks exclusion from 5G revolution if it cannot work out its internal government struggles over the distribution of the auction proceeds, according to advocates within the country.' (Chini, M., The Brussels Time, 2019).

The main problem was the distribution of the benefits allow by this 'new' industry. As you maybe know, in Belgium there is a lot of different government, with different interests and responsibility, and also with different values and culture. It is thus often a mess to get everyone on the same board.

Anyway, the point was that 5G is crucial to the development of IoT and, obviously, for the development of connected cars. But to make it relevant, that must be available in most places and there is different political and technological challenges, and others that we will explain in the different IoT's challenges.

Now, the car is no longer a 'black box' offering a portfolio of services only dedicated to safety and security. On the contrary, it is now the result of the convergence of smartphones and connectivity to Cloud infrastructure. So, new services can be created. The relationship between the drivers and their cars will not be the same anymore.

The connected car is a major trend of the automobile industry. However, one must distinguish between connected car and autonomous car. The connected car is already available, and it is not autonomous whereas the autonomous car will obviously be connected but will only be available in a few years. The autonomous car's main goal is to alleviate certain constraints linked to driving conditions (highway, traffic jams…) and to greatly enhance security while maintaining the pleasurable aspect of driving. On the other hand, the connected car brings an enhanced driver's experience wherever they may be while enabling manufacturers to fine-tune their digital growth engine through data collection.

Future cars, which will integrate personal assistants able to help during your drives, will be equipped with an array of sensors and will be connected to Data Analytics Cloud servers in order to answer to many more use cases.

The hyper-security of data and vehicles remains the most critical element and is a key requirement for customers. The media coverage of incidents linked to autonomous cars has placed doubts on the future of these vehicles and, hence defiance from consumers. Automobile

manufacturers must then rely on partners with expertise in cybersecurity who will guarantee the reliability of the cars' connectivity as well as the secured storage of all their data.

Lastly, the systems of tomorrow's connected cars will need to be scalable and reliable. The connected car's lifecycle is far greater than one of a smartphone. It is highly inconceivable to keep the same smartphone for 10 years without constant system updates (Luczak, D., 2017).

Thus, you understand now that new technologies will make evolve the car industry. The website 'IoT for all' gives a look at the seven most talked and written trends about connected cars and the mobility of tomorrow. Let's see it together:

1. Driverless Cars

'Driverless,' 'autonomous' and 'self-driving' are all terms that have come to mean pretty much the same thing: a vehicle that can drive itself with no human intervention required, at least under some circumstances. The companies racing to develop the first driverless car includes major automakers and technology companies.

The first truly driverless car will be a game changer. But don't expect to see widespread acceptance and production of driverless cars for at least another decade due to the need for a connected infrastructure and advancement of other technologies, such as V2V (IoT For All, 2018, website).

2. AI Interfaces

Building upon technology that, for now, is confined to smartphones or smart speakers, automakers will provide artificial intelligence software in a vehicle's infotainment system that will serve as a virtual personal assistant with the ability to respond to voice commands and proactively guide drivers in collaboration with its navigation system. Automakers are expected to introduce models with AI interfaces as early as 2019 or 2020.

But that's not all. With the increasing use of sensors and other technologies that collect data, AI will be key to making sense of everything. Some automobiles already use AI for Level 3 autonomous driving, but for the industry to reach Level 5, major enhancements need to be made to the car as well as the infrastructure (IoT For All, 2018, website).

3. Telematics

Automotive telematics play a vital role in assessing the driver behaviour for a wide range of purposes, from determining a more accurate insurance premium to learning more about when and where people drive. Dealerships value telematics as a way to monitor vehicles diagnostic and smart maintenance service.

Currently it is estimated that between 60 and 80 percent of cars sold in 2017 contained installed telematics. However the market for connected car packages continue to focus on premium vehicles. By 2022, 75 percent of connected car packages will be sold as part of smaller, less expensive cars (IoT For All, 2018, website).

4. Vehicle-to-Vehicle Connectivity

V2V technology, as the name implies, allows vehicles on a road to 'talk to each other' by sharing data on speed, road conditions and other factors through an ad-hoc network created among vehicles. V2V shows great promise in helping to avoid crashes, ease traffic congestion, and improve the environment.

Taking the concept one step further, 'vehicle-to-everything' (V2X) technology will make it possible for vehicles to communicate with smart traffic signals and even conduct a transaction at a gas pump. It is expected that all new cars on the road will have V2V technology installed by 2023 and that V2X technology will follow along shortly thereafter (IoT For All, 2018, website)*.*

5. Sensor Application

Innovative sensors monitor and regulate a car's operation and provide the foundation for autonomous driving by sharing important data in demanding applications, such as engines and brake and transmission systems. Sensors such as LiDAR, radar, cameras and ultrasonic are significantly impacting auto safety, security and vehicle maintenance costs. The future for sensors is now, and it is only a matter of how they are integrated into AI and connected car technologies that will determine their possibilities (IoT For All, 2018, website)*.*

6. The Totally Connected Car

There's a good chance your next car will be every bit connected as your smartphone, with access to the Internet and the Cloud. Don't be surprised if at some point in the not-too-distant future, Internet access will be as important as fuel efficiency and engine power when you purchase your next car. Widespread access to a connected car is not here yet, but I agree with the experts who predict that 90 percent of new cars will be connected to the Internet by 2020 (IoT For All, 2018, website)*.*

7. Brain-to-Vehicle Technology

Brain-to-Vehicle technology uses a device to imperceptibly measure brain wave activity, which is analysed by the vehicle's autonomous systems and used to predict and eventually anticipate driver behaviours. B2V technology may not be for everyone. It requires the use of a headset dotted with electrodes that either press directly against a person's scalp or come as close as possible (IoT For All, 2018, website)*.*

Conclusion

Now, you realize what the three main environments are, and you could already imagine where insurers could have a serious impact using IoT. You see that those markets were in a serious expansion and that people's interest was growing too. The technological improvement and the evolution of politics are beginning to allow real profitability of these services and we will see later than the opportunities for insurers are huge.

4. The Opportunities for Insurers

Now that we have an idea on the scope of possibilities for IoT's use in the three main services we are working on, let's have a look on the real opportunities for Belgian insurers, but also on the risks.

According to a KPMG report (2015), IoT is the ultimate game changer for insurers. The technology allows new competitive advantages, new business models, and also new revenues. Thanks to the active role in risk prevention, the profit of insurance companies could be improved. We could imagine that in the next few years, with the implementation of more and more embedded technology and broadly IoT devices, people and insurers will have more control on the everyday issues. The automation of those could lead to a control that automatically shut off the mains if certain risk conditions are met. Now, what if the automatic control fails? Who will be responsible? What will be the consequences? These questions remain unresolved, but the answers shall be found soon to allow a proper expansion of these services and more authorization inside the regulations. Because 'IoT could, for example, provide insurers with the right data to finally unlock the potential of usage-based insurance' (Richardson, G., KPMG-2015).

We have split the main opportunities in three parts: The reduction of risks; the development of tailor-made adaptive insurances; and the enhancement of the customer experience.

4.1. The Reduction of Risks

The IoT utilization allows a better control on many different things. This control gives the opportunity to people and insurance to prevent from trouble and so to avoid claims. It's important to know that claims are the biggest cost for insurers. Indeed, it is when the insurer will have to pay large amounts to cover one of its clients that the company will lose the most money. Thanks to investment in technology such as IoT, risk prevention is much higher. Which allows the consumers to be more responsible and, for example, to avoid causing an accident (in the case of driving). If we now take the case of home insurance, the installation of sensors in the home could help prevent the risk of moisture and collapse, or even water damage. This allows the client to react at the right time, limiting possible financial and material losses as well as unwanted complication, but it will also allow the insurer not to have to reimburse an entire house because of problems that could have been prevented. A Deloitte University Press report even speaks about the prevention of risk in the workplace, for employees doing heavy work, in this report they said that 'Wearable sensors could monitor employee movements in high-risk areas and transmit data to employers in real time to warn the wearer of potential danger as well as decrease fraud related to workplace accident' (Canaan, Lucker, Spector, 2016). This example shows how far the utilization of this technology could go.

All this prevention will allow, on the one hand, customers to avoid trouble and to see their insurance premium drop down, and on the other hand, insurers to see their benefits increase

through the reduction of claims. The loss rate will be drastically lower. According to ATKearney, there will be a real shift from restitution to prevention. Thus, there will be greater upfront costs to lower loss pay-outs in the future.

4.2. The Development of Adaptive Insurances

IoT will lead to data capture and management at an unprecedented scale. Thanks to the increasing of data collection and the accuracy of those, insurers will be able to adapt their policies, to create it in real time and bespoke for each client. These personalized policies will make easier to accurately predict and mitigate risks. More you know about your client; more you can predict his behaviour and prevent his mistakes. Through the IoT and with a strong data analytic software, it will be possible to adapt each offer to each client and so to improve the customer management and the customer satisfaction. Nevertheless, that will necessitate a big internal process because people who manage the claims processes shall be able to adapt to each client and without policy standardization, that's a real challenge. Furthermore, the regulations don't allow this kind of product yet. The IoT utilization by insurers is still limited and they cannot propose fully efficient services. Also, it's important to notify that the public distrust is still significant.

However, these trends will change with time, 'by 2025, IoT will be pervasive, with connected "things" driving a data explosion with sensors embedded in cars, buildings, and wearable devices – so much that a family of four could have more than 100 connected devices' (Reifel, Pei, Bhardwaj, Hales and Lala, 2014).

4.3. The customer experiences

'Insurers are operating in an environment where consumers' expectations and the technologies available to meet them are evolving rapidly' (Reifel, Pei, Bhardwaj, Hales and Lala, 2014).

This sentence sums up the world we live in today. A world where people are so connected, so aware of everything, that their expectations are increasing. They expect more from each service. But also, a world where technology is evolving so rapidly that it is becoming possible for companies to offer progressively high-quality services. Services that allow us to get closer to the customer, to learn more about him and thus to adapt the service to this customer. We are really moving towards the personalization of services and the insurance industry is not excluded.

The greatest digital sophistication gives new value proposition for insurers, and so new sources of revenues. More timely information can make claims payments speedy and efficient, while data analytic can make detection of potential fraud both easier and more successful (Reifel, Pei, Bhardwaj, Hales and Lala, 2014).

Thus, everyone is winning. The client receives a more efficient and enjoyable services (with for instance the new approach of gamification [Fitbit] which is engaging for younger customers to change behaviour and subsequently their risk profiles), and the insurer can make

easier more benefit and avoid fraud. So, one could imagine that insurers could also reduce their price.

Nevertheless, insurers must now take the lead, because in this connected world, competition will be even tougher, and only those insurers offering the most advantageous and efficient services will create a place for themselves in this digitalized market. According to ATKearney, 'Overal success for insurers will come by the ability to differentiate in an increasingly commoditized market. IoT is one-way insurers can achieve that differentiation' (Reifel, Pei, Bhardwaj, Hales and Lala, 2014). Different case will be present in another chapter of this thesis. The AXA's service DriveXperience is a great example of this gamification and of the enhancement of the customer experience. One will see it later in the case analysis part.

4.4.   The Risks

From the perspective of a Deloitte University Press report, the implementation of IoT technology in insurance services could have some negatives impact for insurers. As actual risk level is reduced through smart automation, the requirement for purchasing insurance may also decrease. Indeed, if the prevention is enough to avoid accident, and if the technology is sufficiently successful to be efficient, the need of insurance will be almost absent. And if this need disappears thanks to technology, insurers will have dug their own graves and caused the death of their industry. Furthermore, to make an IoT strategy efficient, the efforts may require patience and long-term investments. If, at the end of the day, insurers can't figure it out, it's a problem and that's probably why some of them are still reluctant. Nevertheless, insurers which don't plug in into IoT will undoubtedly be caught up by the competition and will disappear sooner than others.

On the same line of ideas, another thing is the risk of overpricing by insurance compared to the low risk. Undeniably, if the risk of claims is near to zero, there is not a real interest to take insurance anymore. Once again if the technology allows a good enough prevention and even a protection of people, there is no need of insurers.

The last important risk is completely different. The privacy and the security concerns will need to be addressed. At this moment it's pretty hard to imagine how to secure the IoT and the data. People are working on it and most think that the 5G could be the solution for this. The network will allow more security and a more efficient propagation of the system. For instance, that could expand the network in the roads and allows a real security system to prevent the accident or to act faster than ever in case of a collision.

5. The Different Challenges

5.1.   Business challenges

Business model design – Delivering a valuable product to customers in a profitable way

A business model is 'the architecture of the product, service and information flows, including a description of the various business actors; and a description of the sources of revenues' (Timmers, 1998).

The emerging IoT business imposes a necessity to transform the business rules. There will be impacts at all levels of the organization, and everyone in the company will be affected. However, the final goal is to improve the customer experience and that's important for companies to create a model which please clients, and which is profitable. To reach it, many strategic questions need to find answers, as: What are the main benefits to the enterprise and its customers? What are the key considerations? What are the best practices that can help to ensure a successful transformation? 'The challenge of identifying horizontal needs and opportunities, managerial challenge related to internal team alignment, and the ways to overcome the market maturity problem for novel IoT technology' (Westerlund, M., Leminen, S., Rajahonka, M., 2014).

In a TIM[1] article (2014), three major challenges are identified: the diversity of objects; the immaturity of innovations and the unstructured ecosystem.

Diversity of Objects

Here the problem is that in the IoT ecosystem, countless different objects, from the fridge to the car, will be directly connected and linked together by a M2M system. It will therefore be necessary that the interface be sufficiently standardized in order to be able to connect these different connected objects correctly.

'More than 99% of physical objects that may one day join the network are still not connected' (Evans, 2011).

Evans, through this sentence, tells us that it is important to consider a *real* standardization and clear rules regarding connected objects. If this is done on all sides without common measures, it will not work and will not be efficient. It is therefore today, at this emerging stage, that rules must be created to enable harmonization of the IoT sector.

Immaturity of the Innovation

In order to be able to launch an efficient and secure IoT-based service, players such as Belgian insurers must ensure that the technology works properly. The main challenge here is the following question: 'When is a technology mature enough to be launched on a large scale and offer the desired service?' Indeed, the problem is when to launch these new services. All this with the constraint of being the first mover, on the one hand, to be able to capture the

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[1] Technology Innovation Management Review

advantages of the market, and on the other hand, to be almost certain that the technology used is sufficiently reliable. For this, some tests are necessary, and it takes not only time but also money. Finally, if the tests are not successful, the company will have made losses. So, you must know when to choose the right time. With the maturity of the technology comes customer acceptance. Many companies around the world have failed their projects. It was not because the idea was wrong or poorly conceived, but only because the timing was not right.

Unstructured Ecosystem

'The complexity of an ecosystem is associated with the number of participants' (Möller and al., 2005)

Here the challenge is in fact to succeed in building an effective ecosystem in an initially chaotic ecosystem. At the beginning of the development of a new service using a technology still unknown to many people, it is difficult to design an ecosystem where all the links in the chain are present and effective. At first, there are many 'holes' in the supply chain and the expertise is still quite poor. It is then really difficult to structure this ecosystem to finally deliver a service that is efficient and pleasant for customers.

Broadly, the challenge of proposing a valuable product to customers in a profitable way is also a hard one. Actually, the investments to propose IoT solutions could be important and companies don't know about their ROI yet. That's why a lot of them are hesitating to plug in into the IoT. Nonetheless, we will see in the cases analysis that some solutions are possible and that is conceivable for insurers to find a way to avoid too much investment in proposing an efficient and cheap service for customers.

Figure 6: Consumer Adoption and Trust
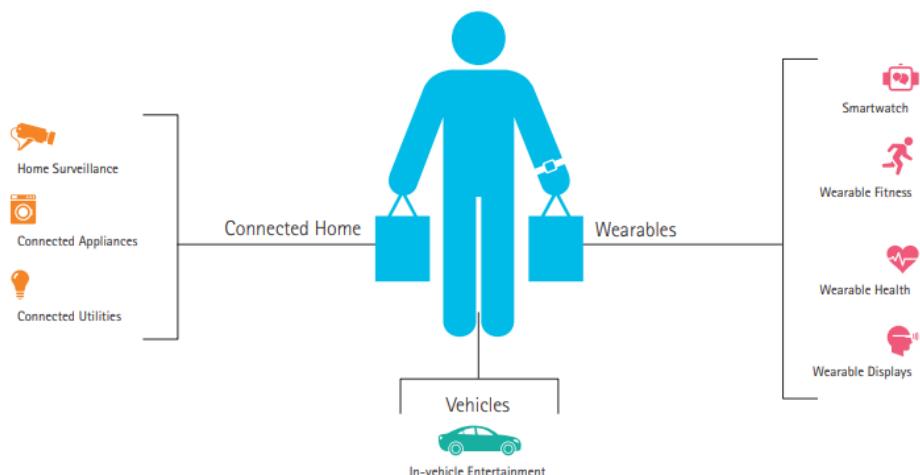
Source: Accenture, Murdoch, R. and Johnson, P. (2015). *Digital trust in IoT era*. Retrieved July 21, 2019.

The last figure shows the IoT consumer device universe. That's important in this part to understand that soon the proportion of the IoT will be so big that it will intervene in every little things we are doing. That's why we need to go deeply into the consumer trust which is a major element for the success of the technology around the world. Without trust, there will not be this digital future and there will not be the expected people protection.

'As the Internet of Things (IoT) matures, the success of businesses that participate in the world of connected devices depends on the level of digital trust consumers have in them' (Murdoch, R. and Johnson, P., 2015). Still according to this Accenture report (2015), 54% of digital consumers are cautious about the information they share due to the lack of confidence in the online security that protects their personal data. Which means that a lot of people using digital platform don't have any trust on it.

Trust in a digital tool is extremely important for the consumer. If there is no trust, this one will not use the tool and the investments made by the company will not have the expected return. It is therefore important to build a service where the customer feels at least as safe as in the physical space. Furthermore, companies have to pay attention to security and privacy because every additional connected device makes the network bigger, and so the risk of a security breach is bigger too. Additionally, the traditional security and privacy measures don't work with IoT. The system is too complex and too much split compared to a 'simple' IT system. That's also why IoT is not trusted enough by people, as the Internet was at the beginning. To be trusted and accepted, an IoT system must possess a series of characteristics, such as encryption and usefulness (Alhogail, A., 2018). According to Alhogail, A. (2018), trust is mainly impacted by numerous quantifiable and non-quantifiable factors. He classified it in three main dimensions: the product-related factors, with for instance the functionality and reliability, the helpfulness, the ease of use and the perceived usefulness; The social influence-related factors, with the social network and the community interest; and the security-related factors, with the product or service security and the perceived risks associated with a product or service. In his study, the assumptions are that most of those have a positive impact on the customers' confidence. The results show that indeed most of them seem to have an impact on trust, and that in often more than 70% of the interviewees.

Nowadays, companies can already collect a lot of data. Our phones know where we are, who we contact, with whom we like to talk to, they can see us, hear us. Some companies may know how we drive, our connected watches know if we are in good shape or if we are sick, if we have a good quality sleep, if we regularly exercise. Some sensors go so far that they are able to determinate, for example, if the position of our feet is adapted when we are walking. This is a lot of data that can potentially be used by companies. To do this, the client must not only be confident but also see it as a personal interest. According to a study by Accenture (2015), more than half of people are not confident about the security of their personal data protected on the Internet. And as you can see in the figure below, it varies slightly by age or region but remains more or less in the same line of thought.

Figure 7: Digital Trust about IoT Era
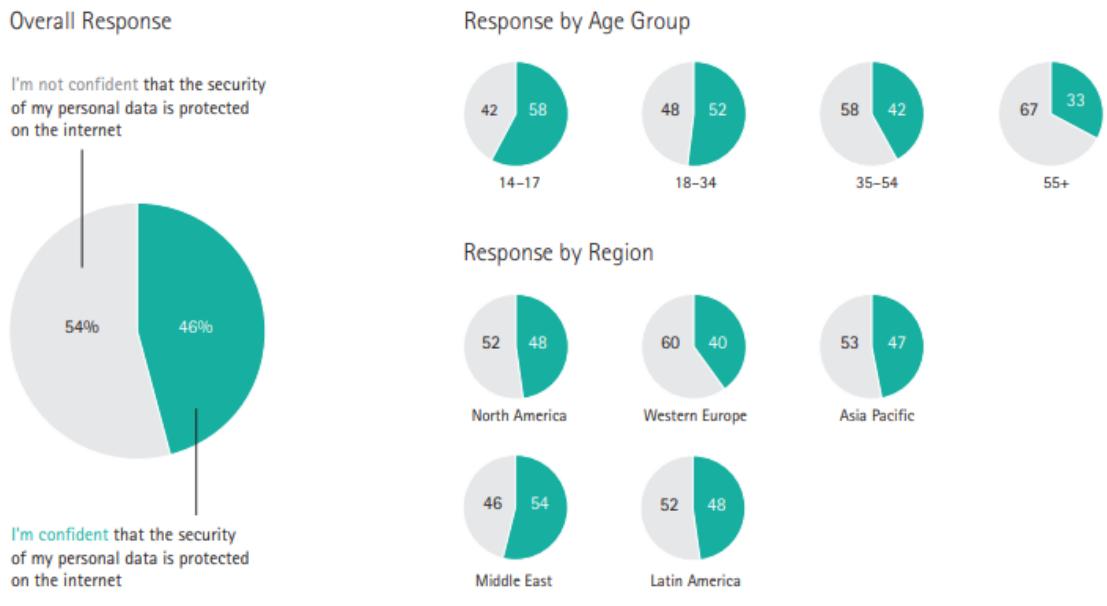
Source: 2015 Accenture Digital Consumer Survey

Source: Accenture, Murdoch, R. and Johnson, P. (2015). *Digital trust in IoT era.* Retrieved July 21, 2019.

It is therefore important for companies wishing to engage in IoT services to create consistent partnerships with companies that already inspire trust, in order to improve customer confidence in a company's use of their data. A final point not to be overlooked is also to know what the consumer considers to be a violation of their privacy. The following figure shows the results obtained by Accenture (2015) during one of its studies.

Figure 8: What could be considered as a data violation for consumers
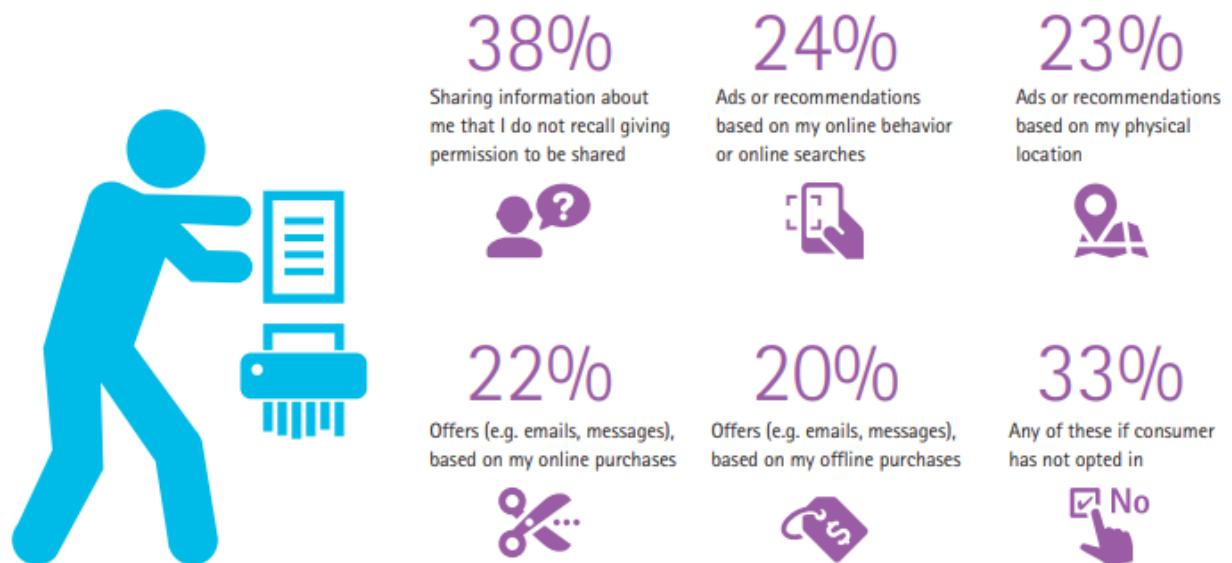
Source: 2015 Accenture Digital Consumer Survey

Source: Accenture, Murdoch, R. and Johnson, P. (2015). *Digital trust in IoT era*. Retrieved July 21, 2019.

'Once companies gain digital trust, they can leverage IoT business and technology opportunities. Most importantly, they can access more consumer data from those who trust them, use analytic to unlock more value from that data, deepen customer loyalty and offer more relevant, revenue-generating services and applications' (Murdoch, R. and Johnson, P, 2015).

However, all these things were mostly companies' concerns, but the state and international organization have also a role to play. That's what we see with the implementation of GDPR in the European Union.

GDPR

'Regulation (EU) 2016/679 of the European Parliament and of the Council, the European Union's ("EU") new General Data Protection Regulation ("GDPR"), regulates the processing by an individual, a company or an organization of personal data relating to individuals in the EU.

It doesn't apply to the processing of personal data of deceased persons or of legal persons.

The rules don't apply to data processed by an individual for purely personal reasons or for activities carried out in one's home, provided there is no connection to a professional or commercial activity. When an individual uses personal data outside the personal sphere, for socio-cultural or financial activities, for example, then the data protection law has to be respected.' (European Commission, 2016)

The GDPR is there to regulate and protect the utilization of data. This part could also be processed in the technology part, where one speaks about privacy matters. Nevertheless, I think that's important to speak about GDPR in the consumer trust part. Because, even if the main purpose is to conserve a kind of privacy for European citizens, the real matter beside this is to get trust of these citizens. The GDPR is a regulation which wants to protect consumers in the digital world, but another purpose is to be able to develop and obtain a bigger trust of people in digitalization. The GDPR controls the type and the volumes of data that can be processed, for how much time companies can keep it, and explains what information must be given to individuals whose data is collected.

According to the European Commission (2016), companies operating in the European Union must respect some different things to be conformed to GDPR:

- personal data must be processed in a **lawful and transparent manner**, ensuring fairness towards the individuals whose personal data is being processed ('lawfulness, fairness and transparency');

- there must be **specific purposes** for processing the data and the company/organization must indicate those purposes to individuals when collecting their personal data. A company/organization can't simply collect personal data for undefined purposes ('purpose limitation');

- the company/organization must collect and process **only the personal data that is necessary to fulfil that purpose** ('data minimization');

- the company/organization must ensure the personal data is accurate and up-to-date, having regard to the purposes for which it is processed, and correct it if not ('accuracy');

- the company/organization can't further use the personal data for other purposes that aren't **compatible** with the original purpose;

- the company/organization must ensure that personal data is **stored for no longer than necessary** for the purposes for which it was collected ('storage limitation');

- the company/organization must install appropriate **technical and organizational safeguards** that ensure the security of personal data, including protection against unauthorized or unlawful processing and against accidental loss, destruction or damage, using appropriate technology ('integrity and confidentiality').

For instance, 'Your company/organization runs a travel agency. When you obtain your clients' personal data, you should explain in clear and plain language why you need the data, how you'll be using it, and how long you intend to keep it. The processing should be tailored in a way that respects the key data protection principles.' (European Commission, 2016).

The GDPR process is hard to implement for companies but very necessary for the good trust and protection of citizens. That's why the intervention of the European Union is really relevant and helpful for the development of the digitalization.

5.2. Technology challenges

Now that one has an overview of the main business challenges, let's have a look on the main technological challenges.

Security and privacy

'It stands to reason that two of the key issues that will slow down the maturity and success of IoT are security and privacy' (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017. Chapter 5)

The security and privacy challenge are a critical consideration. Without a good plan to secure and to allow enough privacy, the expansion of IoT and its efficient utilization will never be possible. We will start with the security challenge. We will explain what the challenges are more accurately, and why it is so important to consider it. Then, we will speak about the privacy issues and we will finish with some advice given by Jason Hong during the CSA Conference 2019 in San Francisco.

Security

'The challenge is that nobody knows what is secure enough. Everyone talks about it for IoT, but what is not clear is what constitutes the point of satisfaction. The most fundamental element undermining privacy is the security consideration. If this protection is violated, then you broke the bargain' (Finocchiaro, M., 2017)[1].

The security is probably the most important challenge in a first time. The problem with the Internet of Things is that, on the one hand, as the Dr Ulf Lindquist, program director of SRI international[2] said, the IT security techniques will not work anymore for this kind of service, and on the other hand, the IoT is connected to bigger and riskier infrastructure as power grids; nuclear station; traffic grid, … Infiltrating connected devices responsible for the good functioning of these infrastructure would allow the hacker to cause real trouble. So, the issue is very important and must be considered seriously by experts. That's a big deal, there will be more than 50 billion connected devices in 2020, a lot of different information and data will be collected all the time. The development of smart cities, smart traffic system, smart cars, mobile health, smart grids, and so on, makes it essential to safeguard against improper use of these advances. Currently, these installations could be vulnerable to any hackers. That's why 'all serious IoT players will have security as a principal component of anything they offer and will continue to make a bigger and bigger deal about it' (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017. Chapter 5).

Furthermore, in our current world knowledge is power. It's thus important to know and to control who has the data and who is using those? Who has a right of access to this data? How people could have enough trust?

Cynical said that the security challenge of IoT will lead, in part, to the end of the world. All these connected devices across the world, able to collect huge amount of data at every second and managing everything could lead to a world of fear where hackers are able to blackmail, to pirate sensitive installations, to destabilize the economy and the finance market, and so on. If we don't take the good measure and if we don't secure enough the system, we could live in Black Mirror for a time. It will take time and money to ensure it's done right, but that's crucial. IoT security breaches can reach into the physical asset: to compromise nuclear plans; to shut off electric grids; to destabilize the traffic of autonomous cars. A concrete example gives in the book 'The Future of IoT' said:

'Consider a light bulb. James Lyne, head of security research at security software firm Sophos, tells the story of buying an inexpensive programmable light bulb and programming it to turn on and off 200 times per second. The outcome, as you might imagine, is an explosion followed by fire. There was virtually no authentication, and it was fairly easy for anyone with beginner

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[1] Vice President, Business development LogMein/Xively – Xively is an IoT platform, founded in 2007 and owns by Google.
[2] SRI International is an American nonprofit scientific research institute and organization headquartered in Menlo Park, California.

skills to accomplish this. And while this might seem benign, it isn't. James conducted this experiment in his hotel room and set the hotel alarms off with one bulb' (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017. Chapter 5).

Now, do you understand the danger?

If we take the industrial sector, which is the fastest mover and arguably the greatest beneficiary of IoT to date, the risks are becoming more and more understood by responsible people and the efforts to safeguard these systems evolve all the time. 'The security will continue to evolve as the market mature' (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017. Chapter 5), and 'the architecture and the means of protecting IoT will increase in sophistication, as will the capabilities of the hackers' (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017. Chapter 5). This last part seems very important to me, because it's important to notify that this world of technology is a constant run for security where the responsible must be faster than the hackers and always be one step ahead to ensure the security of their material.

Privacy

'Privacy is a value to be negotiated with a vendor. People will exchange privacy value. The margin between the brand and the customer is the value they get for the privacy they relinquish' (Finocchiaro, M., 2017).

Privacy is as much a big deal than security. We see a lot of people afraid to adopt 'new technologies' because they know that a lot of their data are collected and they want to keep their private sphere. How many people are afraid of how Facebook use and manipulate data now? The idea of Big Brother watching didn't go over well. It's true that now, just with your smartphone, it's possible to know your energy usage, driving habits, walking habits, eating habits, buying habits, and whatever. Indeed, all this data is stored and probably used by some companies. Is that a big deal? That depends of people, some think that is a very big deal, some realize that it could be a way to make their life easier. Most doesn't understand that our smartphone already knows who we know, where we go, what we like, etc. Actually, the difference with a bigger propagation of IoT is that will become more intimate data and more sensitive ones. It's true that a secure planet doesn't necessarily mean a private one and it could seem hard to cumulate both security and privacy. Nonetheless, 'one of the compelling aspects of the Internet of Things is that the world can become somewhat tailored and much more efficient to you, as an individual, because data can be understood and interpreted in the context of what makes your life better, from energy management to transportation to shopping and more' (Don DeLoach, Emil Berthelsen, and Wael Elrifai, 2017. Chapter 5).

The real problem in all of this thing is always the same: the possibility that someone with bad intentions may end up possessing these sensitive and/or personal data. That's why the security is enhancing all the time and new processes are emerging every day. In the future, and already now actually, the authentication of IoT devices will be different, in many ways,

than the authentication of laptops and smartphones. There will be a bigger proportion of biometric authentication, most of the time with a two phases process.

Moreover, main problem today is the data breach but tomorrow, according to an RSA Conference of Jason Hong, there is a huge potential for many nasty scenarios:

- Malware that locks people out of their houses
- Malware that turns off thermostats in winter
- Autonomous drones or vehicles deliberately crashing into thing
- Implanted medical devices giving or receiving fake data

All these scenarios could lead to a disaster and that's now that we have to prevent it. During the same conference, Jason Hong gave some clues for how to address privacy issues.

There are four main points: Better technical approach (operating systems, networking, programming languages); Better UX design (better disclosures, awareness of devices, controls, decision-making); Better developer support (Tools, education, best practices for privacy and security); and better laws, policies and standards (mandatory cybersecurity insurance for manufacturers, tools to help policy makers, journalists, …).

The important point to notify is that we will not able to have second chance on IoT and that's now that we must create a safer and efficient system.

Interoperability

The Institute of Electrical and Electronics Engineers (IEEE), defines interoperability as 'the ability of two or more systems or components to exchange data and use information'.

That's obviously a real IoT matter given that the system is composed of many different connected objects. All the systems must do some links between all this heterogenous environment, and with the Internet. The things are built by some different constructors, sold by some different vendors, with different agreements and probably different technology. The challenge here is to create an ecosystem where everything can be easily linked. The non-interoperability could be a disaster for this system because that will mean a lot of missed data and information, and so a non-efficiency of all the systems. One of the critical issues in IoT is that the different proprietary IoT platforms and systems are still not interoperable. IoT devices and components from different vendors often don't integrate well or easily.

However, there is a need to build some standards to make the system efficient. 'The interoperability challenge is well known. A simple web search will bring up many articles published over the last couple of years on the topic. Numerous industry standard organizations have also taken up the challenge to develop interoperability standards. Traditional standards bodies like ANSI, IEC and ISO have sought to evolve existing manufacturing interoperability standards to support new technology trends. The International Society of Automation has taken on the Industrial IoT scenarios in

earnest and The Open Group has sought to address IoT and Microservice interoperability as a part of their Open Platform 3.0 initiative' (Curren-Hays, M., 2019).

To launch the industry 4.0 efficiently, these standards will be essential.

This challenge is only quickly exposed because it will be very technical to go into the details. Nevertheless, it represents one of the biggest efforts in the IoT development.

In conclusion, we can perceive that there still are a lot of challenges (those and others) and it will be hard to manage this. Anyway, experts and different people and companies are on it and we can hope that soon the system will be efficient enough to truly show its potential.

6. Cases Analysis (Cfr Appendix I; II and III)

6.1.   Case 1: AXA – DriveXperience[1]

6.1.1. Service Presentation

AXA DriveXperience is a service which works with one smartphone application (AXA Drive 2) and discreet case to install in your car (AXA Drive Key). It evaluates how you drive with 4 criteria: acceleration, braking action, bends and how fast you drive. After every journey, you get a score and you can see your drive strength and your drive weaknesses. Every time that your global score is recorded, you get a reduction of your insurance premium from 20 to 50%.

Figure 9: AXA DriveXperience

AXA driveXperience en 5 étapes:

Upload the app AXA Drive 2 on your smartphone, record your contract number and plug the AXA Drive key in your vehicle.

Ride as you usually do. The AXA Drive Key records your drive data and give you a score after each journey.

Your application gives you the possibility to consult your scores and to analyse your ride style at every moment.

Your different individual scores create a global score, represented by an amount of stars

After 4 months of observation, your global score is once in a while stopped, and if it's enough, AXA repays a part of your insurance premium. Then, your global score is stopped every year, 3 months before your due date. This score will influence the insurance premium amount.

Source: AXA Belgium website, 2019. *AXA DriveXperience en quatre questions. Retrieved May 5, 2019. Translate from french.* https://www.axa.be/ab/FR/particuliers/Assurances/auto/Pages/AXA-driveXperience-en-quatre-questions.aspx#section1

This offer is for young (between 18 and 24 years old) Belgian drivers, who get a good enough smartphone, and a car which responds to some criteria (as most of Belgian cars).

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[1] AXA – DriveXperience website - https://www.axa.be/ab/FR/particuliers/Assurances/auto/Pages/AXA-driveXperience-en-quatre-questions.aspx#section1

6.1.2. Why the company put it in place?

There are some different trends. The first reason is that AXA is always looking for more innovative solutions. With these innovations they want to enhance the customer experience more and more. The insurance market is a very competitive one, all companies sell almost the same services but as in every market, if you want to be the leader you must be different. That's why AXA invests in new ways to provide insurance services. Globally, the client wants to be covered in the event of a problem, for an acceptable price. That's also why insurance companies as AXA tries new things, to be able to offer a trustful, efficient and cheaper service.

The second reason is that, here, we talk about insurance for young drivers. You are not without knowing that the insurance premium for young drivers are huge. Statistically, a young driver is more likely to make a claim. Actually, one in five of them will have an accident in the first year of obtaining the drive licence. That is a very important element and the insurance company, to recover its expenses, must charge the four others for this claim. So, the insurance premium is higher. This service is a solution to go against this logic. The idea is to say: 'Listen, if you can prove to me that you are a good and cautious driver, you will get a reduction of your insurance premium.'

The third and last reason is a simple observation. Belgian insurers, as AXA, watch what is done in other countries. This way, they can see what works and what doesn't. Then, they see what they can put in place in their own market. At this point, they saw that telematics for young drivers was a new trend that worked well in some other countries. Obviously, they don't take a process that they copy/paste in their country. They make their own research&development, they innovate, and if it's a failure they learn about it.

6.1.3. What Were the Different Implementation Challenges?

GDPR

GDPR is one of the big new challenges. In addition to all the information collected in the insurance contract, the company will take a lot of sensitive data. With the device, the insurance company can know where the client is, where he lives, where he works, when he goes on vacation and where. So, it's important to establish a contract that said which data the company will take and use. There is an important work in a legal perspective but also in communication with the client. The communication aims to explain to the client which the collected data will be and who will manage those. Most of the time, it's a subcontractor. The client must be aware of that. It's this partner who will transform this data to give them meaning. The customer needs to be comforted, and to allow this, the balance between collected data and customer profit must be explained. Moreover, the client must have the right to stop it at every moment and to say: 'I'm leaving, I want all my data back and you delete all information you have about me.' Thus, it's important to create beforehand these lines in the contract.

Technology

The work of an insurance company is to create contracts and to manage claims. They don't have any technological expertise. So, to propose a service using IoT, they must contract with other technology experts' partners. During their discussions with potential partners, they defined how the data is collected, with which device, how plug it in into the car, is the branding possible, will it work in every kind of car, etc.

For instance, if the company decides to use only a smartphone, they cannot do anything they want. Imagine if the client takes the bus. How does the smartphone know that the client is not driving at this moment? If he is a passenger next to another driver, how does the smartphone know it? Now, if the company decide to put another device in the client's car. Which device will be the most suitable? How does the device communicate with the central hub? How much does it cost to the company? Moreover, it's important to know that a device able to transmit data directly by satellite could be expensive. Is the company ready to spend so much? Will it be profitable? They must find a way to satisfy the customer and to be profitable at the end.

Finally, AXA and its partner decided to provide a mix between embedded technology and smartphone application. The company offers a dongle (embedded technology) to the client and this dongle is plugged into the car and when the client takes his car with his smartphone, the dongle connects to the smartphone and this way the company knows the customer is driving and not another person. The data is sent with the customer's phone and so the company doesn't pay for this data. Nonetheless, another challenge arises here, because from one car to another, the dongle cannot be plugged in the same place. So, the company must think about how to communicate it to clients. This one must directly know where to put it. There is an importance of congruence, but also a need for a big work to know how to communicate.

Data Capabilities

As previously said, a work on the data capabilities should be done. The big challenge here is to find the right partners. Most of the time in this kind of service, two partners must be found: one for the hardware, so the physical part of the device, and one for the software, so the computer program and the data analysis.

To choose the good device, the company must establish a plan of criteria to be able to request to potential partners if they can furnish what the company wants. They also have some test to do, to be sure that the device is a good one, to avoid computer glitch, etc. The choice of this device is really important because that will define the success or the failure of all the project. If the technology doesn't work, nothing does. Another important part in outsourcing is to create a hard contract to avoid problems in the future, be sure that the partners is robust and will be not in bankruptcy in a year. That must be a long-term relation, during which the device must stay pretty much the same. If at a moment, the partner decides not to produce

the device anymore, there is a big problem. If at a moment, the partner decides to change the product but that this one is no longer appropriate for the company, there is a problem. Thus, everything must be thought before, and every possibility must be evaluated to avoid troubles.

For the software, it's quite similar, but as there is a true data analysis part, companies as AXA often prefer to manage it themselves. That's why big companies often have a data analysis department (here for AXA it's in France, formerly known as the *data innovation lab*, currently called *AXA Rev*) to provide them a data analysis solution. That allows them to manage themselves this data and often that's also preferred by the client.

Communication

As previously said, it's important to communicate well to the broker and to the customer, but there is also a third important one: the AXA employees. That's this last one who will be responsible for managing the day-to-day contracts and so it's important that he has a good understanding of the service. All this communication is part of the change management.

First, they identified the brokers' fears and needs, to be able to communicate something easy to understand and which seems to be a good opportunity. For this part, it's important to imagine how to create the communication email, the presentation videos, etc.[1]

It's also imperative to explain to the broker how the technology is working and how to properly use the product. The thing is that if it's too complicated, the broker will not sell it and the client will not want it, it will be a failure. For the employees, it's vital to explain how it works internally. So, for instance, how the pricing works and how it will change the insurance premium. They must understand what has been created.

Pricing

The value proposition of this service is: 'you take this technology which analyses your drive style and we give you a reduction on your insurance premium', but how establish the rules of this reduction?

Actually there are two main possibilities: either you create 3 categories, for instance you have 100 clients, the thirty-three worst will have a 5% reduction, the thirty-three in the middle will have a 10% reduction and the best will have a 15% reduction; or you defined the reduction upfront, so you decide that between a score and another the client has a certain reduction and so on. This last possibility is maybe the hardest to put in place if you don't have any data. Fortunately for them, AXA already had some data. Actually, they created previously a free application, the AXA drive, which gave to everyone uploading it a driving score. Thanks to this data, it was easy for AXA to know which scores used to their reduction levels.

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[1]https://www.youtube.com/watch?v=XxvSt8_Y2FA

6.1.4. Results

The results must be analysed in three main parts: the customer experience (is the client happy with this service?); the brand visibility (does this service gives more visibility to AXA?) and obviously the project profitability.

The customer Experience: Broadly speaking, the service is really appreciated by customers. That allows him/her to prove he/she is a good driver and thanks to this, to see his/her insurance premium reduced. Furthermore, the application is kind of entertaining. After each journey, the client has a score, a global one but also one relative to each specific event. After, the drive receives some advice to enhance his/her drive style. It's not only about paid the insurance premium, it's also created a relation with the client, a modern goal of insurers.

The brand visibility: When the service came out, AXA was in the front page of Het Nieuwsblad. It's been a great point for the communication of the project, on the one hand, and for the brand visibility, on the other hand.

The project profitability: An important thing is, obviously, that the company must earn money with this service. They noted that the customer interested in this kind of product he is not a 'cowboy', that's not the guy who will do some race with his friends and who cannot drive carefully. That kind of profile will stay as far away as possible from a product like this. The first assumption they wanted to test was: 'to what extent the clients attracted by this kind of product are better drivers?' They are ready to play the game, ready to have a little spy in their car and to give their data to obtain a reduction of their insurance premium. This assumption was right. That's what they call an 'anti-selection positive', the service attracts clients who are naturally good clients. The second assumption was: 'Does the client who takes this product enhance his drive style? And so, became a better driver?' The true point here is 'does the client is less likely to make a claim?' Thus, this kind of client is not a good driver, but he is more careful because he has this little spy in his car. To analyse this, insurer measure the Incurred Claims Ratio, it is the ratio of all paid claims versus all paid premiums of an issued insurance policy for a particular account. It is sometimes called Combined Ratio that is the total amount of paid claims/total amount of premium. Very important for calculating the renewal premium as higher incurred claims will affect the rate to be used by underwriters in renewing the terms and conditions of the policy which is normally increase in premium. If there is low Incurred Claims ratio then premium can be pegged at a lower rate (Villas, A., 2014). For instance, an incurred claims ratio of 60% means that, considering an insurance premium of 100, 60 will have to be paid to the clients for accidents. Therefore, they saw that people who choose this product had a much lower sinistrality than other clients. That's a success for these clients who have a better and more entertaining experience with their insurance. That's also a good thing for AXA, because as clients who choose this kind of product have less sinistrality, they are less costly for the company and since claims is the biggest cost for insurers, that's really interesting from a profitability perspective.

Actually, on these three main points, this service is a success for AXA. Nevertheless, everything apparently is not perfect. Creators are not satisfied with the number of contracts sold. They expected something like 50% of all contracts underwritten by young drivers, so one in two. In fact, the real number is 10%, which is pretty disappointing. The main cause they identified is the problem of brokerage. As you probably know, insurance companies don't sell their products by themselves, it's the broker role. A broker is an independent, on average around fifty years old, who works with some different insurance companies, who is expert in his business and who sell a product he trusts. The broker will not have the reflex to sell the new, innovative, telematic product. He will sell something he's already tested, something secure for him and his client. The problem here is that the broker often doesn't know how telematics work and he is not particularly interested to know it. On the one hand, he is afraid of technical problems and embedded technology, and, on the other hand, he is afraid of not being able to help his clients in case of problems. So, he doesn't take any risk and he doesn't sell the new product. He sells what he knows. Indeed, the client looks excited about this product but if the broker isn't, that cannot work.

Consequently, we see that the broker could be a real constraint in the implementation of an innovative service. Furthermore, communication with a broker is always tricky. They receive email from every partner, and account manager of each company (the account managers are the representative of companies who meet brokers to explain how the service works). A product as DriveXperience is a water drop in the insurance ocean. A big challenge for insurance companies is so that brokers pay attention to their product and find it interesting. That's how they will sell it. Moreover, when you create a product like this one, you must make a compromise between what the company wants and what the client desires. Actually, it's important to understand that a client will not do something for the company, he will do something for himself. Also, if the product is not easy to understand and to use, no one will want it. It's crucial to create something that the client doesn't even see, something so easy and instinctive to use that the client forget it. Finally, every possibility, every potential malfunctioning must be evaluated and plan B, C, D, etc., must be made to ensure a perfect utilization of the product in every circumstance.

## 6.2.	Case 2: Allianz – Connected Home Insurance

6.2.1. Service presentation

In addition to the basic home insurance, Allianz proposes 3 things:

- Smoke detectors: if the client installs a smoke detector connected with a central unit, he receives some price cut for his home insurance and prevent the risk of fire.
- Alarm system: If the client installs an alarm system, Verisure or another certified installer for prevention purpose, he receives a discount of 30% on the theft coverage.
- Approved repairers: If the client chooses the Allianz repairers network, the company takes care of finding a handyman in case of damage and the customer does not have to sum up a single cent.

Here, we will have our focus on the Alarm system and on the partnership with Verisure. Actually, the co-operation between Allianz and Verisure is not limited to a reduction in the insurance premium. In addition, you also have an integrated service which allows a better performance thanks to the synergy between both service providers.

The basic example is rather simple: imagine that you are in holiday, Verisure call you because there is a problem in your house. They are in front of your house, the door is broken, thieves came into your house, and broke furniture. Usually, you must manage everything from where you are, and your holidays are ruined. But here, the co-operation proposes a full service where Verisure notifies the insurer and everything is settled at no extra cost. Now, this teamwork makes the difference and Verisure or the insurer can call the client and say: 'Everything is settled, don't worry, have nice holidays'.

6.2.2. Why the company put it in place?

The corporation chooses to launch this service because the market of SmartHome is a market in permanent evolution. The growth is important, and it seemed relevant for Allianz to take advantage of this market and to be the first proposing something with Smarthome. Typically, the services of Verisure was not aggregated by the Belgian insurance federation but the federation's criteria are not mandatory for insurers. An insurance company can decide if it wants to negotiate a partnership with another, even if that partner doesn't have the insurer federation agreement.

Two years ago, Verisure was the leader with 60,000 clients and a progression of 10% per year (which was huge). There was a real interest for these kinds of solutions, but customers hesitate to invest in it because it wasn't recognized by insurers, and so they couldn't have reduction in their insurance premium with these installations.

Consequently, it was a real opportunity for Allianz to create a partnership with Verisure. Verisure obtained the agreement of an insurer and therefore more customer confidence. Allianz won some clients with high incomes (Verisure proposes an expensive high-tech

solution, so the population who invest in it is relatively wealthy, and that's obviously an interesting segment for insurers).

6.2.3. What do the Challenges Were?

Partnership

The problem in this special case wasn't to choose the partner because they create the service according to a partner already chosen. Nevertheless, an important challenge was to choose which kind of partnership would be the more efficient and relevant.

There are many different possibilities of collaboration in this case. The first imaginable is a recognition of each other. So, a collaboration exists between both companies but is limited. For instance, the insurer proposes some discount for Verisure's clients. Here, the issue is that the insurer cannot give exclusivity to Verisure. In this special case the 'joint selling', so 'an offer to link the acquirement of goods or services, free or not, to the acquisition of other goods or services' (SPF Economie, 2019) is forbidden because it would constitute an unfair commercial practice.

However, a possible solution is to establish a list of criteria in accordance to Verisure. This way, a kind of 'bypass' is made and there is not the joint selling issue anymore. More accurately, the insurer creates some criteria. Those include companies as Verisure and can also include the other but only if they are very similar to Verisure. That allows to the insurer to almost only include Verisure in the deal.

Another possibility of collaboration is the integration of services. Here, there is an authentic concordance between both companies, and an exchange of data. The challenge here is so to communicate efficiently with the client because for the good of the service there is a real need of co-operation between Verisure and Allianz. Consequently, the client must accept to share his data with both companies and that the information held by one is shared with the other. For instance, Verisure would have to know which client has which insurer.

The last possibility here is a 'lead exchange'. So, the insurer advises the client to go to Verisure and vice versa. In this possibility, the problem is mainly for Verisure, because if they advertise for only one insurer, the others will not be happy and so Verisure could lose the partnerships with the other, and so lose customers and a lot of income.

Brand Association

It is never easy for a strong brand that can be trusted, to be associated with another brand. A big challenge when you must do partnership is to find the good one. Imagine that the other company has a bad reputation and does things that are not in line with your company's policy, there is a real problem. Once again, it is hard to find the right partner and be sure that everything will be alright because sometimes even if you make investigation about it, there

may be problems that arise because of a new manager or an isolated act and here your company's reputation may be damaged.

In case of a big issue in this context, a solution could also be a good communication and a quick separation with the disruptive element but anyway there could be some damage in the company's image. Furthermore, it's very hard to prevent this kind of problem, even if you are very careful, that can happen.

Technology Management

As already explain in the previous example, technology management is not obvious at all. The insurer must choose if the management is internal or external and in the second phase have a lot of confidence in its partner. In the case of Allianz and Verisure, it's clear that the technology management was external, and Allianz doesn't have to worry about (at all). Nonetheless, the interviewee spoke about an interesting point that I will explain in the next chapter to introduce an example of failure in IoT service in insurance. That will show that even if you know how to do, you are never safe from unwanted surprise.

6.2.4. Results

For Allianz, the true purpose was to innovate and to propose services with connected technology. It was a success and they succeeded in offering an insurance that not only used IoT technology, but also gave them an innovative and forward-looking image. In addition to the image, the service was a real hit, which also gave them a significant increase in turnover and significant business growth in the home insurance sector. Unfortunately, the company being not alone on the market, nor all-powerful, was soon caught up by the competition. Companies, such as AXA for example, that are larger and better prepared to provide this type of service quickly. This did not preclude Allianz from acquiring new customers and showing their presence on the market.

6.3. Conclusion

In conclusion, we saw in this part that there were a lot of different possibilities. The technology is not in every house yet, but it is ready, and many different devices are created to be the things of tomorrow. Whether it is for the home, the car or health, the range of possibilities is enormous and soon ready to be exploited. It is therefore now that we must think and analyse the opportunities opened up by this new connected world. The opportunities for insurers are plentiful, they probably go beyond the ones presented in this thesis, but the same is true for the risks involved. Many challenges are still present, and it will not be easy to tackle them. Nevertheless, we see that things are already being developed. For me, a service such as DriveXperience is a perfect example of designing a service that promotes risk prevention and customer protection by using IoT through embedded technology. Even if currently, some strategies probably fail internally (unfortunately it has been difficult for me to find examples because insurers do not generally brag about them) we can see that others are a real success because they are well thought out and well designed.

Part 3 – Summary of Advices and Application

In the previous parts, we analyse the facts about the IoT environment in Belgium and more commonly in all the world. In this final part, we will analyse as a first step, what insurers need to do to be efficient in this particular Belgian market. Then, according to these advices, we will create a prevention service for the Health Insurance sector (currently the less developed part in connected insurance given that most of it is ensured by the mutual and the Belgian state). Lastly, we will demonstrate how this kind of service would help insurers (and also Belgium's state in general) to provide more risk prevention and clients protections, and we will evaluate the costs and profits of this service for insurance company in a certain scale.

7. What Insurers Need to Do

According to McKinsey (2019), to succeed in an ecosystem using IoT, insurers must tackle 5 key tasks: Define application areas; Lock in adequate partnerships early; Ensure scaleability; maximize rollout speed and ensure a long-term perspectives.

7.1. Define application areas

The insurer must understand that it must adapt to the customers' needs and define concrete applications that meet these needs. To do this, more specific customer segments must be created. This makes it easier to target a given audience and create relatively standardized services that can then, through data analytics, be more personalized to suit the person even better. In addition to the customer segments, it is necessary to know how to create a service that will be 100% suitable for the customer and above all that will be used properly by these customers. The service must be able to be integrated into things that the customer does every day. The latter must not end up with extra actions to do or extra objects to carry. Nevertheless, in order to achieve its objective of being close to the client, the insurer must be present in a weekly or even daily task of the client without this one having to think of anything more. A good counter example could be a connected bracelet. A bracelet connected alone has no real interest for a clientele often already wearing a watch and sometimes a decorative wristlet. The connected bracelet would be one more thing to wear and the customer would not be ready to get this service. On the other hand, a connected watch or a connected badge added to a ' smart ' watch could be a more relevant alternative solution because it does not change the consumer's lifestyle.

Therefore, a behavioural analysis must be performed in order to understand how to effectively reach the consumer. From one segment to another it will differ slightly and the way they are addressed will be different. For example, it is not really very interesting to offer sophisticated connected home insurance services in a market where most homes are rented by residents and not purchased. This reduces the chances of finding homes with significant home automation installations and therefore the segment of people potentially targeted by this insurance product.

The point to remember here is to know, on the one hand, its customers and their lifestyle, and, on the other hand, the market in which the insurer operates, as well as to know what is interesting for this clientele and not to start creating a service headlong because it works well abroad when the national situation is completely different and as a result the service will not be appreciated or coveted by the population.

Let's have a look on the Belgian market to understand what could be and what couldn't.

Figure 10: Repartition of population

Répartition de la population en fonction des modalités de jouissance du logement, 2016
(en % de la population)

Légende :
- Locataire, loyer à prix réduit ou gratuit
- Locataire, loyer au prix du marché
- Propriétaire, hypothèque ou prêt en cours
- Propriétaire, ni hypothèque, ni prêt en cours

(¹) Données provisoires.
(²) 2015.
Source: Eurostat (code des données en ligne: ilc_lvho02)
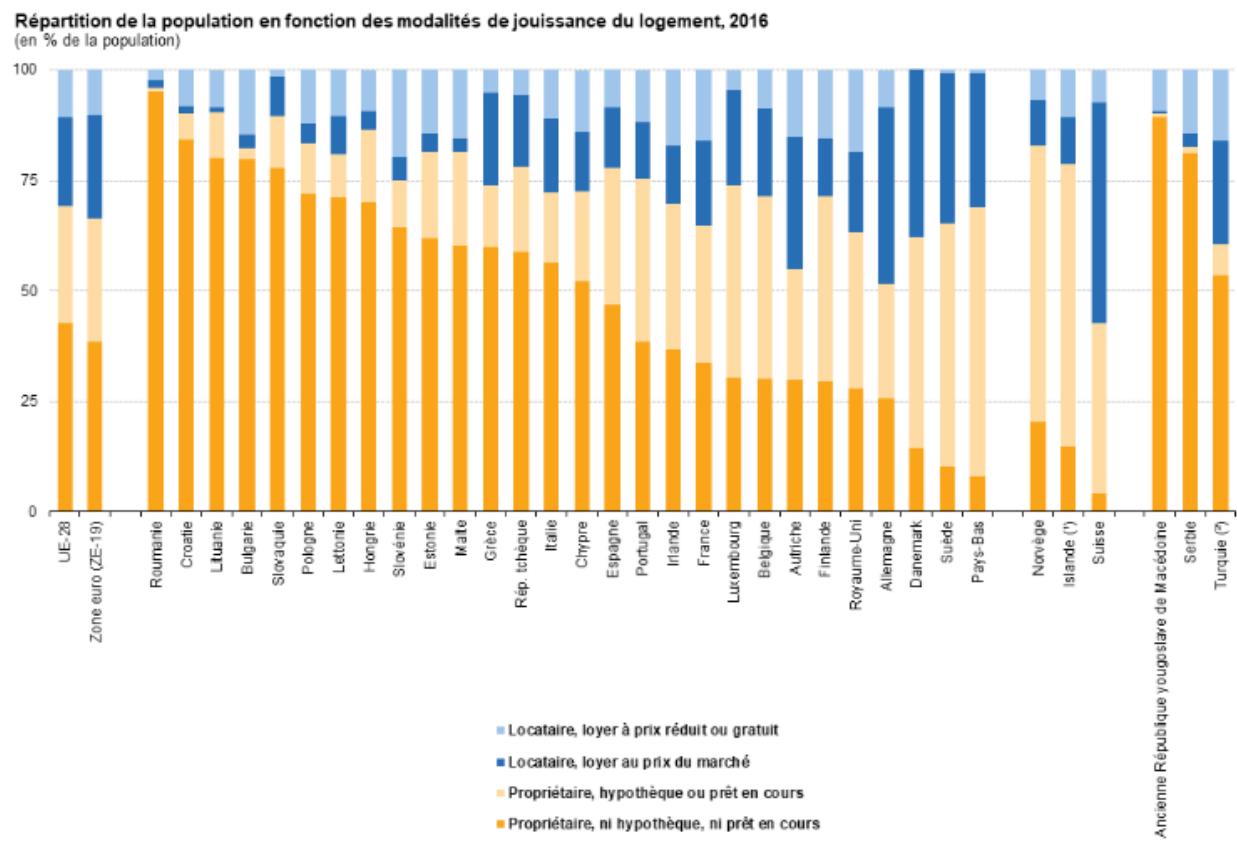
eurostat

Source: Eurostat, Statistic Explained (2016). *Répartition de la population en fonction des modalités de jouissance du logement, 2016.* Retrieved July 24 from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Répartition_de_la_population_en_fonction_des_modalités_de_jouissance_du_logement_2016_(en_%25_de_la_population)_YB18.png

To refer to what was said before, through this graph, one can see that it is much more interesting to invest in the creation of a connected home insurance service in Belgium where nearly 75% of the inhabitants own their home, rather than, for example, in Germany where nearly 50% remain as renters.

Otherwise, an article in LaMeuse (2018) said that one Belgian house in five had an alarm. To evaluate the market for connected alarms, the insurer knows that this is already only twenty percent of the population, in these 20 percent, only a certain percentage has an alarm connected to the Internet, and in this segment only one part will choose a certain Belgian insurer rather than another. The potential percentage is therefore gradually being reduced and ultimately the insurer must assess whether or not it is really worth investing in a service for this segment, in this market.

7.2. Lock in Adequate Strategic Partnerships Early

In this environment, choosing the right partner is crucial for the insurer. Indeed, as we have seen previously in the case analyses, it is important to find the partners who will allow the insurance company to grow in trust and serenity. The partner must be a reliable company capable of promoting technological prowess that meets the needs of customers and the wishes of the insurer. It is also necessary to start this relationship early enough to grow and develop together. This will facilitate a climate of trust towards the parties.

'Selection of candidates for successful and stable partnerships should involve certain key factors. First, partners must have sufficient experience, as well as relevant knowledge of and exposure to the target customer base. For example, IoT device providers must demonstrate mature tech operations and cybersecurity capabilities, and property-tech companies should bring an existing customer base. Second, partnerships should include an adequate commercial agreement from the start that will appropriately incentivize all parties to scale up the joint offering as needed. Flat rates, commission models, or volume-based incentives could all work if shaped with an appropriate risk appetite. Third, partners must be open to technical and business interoperability, to allow for other partners to step in and expand the ecosystem collaboration, as well as submit to an appropriate risk evaluation of their offerings, for example, on adequate geographical coverage or capture of relevant data needed for actual claims processing. Finally, insurers should carefully screen partnership candidates regarding their other business planned or already conducted to avoid the risk of reputation damage, sunk costs, or even accidental abuse of customer data.' (Behm, S., Deetjen, U., Kaniyar, S., Methner, N. and Münstermann, B., 2019)

To ensure this last point, the insurer must first put in place a series of measures. For example, it might be necessary to include a clause in the contract allowing for prompt action by the insurance undertaking in the event of reputational damage due to bad action by the partner.

Another point that is not mentioned by McKinsey in its study, but which nevertheless requires our full attention is the risk of internal change within the partner company. For example, overnight they choose to stop the production of a certain connected object used by the insurer in one of its services. Or they decide to modify this object and it no longer meets the insurer's requirements. This can be extremely damaging and a clause providing for this case

must also be included in the contract. For example, the partner undertakes to produce a certain object over a given period of time. Another risk is also that this partner may fail during the collaboration. The insurer must therefore not only protect itself through a contract but also already have plans B, C and D in place to be able to react in the event of a problem.

7.3.   Ensure Scaleability

Finding the right partner is one thing, but the insurer must also ensure that it provides an efficient service for its clients and, to do so, it must also be able to adapt to its partners and ensure the scaleability of its offer by providing its services to the partners' products. In the IoT era, insurance companies will be able to offer a complete service to their customers. As we have seen, for example, with Allianz, which offered an insurance offer where the customer did not have to worry about anything in the event of damage to his home, and where the insurer took care of everything by coordinating the various partners.

The insurer must therefore also be able to present itself as a first-class partner. For example, by developing in-house programs to ensure consumer safety and privacy. Or software that can be installed efficiently in any connected object and offers real added value to customers. For example, it is important for the insurer operating in the IoT ecosystem to demonstrate to customers their benefits. Whether they are financial, through a reduction in the insurance premium, or practical, through collaborations allowing faster and more effective actions in the event of disasters. In addition, in order to ensure the success of the IoT, 'It's important for insurers to go to market with a first offer swiftly to test customer acceptance. As a second step, they can scale the offer' (Behm, S., Deetjen, U., Kaniyar, S., Methner, N. and Münstermann, B., 2019).

And indeed, we can see that this is being done correctly on the Belgian market. Just look at how AXA set up DriveXperience. First, they launched a free application that allowed drivers using it to assess the quality of their driving in a fun and entertaining way. In this way, AXA was able not only to assess customer acceptance of this 'little spy' in their car, but also to collect important data for developing their pricing policy when DriveXperience was launched. In concrete terms, this helped them to set up the different grades and to know what reduction to give for which driving score.

7.4.   Maximize Rollout Speed

According to Mike Toran, CIO of Starr Companies[1], speed-to-market is a fundamental metric for determining how agile your organization truly is. Recognizing an opportunity to diversify your portfolio is only the first step, capitalizing on it is another.

In the current context, it's necessary to act quick and to act well.

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[1] **Starr Companies** is a global insurance and financial services organization providing innovative risk management solutions

'The IoT could soon reach a point where market penetration also increases exponentially for insurance products. Insurers that are not able to act fast will run the risk of losing out completely' (Behm, S., Deetjen, U., Kaniyar, S., Methner, N. and Münstermann, B., 2019). That's why insurers must make their organization agile which refers to 'the ability of organizations to detect and respond to opportunities and threats fast and easily. Agile organizations anticipate environmental shifts and act on them as they emerge' (Y.L Doz and M. Kosonen, 2010). So, the organization must also be ready to be modified quickly and efficiently. For this, the change management process must be implemented and integrated into the company.

According to John Paul Kotter, change management is the process, tools and techniques to manage the people side of change to achieve the required business outcome. Change management incorporates the organizational tools that can be utilized to help individuals make successful personal transitions resulting in the adoption and realization of change.

However, methods as Kotter's Eight steps for change must be integrated in the company's culture and in the employee's mind to ensure good performance when new services are emerging.

Figure 11: Kotter's 8 steps
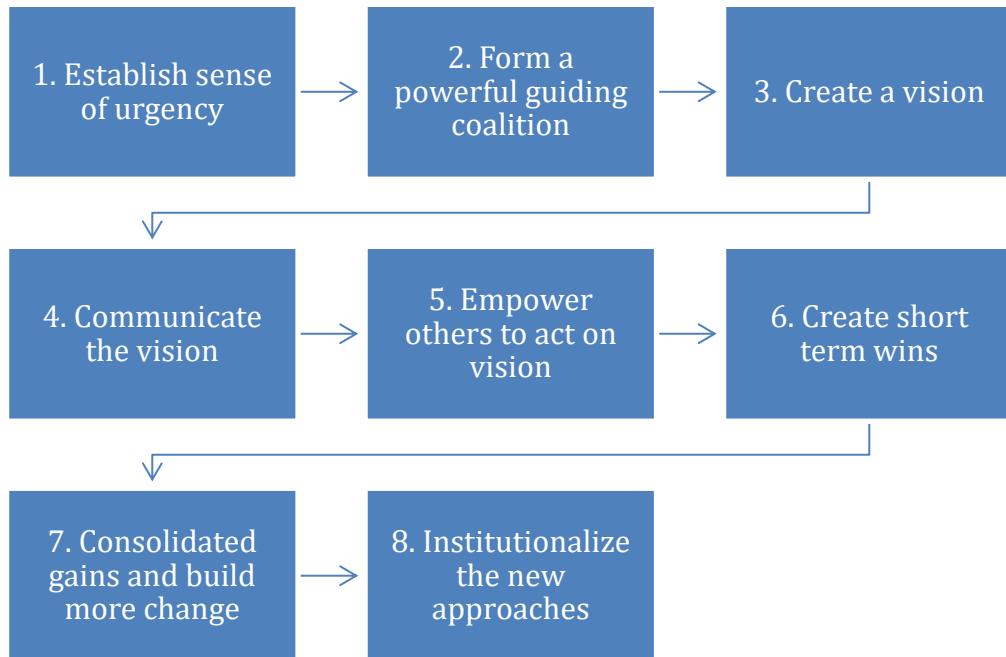
Sources: J. Kottler, 'Leading change: why transformation efforts fail', *Harvard Business Review*, March-April 1996, P. 61.

Even today, this well-known theory of project management is still used in companies (Mindtools, 2018). Nevertheless, it is essential to step back and establish your own processes. The one that will be most suitable for your company.

Thus, it is important to have the appropriate company's culture and employee's formation to be able to change in the way and as fast as we want. Companies which will be able to act this way will be the big winner of tomorrow and will be able to propose the best services on the market, faster than everyone else and so, as the first mover, will take the most part of the market.

7.5.   Ensure a Long-term Perspective

'Insurers should see the development of IoT services for ecosystems as a long-term investment in future capabilities. It is still not exactly clear what a positive business case for IoT offerings looks like. Reductions in premiums due to use of telematics may be significant in some markets, while there is not yet any reliable evidence of the benefits of better claims ratios. In the years to come, as maturity grows and the cost of the services continues to fall, the value for customers as well as insurers will decline considerably. Insurers should begin building their long-term capabilities now to expand their market position and develop innovative, competitive services for their customers in the years ahead' (Behm, S., Deetjen, U., Kaniyar, S., Methner, N. and Münstermann, B., 2019).

Figure 12: Average costs of industrial Internet of Things (IoT) sensors from 2004 to 2020 (in U.S. dollars)

The figure above shows that gradually the average cost of a device using IoT is gradually decreasing. In addition to this, other miscellaneous information may be added.

According to Ericsson, the number of cellular IoT connections is expected to reach 3.5 billion in 2023. The ongoing large-scale deployment in China is the main factor behind the almost doubling of the forecast for the Internet of things mobile market. Of the 3.5 billion cellular IoT connections, expected to be present in 2023, 2.2 billion are anticipated to be active in North-East Asia.

According to McKinsey Global Institute, by 2022, 100% of the global population is expected to have LPWAN coverage. Low-power, wide-area networks allow long-range communications among a large number of connected devices at optimized costs and power consumption rates. In 2017, only 20% of the world population was covered by this type of network. Many other advances are helping reduce costs and power requirements to help faster IoT adoption. Another example is the cost of lidar sensors, essential for autonomous driving, which have become 10 times cheaper in the last decade and are expected to get several times cheaper still in the next few years.

Still according to McKinsey Global Institute, 127 new IoT devices connect to the Internet every second. Consumers are more connected than ever, owning an average of four IoT devices that communicate with the cloud. While this presents a valid case for optimism, the consensus seems to be that the adoption rate of IoT is still very slow. Thankfully, there are a number of technological advances taking place that should speed up IoT adoption.

According to PWC, business investment will account for more than 50% of the overall IoT spend in 2020. Business investment will grow from $215 billion in 2015 to $832 billion in 2020, while consumer-driven spending will grow from $72 billion in 2015 to $236 billion in 2020. This represents a slightly higher growth in business spending as compared to consumer spending on IoT in the 5-year period. Government-spending will add an extra $500 billion or so to the total spend on IoT in 2020.

And a lot of different numbers could be demonstrated this way.

The most important is that IoT is a long-term investment and insurers must ensure a long-term perspective to their strategy. That's how they will benefit from this technology.

In the next figure, we can have a overview of the average claim in euros for the EU27 and some selected USA States. We can see that in Belgium the average claim in 2008 is around €3200, which today, with the inflation worth around €3900 and the claim frequency is close to 7%. From purely financial perspective, We could say that thanks to IoT and telematics the impact could be around 10% of reduction in total claim costs, 60% or greater reduction in time to settle claims and 20% reduction in time frequency (Octotelematics, 2019).

Consequently, the impact would be really important in Belgium and that's why the strategy build now must be long-term forecasted and should evolve progressively.

Figure 13: Variation in Claim Frequency and Claim Value in the EU27 and the Selected USA States
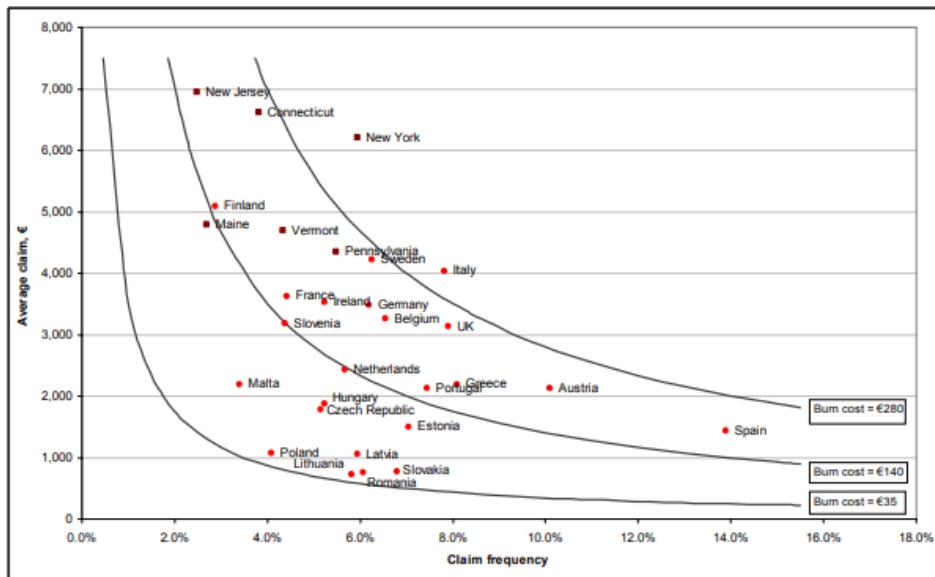
Source: Comité Européen des Assurances (CEA), National Association of Insurance Commissioners (NAIC) (Selected USA States), Association of British Insurers (ABI) (UK), Irish Insurance Federation (IIF) (Ireland), Malta Financial Services Authority (MFSA) (Malta), Magyar Biztosítók Szövetsége (MABISZ) (Hungary), Verbond van Verzekeraars (VVV) (the Netherlands), EE calculations (2008). *Retail Insurance Market Study MARKT/2008/18/H Final Report by Europe Economics*.

7.6.   Others

The five McKinsey's keys are really important but that's not all. During the second part of this thesis, we realized that some other elements were crucial for the success of a good IoT strategy.

For example, during the DriveXperience analysis, we found that the insurer's relationship with its brokers was an extremely important element for the successful digitalization of insurance services. Indeed, brokers are the only ones who actually sell insurance services to individuals. They must therefore be satisfied with the service before it can be effectively sold to customers. To do this, trust must be built, and the insurer must ensure that the product is easy to use and does not intimidate the broker. He must feel that he knows how to manage the product without any problems in the event of claims or technical problems. Today, the broker's challenge remains a major element because he is often a man of about 50 years old, who knows his profession and the insurance services he offers, but also who is suspicious of new technologies and does not feel comfortable with them. This will make it easier for them to direct their clients to the services and insurers with whom they feel most comfortable. He will rarely trust services using new technologies. Therefore, these services are still relatively unsold at the moment. Moreover, the insurer rarely thinks about this challenge. The insurer must consequently set up a real communication campaign exclusively dedicated to brokers. This should include a presentation of the product with explanatory elements to know how to take charge of the service and how to manage any claims, to know what the client's advantages are, but also how the service helps the broker in his work. A lot of information is

needed for the broker, but the insurer must also make sure that his communication is short and concise. Indeed, the broker does not work with a single insurer but with many different partners. He therefore receives a lot of information of this type and that is why the insurer must be sure that the information he gives is accurate and accurate but also short and effective.

8. Create a new service for prevention with IoT and digital tools

8.1.   Introduction

For this chapter, we choose to work on a health insurance product. More specifically, we choose to work on healthcare insurance. In Belgium, there is a compulsory healthcare insurance system organized by the social security system. According to Wikifin (2019), his insurance allows everyone, employees, self-employed, civil servants, unemployed, children, disabled, students, and so on, to benefit from access to medical care. It is financed by contributions from employees, self-employed people and employers as well as by state subsidies. As an employee or civil servant, in order to benefit from this compulsory healthcare insurance system, you must join a mutual insurance company or the Caisse Auxiliaire d'assurance maladie invalidité (CAAMI). This insurance covers all or part of your medical expenses: medicines, consultations with a general practitioner or specialist, dentist, physiotherapist, ophthalmologist, births, hospital care, etc.

This division of insurance services is less used in IoT strategy because probably more complex and less technologically achieved. Nevertheless, some things are existing, and insurers slowly begin to think about how to enhance their health services with the Internet of Things. The cost of digitalization in health is also probably more important than in other branches but the investment could be as interesting for insurers as the others because the prevention and the protection of clients in healthcare seems more logical than in any other activity. A shift from claims payers to prevention partner is coming.

The healthcare system is beginning to change, and that's more and more necessary because according to some predictions, the earth will be composed of more than 2 billion older people by 2050 (Saranya, M., Preethi, R., Rupasri, M. and Dr. Veena, S., 2018), and the United Nations forecast that world population will reach 9.7 billion people by 2050. Which means that one in five people will be an elderly person. These numbers are for all the world, but we already saw previously that will be worst for the European Union. That's a current problem which must be solved now to be manageable in the future. Still according to the study of Saranya, M., Preethi, R., Rupasri, M. and Dr. Veena, S. (A Survey on Health Monitoring System by using IOT, 2018), 89% of these people will live alone and independently, and 80% of those over 65 years old will suffer from chronic diseases as obesity, hypertension, diabetes, heart failure, cancer, and so on. What does it mean? That means around 20% of the world population will need a lot of healthcare and with the current system we should increase the number of hospitals and doctors, but also the efficiency of those.

That's where the IoT comes into play. The technology would allow an efficient enhancement of healthcare and would make the digitalization of this division possible. Nonetheless, currently there is still 62% of people who are not trusting IoT medical devices. Moreover, older age ranges are the most fearful about this, 74% of these over 55-year-old expressing distrust. Indeed, the utilization of the Internet of Things, often considered as a spy in our life, in

healthcare is a particular challenge. The data are mostly sensitive and given that healthcare will necessitate a lot of IoT devices and will generate a tremendous amount of those, the available attack surface will also grow up, and it could be easier for hackers to find a failure in the system. 'A forecast suggests that by 2025, healthcare will be responsible for generating the most data of any other sector' (Matthews, K., 2018). We can see that there are real fears in this innovation, and it is appropriate. Nevertheless, as we cannot stop the population from ageing or eradicate the chronic diseases, the digitalization of healthcare could be a nice solution.

Currently, a lot of resources are used for diagnostics. People must move to the hospital (or their attending physician), they must wait, then they explain the problem as they can, and the doctor realize a diagnostic as he can. Soon, we will quit this hospital centric system to go to a home-centric system. The prevalence of DIY[1] is coming in healthcare. The medical check will be done thanks to digital installations which already exists today and that will make all that process faster but also easier for people who have difficulty to move.

'Technology-driven setup brings down the cost, by cutting down unnecessary visits, utilizing better quality resources, and improving the allocation and planning' (Patel, N., 2019).

Obviously, here we don't speak yet about special case but more about usual consultation. According to a Deloitte study (A journey towards smart health – The impact of digitalization on patient experience, 2018), 60% of patients also indicated that they repeatedly take the same test. For those that's useless to lose all the time necessary to have a physical appointment. The technology will be there to help them and to realize good diagnostics about their health state. The same Deloitte study (2018) said that 'nearly 80% of surveyed doctors believe telemedicine to be a better way to manage chronic diseases'. Undoubtedly, this system will help to keep people out of the hospital when it's not necessary for them to come and will also help people to take their medicine more efficiently which could also be helpful for the elderly people issue. 'IoT enables real-time alerting, tracking and monitoring, which permits hands-on treatments, better accuracy, apt intervention by doctors and improve complete patient care delivery results' (Patel, N., 2019).

Currently, even if the technology is being ready, we are not at this step yet. There are still challenges to solve before. In this chapter, we will create a health insurance prevention service, using IoT to prevent and protect clients. Probably against their own mistakes. For costs, legal or some other reasons, it's possible that this one will not be implantable yet in our country. Nevertheless, one day we will arrive at this category of service, and perhaps much sooner than you can imagine.

It is also interesting to address the fact that some risks are existing using IoT in healthcare. The IoT could help to save lives, in preventing, in protecting, in keeping the patients aware of their treatments, and so on. Unfortunately, the technology cannot be perfect, and some

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[1] Do It Yourself

troubles can be envisaged. For instance, the technology could defect and even cause injury or death to a patient due to mistreatment. Imagine a patient which is a bit confused but fully trust his IoT system to remember him when and which medicines take. If all the system fails and does not transmit the information anymore or transmit wrong information that could be life-threatening for him. Another example is the cyber-risk, the data could be hacked and changed. Or could be stolen for a reason or another.

To minimizing exposure to these risks, the Travelers Company (2019) proposed to:

- Evaluate and implement appropriate quality and risk management systems.

- Build in cyber security.

- Evaluate company contract practices

It is important to have a thoughtful process before to begin to introduce this kind of technology in a sector as sensitive as healthcare.

According to the AXA Trendbook (2018), the development of IoMT[1] will help to avoid the dependency of people because of their loss of autonomy. Furthermore, patient engagement and understanding of their care is often seen as a key component of the healthcare sector. Sensitizing the patient to his or her ability to help himself or herself heal and treat properly could be a viable solution to allow for better rehabilitation and avoid recurrence of injury or certain chronic diseases (not in all cases of course). With digitalization, increasingly integrated digital platforms connect patients, doctors and all care providers and improve data sharing. This improvement of data sharing is not only interesting for individuals who can have a better and more efficient treatment. But also, for all the world, because this share of data could allow a better performance in research and development of solutions in healthcare and could accelerate the process of medicine creation.

For this exercise, it's not possible to encompass every conceivable medical problem and it is also difficult to focus only on issues related to older people. I have therefore decided to tackle a common medical problem, which I have personally already encountered, and which concerns a large part of the population (and therefore also the elderly).

In considering which prevention service to offer, I have identified several important points:

- the service must be able to prevent a risk that affects a large part of the population, so that it can be widely used;
- the service must be appropriate for clients and help them in their daily lives;
- the service must result in cost savings for the insurer, such as hospital costs;
- the service must address a problem of recurrence in care (often people do not follow their treatment properly, resulting in recurrences, which is costly for the insurer);
- the service must be feasible in the near future; and, of course,

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[1] Internet of Medical Things

- the service must use IoT and other technologies already present in everyday life or present soon in order to prevent risks in a connected way and without incurring any additional costs for the consumer (or at least not so much costs).

8.2.   Service Presentation

The objectives of tomorrow's insurers, living in this IoT ecosystem, are to move from being an actor reimbursing claims and therefore protecting the financial interests of customers, to a partner in prevention enabling customers to avoid claims and thus protecting customers. Nevertheless, as Thierry Geerts said in Digitalis: 'We have to find the right balance. People may be willing to share their medical data to advance research and thus contribute to their own healing or that of other patients. But no one wants life insurance companies to be able to consult medical records and increase insurance premiums as soon as a health problem arises.' (Translated from French, Digitalis, Geerts, T., 2018). It is important to avoid overflowing and misuse of this data, which is why IoT services must serve the interests of customers, and certainly also insurers, but without customers having a negative feeling about this. That is why prevention is probably the best solution and the best way to use this data.

For the creation of this service, I decided to focus mainly on sportspersons of all ages and the elderly. Indeed, these two categories are the most concerned with rehabilitation following a physical injury. We already know that the elderly represents and will represent a significant part of the population, but what about sportsmen and women? In fact, Belgium ranks rather well on the European Union's ranking. According to a study by E-Santé (Garteiser, M., 2018), 16% of the population participates in sport at least 5 times a week and 34% participate in sport at least once a week. These statistics are higher than the European average, whether for fun, being with friends or relaxing, the Belgian likes to play or to do sports. Whether it is the Sunday sportsman or the avid sportsman, the risk of injury is very present. All it takes is a false movement, a moment of weakness or too much forcing during training or competition, to end up with a muscle or articular injury that can restrain the person from playing sports for a while. The problem with these injuries, and I speak with full knowledge of the facts, is that often the patient does not want to complete his treatment, when he no longer feels pain he will quickly want to start exercising again. In addition, he will limit himself to very few care exercises outside his physiotherapy sessions because of 'lack of time' or simply because he does not know how to do them properly. This negligence will prevent the muscle or articular from repairing itself properly, causing recurrences.

The same applies to the elderly. Often subject to the same type of age-related injuries, the rehabilitation time and effort required to recover from an injury is even more important and valuable because of cell damages. However, many also neglect this phase and once again the injury reappears after a while. These injuries, which could almost be called 'chronic', are also a real problem for Belgian insurers and Mutuals, which must pay hospitalization and care costs in general.

'Rehabilitation is an important step in healing and requires muscle relaxation and a return to normal articular mobility. Thereafter, stretching and strengthening exercises must be done to ensure better stability of the given area.

Regularly, the rehabilitation stage is the one that is not followed by patients. With the pain gone, the need for further care is less felt. However, it is the most important step since it will allow the body to regain its strength, stability and balance. It is by following the recommendations of this step that relapses will be less frequent.' (Translated from French, Dr Malenfant, J., 2015.)

So how could these actors prevent this type of risk and encourage patients to complete their treatment properly?

The idea is to design a digital platform where the people concerned can find the advice they need, and more. The platform could be very complete by offering a mix of Vividoctor[1] and FMS[2], while improving the process with more advanced and powerful technologies. We know that often when a patient has to do physiotherapy sessions, he or she also has exercises to do at home, which are often poorly done or not done for various reasons. With this platform using a postural recognition system, the patient knows exactly how to position himself and the program corrects him if he does not, via audio advice or written text on his screen. Depending on his performance, the patient receives a certain score and after the exercises he can visualize the history of his results, as well as compare himself to an average performed by all the people using the platform. The score is evaluated according to the respect in frequency and working time, as well as in relation to the improvement of the positions achieved. After each session, he will also receive a set of advice on how to adapt his positions appropriately and how to improve for the next time. The physiotherapist can have a view of the exercises the patient performs and send messages of encouragement or congratulation to the client for his or her work. He or she may also simply find that the work done is not enough and warn the patient about the value of these exercises. The physiotherapist therefore has more control over the care provided to the person and can improve the effectiveness of his or her care.

The application will therefore allow a better empowerment of the patient and a better management of his health through a better awareness of the rehabilitation process. The limit of this idea is the person's attendance. This problem is still present. Therefore, it is necessary to find a 'reward' for this patient, something that would encourage him to do his exercises and that would properly involve the insurer and the other actors in the ecosystem. The insurer has a real preventive role to play, but how can it be applied here? More than a prevention investor, the insurer must become a motivator. This is how risk prevention and customer protection will be achieved. Moreover, this is also how car or home insurance works. So, I see

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[1] Real time virtual doctor visits with evaluation, advice and prescriptions - https://www.vividoctor.com/

[2] Functional Movement System, application of sport exercises' advices - https://www.functionalmovement.com/

something similar here. When you think about it, the most motivating thing for people is simply to have to pay less insurance premiums. We can therefore assume that people who correctly follow a proposed program, whether preventive or rehabilitative, will see the costs of compulsory insurance fall or that their care will be reimbursed more. I think that this is the way in which everyone will benefit the most, both insurers or the state, as well as patients or clients.

Let us now develop this idea into an innovative and usable product for consumers. Let's do this in stages.

8.3. The Diagnostic

First, I thought it would be possible to start the service directly from the diagnostic and combine my first idea with an idea as Vividoctor (explained sooner in the chapter). Secondly, I realize that for this kind of injury, the physician is mandatory to have a contact with your body to test some movement that you cannot do by yourself and prepare his diagnostic this way. Thus, it's actually not possible to imagine that this step would be made virtually through a screen. It's important to notice that the application as Vividoctor can be used only for a pre-diagnostic or for some diagnostic which can be only visual, but not for those who imply certain physical practices used by physicians to identify the person's real problem.

Consequently, let's jump directly to the point. The utilization of a digital platform for the good health of your body. In order to fully use the potential of IoT and more precisely in this case, of postural recognition, it is necessary to broaden the idea somewhat. The platform could actually have several applications. Instead of being used only as a complement to physiotherapy exercises, it could also be applied for exercise preparation movements as well as for improving physical capabilities in a clean and effective way for athletes, it could be used for Yoga and Stretching to improve one's technique or to allow elderly people to do small workout to prevent the risks of injuries related indirectly to the person's ageing. So, four main parts: Rehabilitation; Sportsmen/women matters; Relaxing; and Elderly concerns. But foremost, let's speak a bit about postural recognition to understand the capabilities of the technology.

8.4. Postural Recognition

In order to fully understand the technology, its capabilities, its impact and the real cost of developing such software, I met a PhD student from Unamur who is working on postural recognition. Primary, it is important to assimilate the challenges associated with this technology. This will use gestural recognition techniques, which is already used in surgery, for example, when the doctor cannot touch a sterile device, so he will make certain movements in front of a camera capturing his gestures and interpreting them to drive a robot across the room or simply to adjust the brightness. The problem with this type of technology is the change of environment. Depending on the colour of the decor around the person and the person's clothes, the algorithm will not recognize and differentiate movements either. If the

person has flesh-coloured clothes, it is difficult for the program to differentiate each element. It is the same if the background of the room has an unlimited colour. This is called a limiting factor.

Now let's talk a bit about the cameras. In my initial idea, the application could be used via our smartphone, our smart TV, a tablet, etc. However, currently these devices are still using simple 2D cameras. Nowadays, the technology working with these cameras is still very uncertain and does not work very well. It is not currently ideal to use this because data are missing, and it's hard to provide a clean and efficient service. So, it's actually possible but not efficient. One camera that might work very well is the Kinect developed by Microsoft for its Xbox games. The Kinect exploits 2D+ Depth technology, which provides more data on the person's movements and more efficiency. This camera is actually composed of two cameras next to each other, as well as an infrared camera, and all three allow a 2D+Depth image. Thanks to this camera, developers can for example obtain much more precise images and a 'skeleton' of the person drawn with coloured points at the articulations. Kinect technology seems to be a good solution, the problem is that not everyone has this at home, and it takes around €150 to get a new one.

Let's now look at how to develop this technology correctly. A priori, there would be two possibilities. A first one that is quite expensive and not very effective, and a second one that is potentially interesting using machine learning and therefore requiring collaboration from the Internet of Things.

The first possibility is therefore to create an 'expert system'. What does that mean? This means that the developer will have to ask a bunch of doctors and physiotherapists to observe people performing the necessary movements (the same ones that will be asked during the exercises proposed on the digital platform) and to say when the movement is well done and when the movement is not. This will make it possible to make a list of characteristics that include good posture (and this will therefore have to be done for each posture and several times in order to have a fairly wide range and enough elements evaluate what differentiates good posture from bad). Of course, this represents a lot of costs and time. It takes many doctors and physiotherapists who will have to spend time analysing different people of different styles, different ages, etc., doing a lot of different postures, with each time the need for time to reflect and probably debate what makes a good posture or not. This solution is therefore relatively excluded.

The second possibility is, as I said before, to use a machine learning system. This will be much simpler because this technology works simply in binary decisions. More concretely, a physiotherapist or a doctor will have to look at images of people making positions and say 'Yes' if it is a good posture well done or 'No' if it is not. As the images progress, the algorithm will understand by itself what makes a good posture and will be able to adapt this in its process. Nevertheless, there is still the need to obtain about 50,000 photos per posture analysed. This is a lot, but with big data and the IoT to collect these it is totally possible. This

will allow the algorithm to train correctly and give a good result in the end. Of course, here we are talking in terms of 2D images, but 2D+depth would bring even more precision to the algorithm and would probably require a smaller number of photos per posture. For all this, in any case, it will be necessary to create a huge database of gestures and movements.

8.5.   Visualization and Explanation of Main Concept

Properly, how is the application working? Let's have a look on the next figure.

Figure 14: Visualization of the Application Main Screen

In the main screen, you can see the patient doing his treatment. The technology of postural recognition helps him to do the exercise appropriately, with the good moves and the good positions. You can also see some different things on this screen. If a connected watch or something similar is connected, the pulsation of the man can be directly available on this screen. Next to it, the stars show the general score of the person. At the right, a timer with the time remaining to finish the session. And finally, at the left at the very bottom of the screen, a moving representation of the exercise which shows the final goal and how to move to reach it.

Now, let's see what the other things around this screen are. The main things are the coach and the statistic. The coach is there to motivate the man or the woman doing the exercise. There are two possibilities: speaking or shut off. In this visualization, you can see that the coach is shutting off because there is   and not   so, he's talking with phylacteries and

the person must read the coach instructions that you can see in green. The alarm representation, on the left of the phylactery, appears when the coach must give some advice during a shut-off time. The 👁 can be closed too 🚫👁 but at this moment, the application cannot be used at its full potential, the 'coach' (and so the AI) cannot see you anymore and tell you how to perform your exercise. The score cannot be collected either and so the person cannot obtain the benefit of it, but it's essential to put this option if the person just wants to make exercise without having a robot looking at him or her.

Then, the statistics show the current performance of the person. In real time, he can see if he is improving himself or not, his results, and so on. With this magnifying lens 🔍 you can have a look on your results with more precision, in comparison with averages of other people doing the same exercise and also on all your historical data. With this little watch ⌚ you can add a connected object as a watch to add some information as the heartbeat or your real activity during this session. The last icon 🎵 is used to add some music during your session. We think it is useless to add music in the data base of the application. People just must connect their own music to the device and that's it.

With this new platform, the goals of a good preventing tool are reached. Entertaining, with rewards, with a healthcare goal, it encourages the user and motivates him/her, etc.

Here, the example shows a man in rehabilitation or doing exercises after his sport. Nevertheless, as said before, the tool can also be used to do sport, to do yoga or stretching, and to prevent the elderly from a sedentary lifestyle. The principle is the same, thanks to postural recognition, the person can improve his/her movement and become better on it.

9. How is it enhancing risk prevention and client protection?

In fact, it is quite simple. We have two initial problems: an ageing population whose mobility is decreasing, which requires a great deal of care and attention, and a civilization where sporting activity prevails but where people are not motivated enough to take care of themselves until the end, they want to restart sport too quickly. That behaviour leads to recurrent articulation and muscle injuries, because these have never completely healed. Moreover, a part of the population is not encouraged enough to do sport but they could be more motivated with financial rewards and entertaining digital platforms. We would enter here in the gamification of the prevention system.

Where is prevention in this tool? The tool allows people to become autonomous and aware of the limits of their own body, which is extremely important for its appropriate development. By offering people the opportunity to work from home on their bodies, they can prevent the risk of injury. These injuries are often avoidable if muscles and articulations are well prepared. For example, in the case of the rehabilitation process, knowing everywhere and at all times what exercises to do and, above all, how to align one's posture to perform these exercises correctly would allow the person to heal his body properly and thus avoid the risk of recurrence. Let's have a look on another example in the case of elderly people, often isolated, sometimes alone. it is important for them to have a digital coach who will allow them to do exercises within their capabilities, without risking injury and having the opportunity to do better each time (as much as possible). This tool is therefore preventive on three major levels: it prevents sports injuries through better preparation of athletes; some injuries are nevertheless unavoidable, so it prevents the risk of recurrence of a muscle or articulation injury by encouraging the person in rehabilitation to do their exercises correctly, motivating them and leading them to the right movement, the right position to perform; and finally it prevents the risk of muscle or articulation injury in the elderly by offering them an entertaining tool that allows them to do easy exercises in order to keep a certain mobility and a minimum agility despite the ageing of their body.

This is the most visible side of the service, but behind it is hidden something else. The IoT technology, as often repeated during this thesis, allows to accumulate a large amount of data which will then be processed by very advanced software, and after this data can be used to improve something. In the case of this service, for example, the data collected could be used to create new prevention methods. At the moment, it is difficult to say what mistakes people make when they do sports or when they do flexibility exercises. But in the future, thanks to the data collected and stored in the Big Data, we will be able to define what is being done wrong and further improve care and prevention campaigns for people. In addition, thanks to the machine learning technologies, the program will be able to improve itself as it trains its clients. This increasingly improves the service provided and potentially the customer experience.

What about client protection now? In fact, here we are dealing with a service that 'protects customers from themselves'. If we look objectively at other cases where IoT is used for prevention purposes, we can see that this is still the case. DriveXperience, for instance, encourages drivers to drive safely, respecting the rules of the road and avoiding violent driving. The reduction offered to customers who do this is a reward for encouraging them to act in a certain way. In practice, the insurer seeks to protect the client from these dangerous behaviours. That's also the purpose here. On the one hand, there is the aspect of encouraging the client to do sports, but above all, there is the emphasis on doing sports in a way that is healthy for the body in order to avoid potential injuries or at least to prevent these injuries from recurring over and over again. That is really what the insurer wants to go for. Towards offering a service that brings him closer to his client that the insurer no longer be a simple payer but a partner in prevention for individuals.

Nevertheless, even if most people (according to the various studies analysed in this paper between 40 and 80%) are willing to share their data for prevention purposes and in order to get discounts on their insurance premiums, some are still very cautious about going the extra mile. They consider that insurers are not trusted companies and that there is always something behind them. The real fear, and this is also what Thierry Geerts briefly mentioned in his book 'Digitalis', is that the insurer would use this data to drastically increase the insurance premiums of the most at-risk people. It may seem 'logical' for them to do so, but it would not be fair or ethical. So, it will never be accepted by society and they are fully aware of that. Therefore, the services put in place do not seek to punish 'bad customers' but to prevent the risk of becoming a bad customer, to encourage good attitude through various rewards and, as far as possible, to encourage all customers to adopt a responsible and reasonable behaviour.

And finally, what does the insurer gain from all this?

10.   Cost and potential profit for the insurers

In this particular case of healthcare in Belgium, we are not only talking about a private insurer like AXA or AG, but also about Mutuals and the Belgian state in general, which finances healthcare reimbursements through various methods.

It is also difficult to assess what the output will be with these methods of prevention and encouragement to practice sports activities. What we can say with certainty, however, is that the effect can only be positive.

What we found in the previous chapters is that with the ageing of the civilization, there was also an increase in the number of chronic diseases. The best way to overcome this problem is regular physical activity. We have also seen that just under 50% of the population does not practice sport on a regular basis. For these, we have the part of the application that encourages physical activities and the rewards that are induced according to the attendance of these people. For the other 50%, who do sports regularly, we have the part of the application that allows them to do this in a healthy way, on the one hand, and allows for better rehabilitation, on the other hand. Although, of course, the entire population will not be interested in this type of service, some may be. This will depend on their interest in the reward. We can hope that the medium – and long-term result will be a reduction in healthcare costs, through the reduction of recurrent injuries and the reduction of chronic diseases. With regard to chronic diseases, let us take two concrete examples: cardiovascular diseases and diabetes.

Cardiovascular Diseases

'In its report on physical activity, the Surgeon General of the United States identified 7 studies that examined the relationship between the amount of physical activity and the total risk of developing cardiovascular disease and 36 studies that focused on coronary heart disease. Overall, this work shows that there is an inverse relationship between the usual level of physical activity and the incidence of cardiovascular diseases and, more specifically, coronary heart disease. A detailed review of these studies shows that the risk of developing coronary heart disease is 1.8 times higher among sedentary people than among the most active. Sedentary lifestyle is a key element in the range of risk factors for cardiovascular disease' (Translated from French, Education santé, 2008).

Diabetes

'Regular physical activity reduces the risk of developing non-insulin-dependent diabetes. Physical activity helps prevent diabetes in two ways: first, by increasing sensitivity to the action of insulin in skeletal muscle, fat tissue and the liver, and second, by decreasing pancreatic insulin secretion in response to a given level of glucose in the blood. Low- to moderate-intensity physical activity seems sufficient to reduce the risk of developing the disease, but also to substantially increase the physiological action of insulin on blood sugar levels. The most important factor seems to be the regularity of physical activity sessions. Since

the positive effects of physical activity last no more than 48 hours, it is recommended that you engage in some form of physical activity at least every other day to maintain good tissue sensitivity to the action of insulin' (Translated from French, Education santé, 2008).

These are just two examples, but the benefits of sports apply to many other chronic problems such as obesity, hypertension, and even the risk of developing some cancers.

Consequently, it's very hard to evaluate the impact and the consequences of such a service. Nevertheless, we can already have a look on the current facts about healthcare in Belgium. The next figure shows the Financing Schemes of Belgium in healthcare in current price (million €). You can see that the most important are the transfers from government domestic revenue and the social insurance contributions (related to the mandatory health insurance Belgian must pay).

Figure 15: The Financing Schemes of Belgium in healthcare

Financing scheme	All financing schemes				
Measure	Current prices				
Year	2017				
Revenues of financing schemes	Transfers from government domestic revenue	Social insurance contributions	Compulsory prepayment (other than FS.3)	Voluntary prepayment	Other domestic revenues n.e.c.
Country					
Belgium	17.282,2	17.778,2	20,2	2.315,6	8.008,6

Data extracted on 31 Jul 2019 16:31 UTC (GMT) from OECD. Stat

Source: OECD, Stat, 2017. Retrieved July 31, 2019. https://stats.oecd.org/Index.aspx?lang=en&SubSessionId=224f8e67-bf2d-4bfd-89b9-53033100fac8&themetreeid=9#

Next to this, for this specific year (2017), Belgium used 10.3% of its gross department product for healthcare, thus €45,404,800,000.

You can see that the expenses are significant. According to Mutualités Libres (2018), 'Chronic patients represent 25% of the population and 70% of total health expenditure. The considerable and growing burden of chronic diseases on public health expenditure has increased over the years, as shown once again by a study by the Mutualités Libres. In only 5

years, these expenses have increased by 10%.' In addition, 'The average annual expenditure on social security dependent healthcare for people with chronic diseases is seven times higher than that of people without chronic diseases. Between 2010 and 2015, their health costs increased by 10% to reach 5,746 euros per person per year on average. For people without chronic conditions, spending growth is 1%. The increase in health spending is observed in each age group among the chronically ill, while for people without chronic conditions, health spending has remained virtually unchanged (except for those over 80 years of age whose spending is declining).'

It is therefore important to get to the root of the problem and address chronic diseases by launching prevention programs such as this one. Certainly, reducing the cost of compulsory insurance for hardworking and motivated people will somewhat encroach on the healthcare budget in the short term. But in the long term, this can be extremely beneficial for insurers who bear these costs. By tackling chronic diseases, almost three quarters of the healthcare budget could be reduced. Even if it is complicated and it is difficult, even by rewarding them, to motivate people to follow 'prevention programmes', it is important to focus on this kind of problem in order to have the opportunity to reduce these diseases and the costs involved.

Figure 16: Chronic Diseases Increase
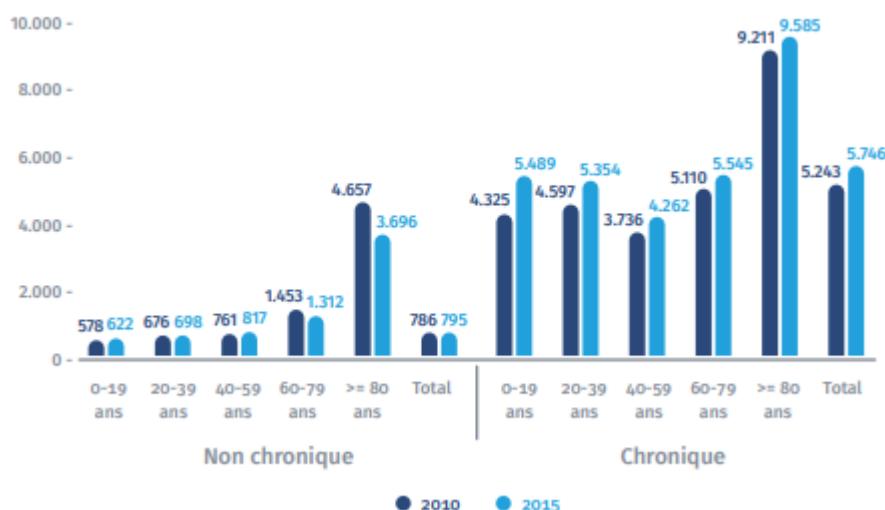
Let's now analyse the cost of developing an application of this type. I will separate this into three main costs. Development costs; storage costs and fixed installation costs. First, for the development of the app, what do we need? Some computer scientists and some designers (at first, we are really talking here about the real cost of creating the application, not its 'marketing' and its maintenance and its updates later). For a computer specialist, in Belgium,

it takes between €3300 and €4000 (gross salary). And we will need these people for about four to six months for the development of the algorithm. We can therefore estimate this cost at around €54,000. As far as designers are concerned, it's a bit less expensive, we can estimate that at around €39,000. Here we are talking about a development with Kinect, because it has already been done. Nevertheless, a development made with a 2D camera would require more time and therefore money because it has not been done yet and will require more expertise. Then we have the storage costs. The best way to store an algorithm of this type is to use the cloud of companies such as Google or Amazon, which are the most mature. For 2 TB[1], the Amazon cloud costs about €10 / month, and we know that we will need about 100 TB. It would cost €500 per month and therefore, as for salaries, a base of 5 months, we are at €2,500.

And finally, in terms of fixed costs, namely the purchase of a server, it takes about €10,000. Using GPUs (graphics card) rented by Google or Amazon, we could lower this cost to about €3500 for five months of development (this service is sold €0.97 / hour). Nevertheless, for a long-term project it is probably more relevant to invest in a server owned. We therefore arrive at a total of about €105,500 for the development of this digital platform. As mentioned before, this will be added to the maintenance and updating costs. It will also include the costs of 'placing on the market', etc. Now let's quickly look at the savings that could be made through an increase in the number of athletes and a decrease in recalcitrant injuries through this app, which hypothetically would reduce the number of chronic diseases. We will make some assumptions in the table below.

Figure 17: Assumptions about savings

	Cost in €	%
Current health expenditure (2017)	€45.404.800.000,00	10,3% (PIB)
Chronic disease patient costs	€31.783.360.000,00	70% (of total healthcare spend)
Assumptions	**Cost in €**	**Savings**
A1-Decrease of 0,1%	€31.751.576.640,00	€31.783.360,00
A2-Decrease of 0,5%	€31.624.443.200,00	€158.916.800,00
A3-Decrease of 1%	€31.465.526.400,00	€317.833.600,00
A4-Decrease of 5%	€30.194.192.000,00	€1.589.168.000,00

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[1] Terabyte

However, one can see that the impact of an application which motivates enough people to do sport or to exercise properly would potentially help a lot to reduce the costs of health insurance and so to reduce the insurance premium and maybe to offer the opportunity to complementary insurers to make more profit.

Conclusion

In conclusion, we saw during this paper that the new objective of insurers was now to bring them closer to the customer. The aim is to become a partner in the life of the insured and to help him/her to prevent common risks. Technologies such as IoT are the most promising technology for this purpose. Efficient use in the future will allow insurers to obtain better information, on the one hand, but also and above all to offer a better-quality service, on the other hand. Do you remember the time of the old insurer asking you to sign a ton of paper? This moment when you signed and then you never to see him again (and you didn't want to see him again because it would mean a claim). This chapter is over, and soon insurers will be more present than ever in our lives. Thanks to the incredible range of technological possibilities, these dinosaurs are able to completely renew themselves and are inventing new services in an industry as old as the world. The opportunities available to them are not negligible, and it is important for any insurer to take advantage of these opportunities. It becomes, in fact, almost essential for them to plug into the Internet of Things, otherwise they will be left behind the competition.

Nevertheless, as always with great opportunities also come risks and challenges. The risk for the insurer to create a world so safe that being insured would become useless is for me quite far from reality. Almost laughable. Only the most pessimistic, or the most fearful insurer, would have such thoughts in mind. In any case, there are real risks and they are not insignificant. The challenges related to its risks seem almost insurmountable and yet gradually we see that the concerned people manage to put in place enough processes and knowledge to mitigate its risks. We are still a long way from a world where IoT and prevention are one. The risk of cyber-attack is still very real, it could lead to a much worse situation than we have ever known. However, things are slowly moving forward and initiatives, such as the GDPR, are being put in place to ensure the safety and privacy of consumers. We have also seen that services are already being implemented in the insurance world. They are still relatively simple, but nevertheless they represent very well the concept of prevention through IoT. The success of these projects gives hope for the proper functioning of this type of system in the future.

Thanks to the various books, reports and articles analysed in this thesis, we now have a clear vision of what insurers must do to perform in their IoT strategy. However, these advices remain quite basic. Much more detailed studies would be needed to assess the full potential of this technology and what it could bring to the insurance world. The service created for this report would potentially help reduce healthcare costs in Belgium. Nevertheless, it is necessary to moderate this. It must be taken into consideration that many studies would be essential. For example, to statistically prove the benefits of sports on chronic diseases, to evaluate how to convince the client to use the platform and how to motivate him to do his exercises or even to know how to communicate that service with the broker so that he is motivated to sell this one rather than another. For the time being, all that has been presented is just a lead to a solution. It's not the solution, it's A potential solution. I think the most important thing is to

open one's mind and immerse oneself completely in the problem in order to be completely aware. For insurers, it is capital to study the challenges and find new ideas to implement. This is how they will stand out and become better every day. It is very likely that some initiatives will fail, and that is normal. In today's world, it is important to stay connected and constantly innovate. It is by staying informed, properly analysing the information available, understanding people's problems, figuring what they like and how they make a claim that insurers will be able to benefit from the Internet of Things technology to improve risk prevention and clients protections.

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