The Future of Industries: How Personalization of Insurance Policies Using Artificial Intelligence Will Disrupt the Insurance Status-Quo

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Abstract

Title: The Future of Industries: How Personalization of Insurance Policies Using Artificial Intelligence Will Disrupt the Insurance Status-Quo

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In the future, the concept of insurance will change and Artificial Intelligence (AI) is already disrupting the state of this industry. Insurers worldwide are using AI to automatize processes and tasks, such as fraud detention, underwriting and claims processing. Additionally, there has been a rise of new competitors in the market, such as InsurTechs, that are bringing innovative solutions for insurance, responding to the new trends in customers' lifestyles and behaviours, that are more demanding for services directed for their needs.
This study aims to understand how personalization of insurance policies, created with Artificial Intelligence, will disrupt this industry in the future and what will be the impact in the European market. Personalization of an insurance policy with AI would encompass the definition of the coverages and premiums more appropriate for an individual customer and do the risk evaluation, in a market of one strategy. This innovation would take advantage of the accrual of Big Data from customers, as people are each time more connected and information about them is constantly being shared, allowing companies to use it to know consumers better.
Some limitations that might arise are related to the regulation applied to the insurance industry in Europe regarding customer's data privacy, with the GDPR and regulation against discrimination in insurance.

Key Words: Artificial Intelligence, Insurance, Europe, Disruption, Big Data, Innovation, Personalization, InsurTechs

Sumário

Título: O Futuro das Indústrias: Como a Personalização de Apólices de Seguro Através de Inteligência Artificial Mudará o Estado Atual dos Seguros

Autora: Marina Reis

No futuro, o conceito dos seguros irá alterar-se e a Inteligência Artificial (IA) já está a causar disrupção no estado desta indústria. Seguradoras por todo o mundo já utilizam IA para automatizar processos e tarefas, como detetar fraudes, na subscrição de seguros ou no processamento de sinistros. Adicionalmente, tem-se assistido a um aumento de concorrentes no mercado, como as *InsurTechs*, que trazem soluções de seguro inovadoras como resposta às novas tendências nos estilos de vida e comportamentos dos consumidores, que são cada vez mais exigentes e procuram serviços mais direcionados às suas necessidades.
A presente dissertação visa estudar como a personalização de apólices de seguro, criadas a partir de Inteligência Artificial, irá disruptar a indústria no futuro, e qual será o impacto no mercado europeu. A personalização de apólices inclui a definição das coberturas e prémio mais apropriados para o consumidor individual, assim como a avaliação do risco, numa estratégia de *market of one*. Esta inovação tiraria partido da acumulação de *Big Data* dos clientes, uma vez que os consumidores estão cada vez mais conectados e informação acerca deles está constantemente a ser partilhada, permitindo às empresas conhecê-los melhor.
Algumas limitações que poderão surgir estão relacionadas à regulamentação da indústria dos seguros na Europa, relativa à proteção de dados, com o RGPD e com a regulamentação contra a discriminação nos seguros.

Palavras-chave: Inteligência Artificial, Seguros, Europa, Disrupção, *Big Data*, Inovação, Personalização, *InsurTechs*

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Chapter 1. Introduction

Industries all over the world are being disrupted by technological advances that are transforming their existence, and the way companies react and adapt to these disruptors will have massive impacts on how industries will look like in the future.

An example is the Insurance industry that has been under the disruption of new trends, such as Artificial Intelligence (AI), driven by the quick advances in the technological field. This transformation includes several other disruptive technologies, such as telematics, Internet of Things, blockchain and digital platforms (Hall, 2017) and the accumulation of Big Data has been feeding these advances.

Technology based innovations have several benefits for insurers, for example, for controlling risks, cost efficiency, better engagement with its customers and tailoring insurance offers (Lamberton et al, 2016). With the evolution of technologies, insurance will change its current state from a "detect and repair" to a "predict and prevent" approach (McKinsey&Company, 2018).

Some of the main issues to tackle in insurance are technology advancements, regulatory implementations, product development, mergers and acquisitions, privacy issues and tax reforms, which insurers must take into consideration in order to improve operational efficiency, increase productivity, lower costs and customize their policies (Deloitte, 2019).

Customers' expectations towards companies and the desire for personalized and flexible insurance policies is emerging and insurers must assess their ability to respond to it. As a result, an alternative for insurers is to join forces with InsurTechs to implement new approaches, platforms and policy plans (Deloitte, 2019).

The purpose of this study is to hypothesize the future of the Insurance Industry in Europe, by identifying the major disruptors in this industry, with focus on Artificial Intelligence. More specifically, it intends to assess how AI powered solutions can be used to personalize insurance policies, in a market of one strategy. Personalization would encompass creating a policy suitable to a customer's individual needs, involving the definition of the most appropriate coverage extent, capital available, premium and evaluation of the risks.

Every day, millions of data about customers' lifestyle and behaviors are generated and accumulated as Big Data. Artificial Intelligence has been a solution to transform and analyze the high amounts of information that can be further used to create personalized policies based on client's exact need, for different categories.

The creation of this innovation requires high amounts of data relative to customers, which can

originate privacy constraints, in which individuals may be withdrawn to share. Furthermore, as the insurance industry is highly regulated, European insurers must consider the regulation applied for their activity and regarding discrimination and data protection. In Europe, an example is the General Data Protection Regulation (GDPR), created by the European Union in 2018 (EY, 2019)

Personalization of insurance policies using Artificial Intelligence may be an opportunity to increase the number of policyholders by increasing the intention to acquire an insurance, as many people still do not want to acquire it, whereas because they consider themselves to be healthy – in the case of health Insurances, or due to its high prices or unnecessary coverages. In addition, it can lead to increases in revenues and accelerate industry growth.

From the managerial relevance of this study, it is pertinent to highlight the Insurance industry and the AI developments. Insurers contribute to the economic growth, financial stability and development of Europe (Mitra, 2016) and companies search each time more for solutions that embed AI benefits in their strategies, especially for reducing costs and increasing efficiency.

The academic relevance of this study is to present a recent and in high demand topic to the academic community. In addition, it intends to deliver insights on how to define strategies to overcome or leverage disruption in industries.

The problem this dissertation attempts to understand is how a market of one strategy, with personalized insurance policies by Artificial Intelligence, will affect the future of the Insurance industry in Europe. In order to conduct the study and hypothesize the future of this industry, the following research questions will be answered:

RQ1. What is the impact that AI will have in the Insurance industry in Europe?

RQ2. How is this industry going to look like in the future, once this disruptor has taken full effect?

In order to research the problem and answer the research questions, both primary and secondary methods of data collection were used. The study consists in an exploratory approach and it used qualitative and quantitative data. For the primary data collection, a survey was done with European respondents and semi-structured interviews were conducted with experts working in Insurance and Artificial Intelligence. For the secondary data, the theoretical foundation of the study was supported by existing literature, such as academic articles, journals, companies' reports, industry indicators in Europe and other relevant studies.

Chapter 2. Literature Review

2.1. The Insurance Industry

The Insurance industry is composed by two main groups of policy contracts: life and non-life (general) insurance. The insurer pays a compensation to the policyholder in case of loss, damage or death, in return of a regular payment of the premium. Insurance policies contain coverage for losses arising from uncontrollable factors and allow risk averse clients, due to wealth constraints, to transfer risk to an insurer that takes a risk neutral role (Serpa et al, 2017).

Life Insurance is a contract in which the policyholder acquires an insurance that will be reimbursed upon death or maturity, being considered a form of investment. It is a complex service, often associated with uncertainty of its unsure future benefits, and the way customers choose it depend on their proposal, agent, image of the insurer company and it also varies according to the culture of the country (Chui et al., 2008).

General insurance consists in all types of insurance of non-life policies (e.g. health, work, property, vehicle), and consist in reimbursements for uncertain events. Non-Life insurance products are standardized and prices follow actuarial principles. The price definition involves risk evaluation of the insured person or object, that is private to the firms (Greve, 2008).

Insurers hold a portfolio of insurance policies and an investment portfolio, and the income of insurers come from two sources. The first one is from the portfolio of customers insured, originated from the underwriting process, that is the difference between the premiums paid from customers and the payments made to the policyholder for incurred losses and expenses (Desyllas et al., 2013). There exists a concept of mutualism, based on a principle of pooling risks, in which policyholders who do not have losses subsidies those who do (Finance Watch, 2019). The second source is from insurers investing the premiums earned in common equities and fixed-income securities (Desyllas et al., 2013).

In the last decades, the Insurance industry has been under several transformations, due to globalization, deregulation and the massive digitalization (Mitra, 2016). Nevertheless, insurance activities have been growing, especially in emerging markets, driven by the process of financial liberalization and integration that contribute to economic growth, as a result of the premium incomes, insurers' assets and investments made (Chang, 2014).

The Insurance industry is extremely regulated and traditional. Its customers consider it impersonal and with lack of enthusiasm (McFall, 2018), with low consumer engagement and interaction, since there are only two points of contacts with customers: when the customer buys

the insurance and during claims processes (Hall, 2017).

2.1.1. The European market

The European insurance market is the largest in the world, representing over 30% of the global insurance premium income (Mitra, 2016). Hence, the European market is being studied due to the competitiveness and efficiency of its institutions. This market is composed by large and multinational companies, operating in life and non-life segments, through numerous subsidiaries with different independence levels to conduct their business and that co-exist with other fully independent firms that operate in both segments (Fenn et al, 2008).

European Union's Insurance companies typically have growing returns to scale, which originated increases in firms' sizes and market concentration. Additionally, due to the liberalization of the EU market, the number of mergers and acquisitions among companies increased (Fenn et al, 2008).

The financial services sector, that includes insurance, has been gradually being deregulated by the European Union with the objective of creating a single European market in financial services. This measure allows insurers to do business in every EU country provided with the respective licence (Fenn et al, 2008). Additionally, the Insurance sector allows countries to perform economic transactions among them (e.g. risk transfer and long-term investments) (Mitra, 2016). The insurance sector is the largest institutional investor in Europe and provides economic growth (Insurance Europe, 2019), financial stability and development of the nations (Mitra, 2016).

2.1.2. Factors influencing the consumption of Insurance products

In the case of life insurance in Europe, the demand is determined by economic, demographic and cultural variables. The economic factors are countries' GDP *per capita,* and consequently its higher wages and higher activity levels (Mitra, 2016). Better developed banks also increase the consumption of life insurance (Chang et al., 2014).

The demographic variable that positively impact the demand is the size of the country's population and a cultural variable of long term orientation (Mitra, 2016).

2.2. Artificial Intelligence as the main disruptor

Currently, we are living in the era of Big Data, as a result of the fast advances in technology

over the last decades and the diffusion of large amounts of information online (Duan et al., 2019). New technologies, such as Artificial Intelligence, has been used by diverse industries to develop their businesses and Artificial Intelligence was listed as the number one strategic technology in 2018 (Gartner, 2017).

Artificial Intelligence is the capability of a machine to learn from experience and inputs, in order to perform tasks similarly to a human (Duan et al, 2019). These tasks include learning, planning, reasoning, problem solving and decision making (Hall, 2017), and it may support or completely substitute human tasks (Duan et al, 2019).

This innovation has been expanding as a result of the improvements in computer's processing and memory capacity, as well as the accumulation, availability and power of Big Data (Lu et al., 2018).

Artificial Intelligence developments have been enabling to process and run complex algorithms, faster than humans could (Hall, 2017), as Big Data analysis is extremely time-consuming (Duan et al., 2019).

This advance has been helpful for companies to discover new insights, shorten processing times, improve service and products quality (Krittanawong, 2018) and use data to make predictions, and as a result, it contributes to reduce the cost of these activities (Duan et al, 2019).

Consumers generate each time more data that can be either structured or unstructured. Some examples of sources of data that generated new types of information are social media, wearable devices, sensors and telematics, that permit AI to be useful to process it and generate new ideas based on consumers' information (Hall, 2017).

Firms' innovations in R&D are becoming less science-based, decreasing the benefits of investing in scientific research, as it is not considered as relevant as it was years ago for commercial purposes. Artificial Intelligence and other IT advances are a result of statistics, computer science, electronical engineering and material science, and its connection to science is still important to take into consideration, as these types of technologies are rooted in advances made from science (Ashish Arora, 2017).

2.2.1. Artificial Intelligence techniques

The core AI components are Machine Learning and Deep Learning. Following, there are AI enabled technologies, such as Natural Language Processing, Machine Vision and Predictive Analytics (Hall, 2017). In addition, companies do Data Mining to process Big Data.

Some of the main techniques used in AI's systems to develop its knowledge and algorithms are

rule-based inference, semantic linguistic analysis, Bayesian networks, similarity measures, neural networks, frame-based representation and genetic algorithms (Duan et al, 2019).

2.2.2. Future predictions for AI

Artificial Intelligence is self-learning and over the time these systems adapt to new data and improve their capabilities (Hall, 2017).

Nowadays' Artificial Intelligence is considered as weak, being designed to perform a specific task and being able to outperform humans on that specific task, and innovation technologies for Deep Learning and Corporate Cooperation are emerging (Lu et al, 2018).

Today's Artificial Intelligence developments only encompass the intellectual areas of image and speech recognition and dialogue response of the human brain, which limits its full potential. In addition, it includes several techniques that are only part of the areas of the human brain, and still does not perform like it. For instance, AI's solutions are not yet capable of performing the self-functions of understanding, control, consciousness and motivation that humans do (Lu et al, 2018).

The recompense for digital initiatives through 2025 will be driven by the ability to use AI for decision making, reinventing business models and ecosystems and for customer experience (Duan et al, 2019).

2.3. Artificial Intelligence applications in Insurance

Technology is developing in a fast pace and its advances generated new sources of data and opportunities to leverage. By this reason, Artificial Intelligence is disrupting several industries worldwide, an already has outstanding effects in the Insurance industry.

By using algorithms, firms can understand better their consumers' behaviour and characteristics, which is beneficial to create value not only for the firm, but for customers, generating loyalty to the brand. In addition, using data to serve customers is more difficult to imitate from other firms, which benefits the creation of new and unique innovations (Riikkinen et al, 2018).

Nowadays' consumers, especially the Millennials generation, expect on demand services, and AI is being used for improving customers experience and innovating products (Hall, 2017). For this reason, personal data from customers can be used to increase engagement with insurers and make the relationship more dynamic and interactive, modernize and personalize policies (Deloitte, 2019).

2.3.1. The rise of InsurTechs

Technological disruption is reshaping the financial services sector, which created points of contact between traditional financial companies and start-ups, originating FinTechs (financial technology driven companies). In the specific case of the Insurance industry, it is being disrupted by InsurTechs, a sub-group of FinTechs, that are using innovative technology and disruptive business models in Insurance, making use of Big Data, AI and Internet of Things methods as a way to differentiate products, processes and delivery models (McFall et al, 2018). Artificial Intelligence is being used for underwriting, fraud detention, claims processing, marketing strategies (Hall, 2017), algorithmic trading, blockchain analytics and customer service improvements with chatbots (Riikkinen et al, 2018).

The number of InsurTechs has been increasing and is in high demand for improving customer experience with convenience, transparency, timeliness and engagement (Hall, 2017).

Synergies between InsurTechs and traditional insurers can be leveraged for product development, as InsurTechs can create products with more appropriate coverages, better platforms and without annual commitments. In addition, this type of business model has lower burden of regulation than a traditional insurer. On the other hand, InsurTechs can benefit from insurers' stablished position in the market, for its brand recognition, experience and capital accessibility (Deloitte, 2019).

2.3.2. AI techniques used in Insurance

In order to automatize processes and personalize products in Insurance, several AI-powered solutions are used. Starting with underwriting activities, AI techniques are used to asses risk and price the policy in accordance. Typically, insurers use information such as age, gender, health state, among others, but with AI techniques it can use real time information from different sources and have better information about their customers (Hall, 2017). Sensors can be used for assessing customer's behaviour in relation to the risk being insured and tailoring the insurance policy to the specific customer risks, corresponding to real data (Lamberton et al, 2016).

Natural Language Processing is used in Insurance to create chatbots, that are virtual assistants that answer to customers' enquiries through messaging platforms, instead of having a human performing this task and it aims to improve customer service (Hall, 2017).

Another technique in high demand is Data Mining that is used for marketing and market analysis to support the high amount of data being generated every day. Each time more,

consumers are online and share different types of information about themselves (e.g. on social media), hence, one of the methods used in Data Mining is through consumers' online searches, browsers' information and products ordered online, as a way to identify their purchasing behaviour pattern. For marketing purposes, it is used for advertisement and for recommending products. On the other hand, Data Mining permits to do analysis of the risk of the customer and detect fraud probability, through customer's creditworthiness or fraud insurance, for instance (Xie, 2019).

Claims processing times are being shortened by using Machine Learning techniques, that uses bots to analyse historical data, images and sensors, and permits to automatically review the claim (e.g. evaluate the severity of the claims and predict costs), cross it with the customer's policy, perform anti-fraud algorithms, approve it and send wiring instructions to the banks. At the end, it informs the policyholder that the order was paid and closed. This also decreases the costs associated with it and improves customer experience (Hall, 2017).

Artificial Intelligence also aids to perform anti-fraud techniques to detect doubtful claims, through intelligent automations, self-learning and detecting patterns to identify fraudulent claims. This works by crossing information with the customer's policy, assessing previous customer behaviours and detect activities with high probability of being fraudulent, which sometimes is impossible to detect through humans (Hall, 2017).

2.3.3. Personalization of Insurance Policies using AI

Nowadays, there is an array of devices that are all connected and generate data about consumers, such as cars, home assistants, fitness trackers, smartphones and watches. In the future, there will be even more information being shared and by 2025, it is forecast that there will be one trillion of connected devices and this connectivity will be extended for clothes, shoes, eyewear, medical devices, among others (McKinsey&Company, 2018). The data being shared accrues as Big Data and is further used by AI for creating products and services, allowing insurance transactions to be personalized through innovations in social media marketing and behaviour tracking, for instance (McFall et al., 2018).

This will allow companies to collect higher amounts of information about consumers and define better strategies based on a deeper understanding of their needs and preferences, which will empower the possibility to innovate in the personalization process of new products.

A common segment in which technological innovation is being applied in the car insurance, through the application of telematics, a technology that combines telecommunications, wireless

and vehicular technologies to monitor customer's driving behaviour and determine the premium of their policy accordingly (McFall et al, 2018). Historically, this type of policies used actuarial prices and divided drivers into groups, based on historical facts about claims and considering information such as age, gender, driving licence and vehicle type. This led younger drives to pay more due their less driving experience and association with higher claims costs. Alternatively, telematics policies aim to be personalized based on individual data, considering drivers' locations, speed and driving behaviour (e.g. brakings) (McFall et al, 2018). In addition, sensors are also being used on cars to measure acceleration, braking, time of the day driving and upload all the information on the company (Lamberton et al, 2016).

Another example is in health and life insurance that is extracting data about policyholders from wearable devices and health apps to monitor their activities such as steps taken, exercise, diet and sleeping patterns, which allow insurers to calculate risks and modify premiums to charge them. An example is the Vitality program, created by the South African insurer Discovery, that rewards its customers for achieving points for their healthy behaviour and gives policyholders the possibility to decrease their premiums based on their points achieved (McFall et al, 2018).

The British insurer Aviva created the product Ask It Never, an underwriting innovation that permits customers to buy policies without asking them endless questions. Instead, it relies on Big Data, where digital footprint data takes an important role to underwrite the risk. Another case is the Selfie-Quote.com, where customers upload a photography of themselves and though facial analytics technology, it indicates an estimated quote for life insurance based on the user's age, gender and Body Mass Index. This project was a collaboration of Legal and General America and a technology firm (McFall et al, 2018).

2.3.4. Usage-Based Insurance

An innovation that some insurers adopted is the Usage-Based Insurance (UBI) that are personalized to consumers and adapted to their individual behaviours, with coverages based on their needs and annually renewable. This model includes micro coverage, that includes coverages for phone battery or flight delays, for example, based on the customer's needs (McKinsey&Company, 2018). Nowadays, with the emergence of the shared economy, this model is highly appreciated for physical assets that are shared, for example, cars and home services. Shared economy has several risks associated and businesses operating in this model prefer to have coverages they can activate and deactivate when needed (Deloitte, 2019).

Furthermore, customers want more control over their coverages and to tackle this opportunity,

InsurTechs are already creating coverages based on real time needs. An example is the on-demand insurer Trōv that allows individuals to use an insurance for objects and activate the coverage through a mobile app whenever they need (e.g. an insurance for cameras that is activated when the customer is traveling) (Deloitte, 2019).

2.3.5. Limitations of the use of AI in Insurance

Telematics is being used to define the premium for car insurance policies. Telematics also include detection of other behaviours, such as phone usage and alcohol levels. In this sense, it can create issues regarding who takes the responsibility, because this technology may fail or relate false positives that can have negative impacts for the customer and for the image of the insurer (McFall et al, 2018).

Using self-tracking data to analyse and price individual risk has several obstacles. Because the Insurance industry is heavily regulated, it has several legal prohibitions that limits the type of personal data that insurers can use to price risk (McFall & Moor, 2018).

Some additional challenges are related to the quality of the data gathered, infrastructure compatibility and privacy constraints (Hall, 2017) as personalization also involves some restrictions associated to the privacy and security of personal data shared.

For storing data, the cloud takes a very important role because it can storage large amounts of information and keep it safe. However, companies must bear in mind the risk associated with cybersecurity and insurers must take care of the implication of migrating data to cloud and risk management (Deloitte, 2019).

Chapter 3. Methodology

3.1. Process

The purpose of this paper is to understand how personalization of Insurance policies, created by Artificial Intelligence, will affect the Insurance industry status-quo.

The research questions that the study aims to address are:

RQ1. What is the impact that AI will have in the Insurance industry in Europe?

RQ2. How is this industry going to look like in the future, once this disruptor has taken full effect?

Therefore, for the purpose of this study, primary and secondary data were used.

The secondary data was collected from existing literature, in specific journals, academic articles and companies' publications, in order to get knowledge about Insurance, Artificial Intelligence and the usage of this technology applied to the industry. The quantitative data was gathered based on industry indicators in Europe, such as market shares and revenues, as well as information related to the main players in the European market. From the Artificial Intelligence point of view, information regarding the investments made by enterprises in these innovations and the adoption of companies was collected through websites, studies and surveys previously done by other entities.

The primary data was generated for quantitative and qualitative purposes. Regarding the qualitative data, it was collected through semi-structured interviews conducted with industry professionals, in order to enrich the study with knowledge, insights and suggestions.

Expert Interviews				
Interview	**Position**	**Company type**	**Company**	**Annual Revenue**
A	Health Knowledge Management Director	Insurance	Multicare (Fidelidade)	2,820,187,838€
B	Head of Business Development	Insurance	Multicare (Fidelidade)	2,820,187,838€
C	CTO	AI and human translation platform	Unbabel	8.300.000$
D	President	Engineering University	Instituto Superior Técnico	21.217,11€

Table 1 - Expert Interviews participants

In addition, a survey was held with European residents, to assess respondents' opinion regarding the insurance industry, the personalization of Insurance policies based on AI methods and their perception of it.

3.2. Secondary Data Collection

3.2.1. Literature Review

For the secondary data collection, academic content existing today was used, in specific, academic papers, journals, company reports and other studies.

3.2.2. Online benchmark

The quantitative data from the study was collected through online searches on studies done for collecting information from the Insurance industry and the use of Artificial Intelligence.

The information was extracted from the Insurance Europe website, the Narrative Sciences survey in 2018 and the International Data Corporation.

3.3. Primary Data Collection

3.3.1. Interviews with Industry professionals

In-depth semi-structured interviews were conducted with industry professionals and a total of four experts from Insurance, Technology and Engineering were interviewed. From the Insurance industry, the objective was to understand the market dynamics, customer's needs and behaviors and how AI policies would affect the industry. For Technology and Engineering, professionals working with Artificial Intelligence were interviewed in order to assess the feasibility and requirements of this type of innovation, as well as the effect of this disruption in insurance.

It consisted in semi-structured questions and the interviews were in person.

3.3.2. Online Survey

The online survey was an instrument to collect qualitative data to better understand European respondents' perception about Insurance, their motivation for acquiring innovative insurance products and their opinion regarding the usage of AI for a personalized policy.

The survey was expected to have a total of 100 respondents, residents in European countries, with ages from 18 to 65+ years old and different occupations. It was shared through Social Media channels.

The survey was analysed with excel, using descriptive statistics.

Chapter 4. Analysis and Discussion

4.1. Short to medium term impact of Artificial Intelligence in Insurance in Europe

4.1.1. The European market

Worldwide insurance premiums have been increasing (Insurance Europe, 2019) but the state of the European market registered a slow growth and weak performance during the last 5 years, with decreases in the annual gross written premiums between 2012 and 2017 of -0.5% for life insurance and -1,2% for non-life insurance (EY, 2019).

In 2018, the European market corresponded to 31.6% of the total global insurance premiums, total premiums increased 6,2% and total claims and benefits paid grew 3,1% in comparison to 2017 (Insurance Europe, 2019).

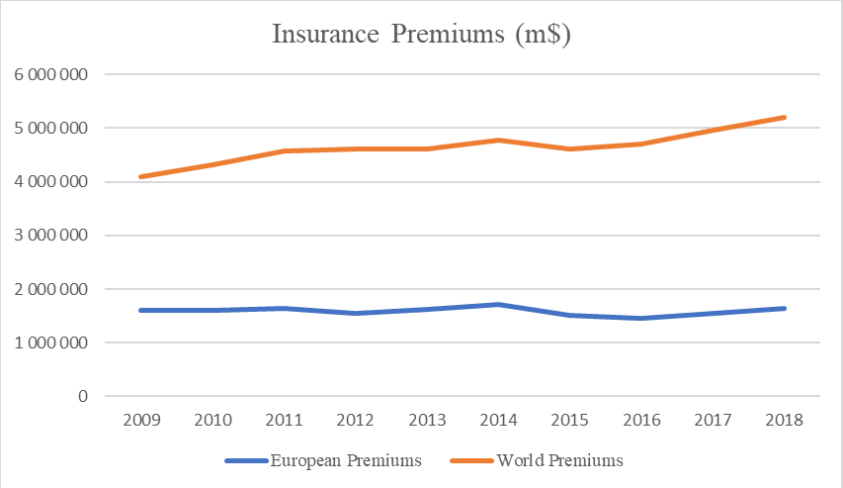

Figure 1 - Source: Insurance Europe 2019

Life Insurance was the segment with the highest premiums and claims paid. In Europe, on average €2.170 was spent *per capita* in insurance, from which 1264€ was in Life insurance, 238€ in Motor, 232€ in Health and 174€ in Property (Insurance Europe, 2019).

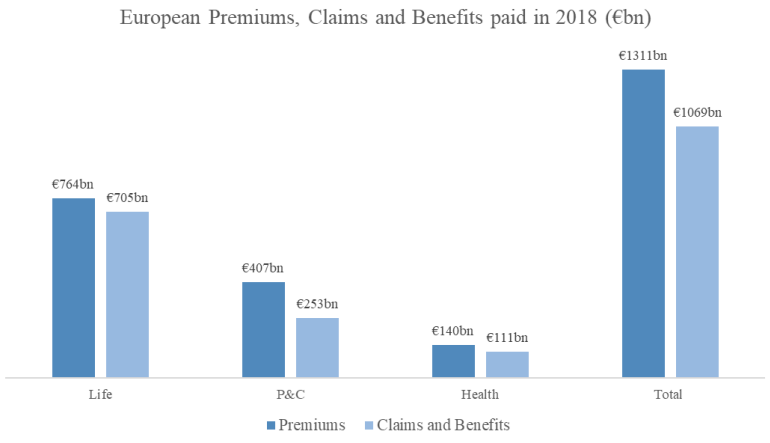

Figure 2 – European Premiums, Claims and Benefits paid in 2018

The European countries with highest total premiums written in 2018 were the United Kingdom, France, Germany and Italy (Statista, 2019).

Economic conditions had a strong effect on the performance of non-life insurances over the last years, and insurers must adapt to customer's expectations and innovate in operations by making use of Big Data, analytics and AI (EY, 2019).

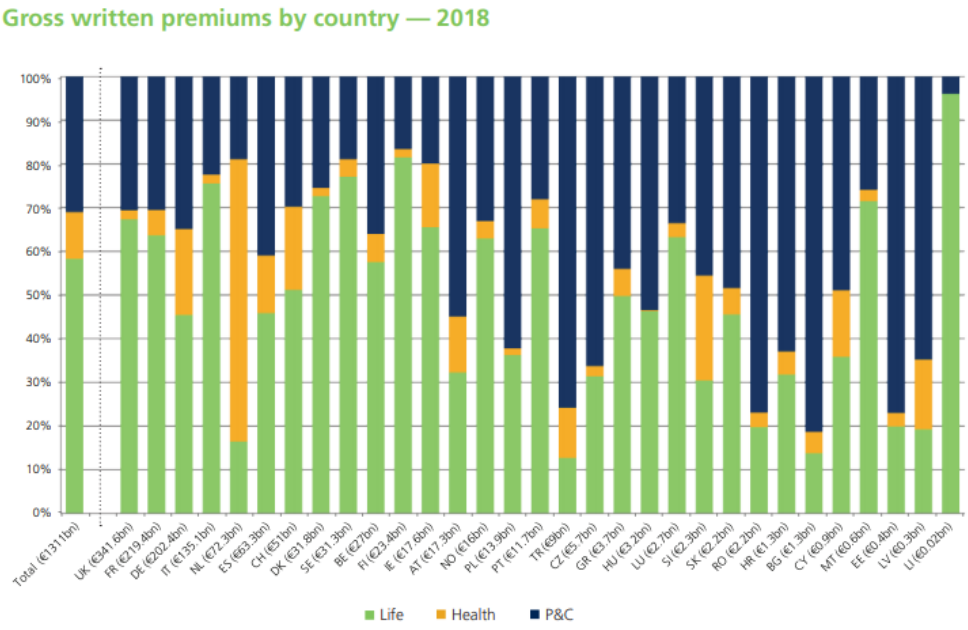

Figure 3 - Source: Insurance Europe 2019

4.1.2. Ownership of insurance policies

Most European residents own at least one type of insurance (84%) and the survey results shown that the categories with more policyholders are Health, Auto, House/Property and Life insurance (Appendix 3). The main reason for not owning any insurance is because it is considered as too expensive (Figure 4).

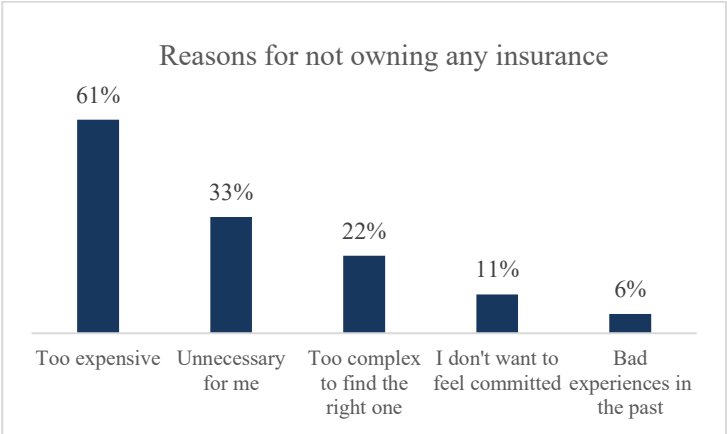

Figure 4 - Reasons for not owning an insurance

The most important insurance categories for European respondents were Health (4.58 out of 5), Auto (4.34) and House/Property (4.26). The categories Life (3.82), Personal Accident (3.62), Pets (2.93), and Technological Items (2.14) had lower scores. Furthermore, the insurance industry was considered by European respondents as traditional, useful, apathetic, expensive, relevant, complex and more untrustworthy than trustworthy (Table 2).

How would you describe the Insurance industry?

Classification	**Innovative**	**Traditional**
%	21%	79%
Classification	**Useful**	**Useless**
%	88%	12%
Classification	**Empathetic**	**Apathetic**
%	25%	75%
Classification	**Cheap**	**Expensive**
%	12%	88%
Classification	**Relevant**	**Irrelevant**
%	90%	10%
Classification	**Simple**	**Complex**
%	14%	86%
Classification	**Trustworthy**	**Untrustworthy**
%	49%	51%

Table 2 – Characterization of the insurance industry

4.1.3. Personalization of an insurance policy

Different suggestions associated with the personalization of an insurance policy were presented in the survey (Figure 5), and the option with highest interest for European respondents was "I can activate/deactivate it whenever I need/want", considered as Very Interesting, followed by the proposals of "Personalize the extent of services coverage" and "Define the amount I need for my coverage". The option considered less interesting for customers was "Insurers using Artificial Intelligence to know me better", considered Moderately Interesting (2.95).

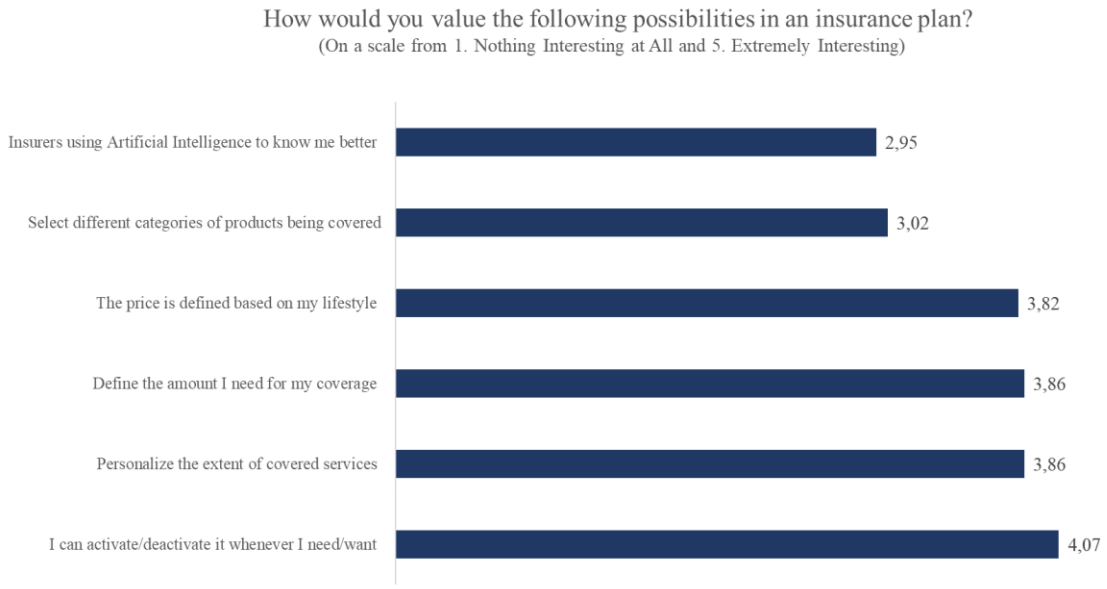

Figure 5 - Suggestions for personalization of insurance

However, when respondents were asked about their level of agreement with the usage of Artificial Intelligence techniques to create personalized insurance policies, the majority of respondents agreed (35%), followed by a neutral opinion (28%).

When asked to consider that a personalized policy made by Artificial Intelligence techniques would be able to define the services coverage based on their lifestyle, having what they need and at a price based on their purchasing power, but it required information about themselves (e.g. information shared online), the majority responded that they still agree (33%) or are neutral (26%) about it. However, negative responses for disagree (20%) and strongly disagree (14%) were also relevant, and it is relevant to highlight that the neutral opinions might be more likely to become a negative position towards this innovation.

4.1.4. Information allowed to be used for personalization of an insurance policy

When respondents were asked about if they would allow or not allow insurers to use certain information about themselves, the most ones that respondents would allow to be used is their physical activity, driving behaviour, eating patterns and shopping behaviour. The information that they would definitely not allow insurers to use would be photos of themselves and social media activity (Table 3). This information could be gathered mainly though their smartphones, devices for health monitoring, car sensors and fitness trackers (Table 4).

Information that European respondents would allow to be used for personalization of their insurance (% of respondents)	
Would Allow	**Would Not Allow**
Physical activity (67%)	Photos of themselves (87%)
Driving behaviour (65%)	Social media activity (75%)
Eating patterns (54%)	Social life habits (67%)
Shopping behaviour (41%)	Other behaviours (e.g. Smoking) (51%)

Table 3 - Customer's information to be used in insurance

From the following devices, which ones would you allow to share information for AI processes? (% of respondents)	
Smartphone	55%
Devices for health monitoring (e.g. blood pressure wristbands)	52%
Car sensors	35%
Fitness trackers	34%
Computer	29%
Payment methods	24%
Smartwatch	22%
Clothing with sensors	14%

Table 4 - Devices for data collection

4.1.5. Regulation applied to insurance in Europe

- **Regulation against discrimination**

The United Nations declaration of human rights banned discrimination based on identity (race, gender, nationality and others) and after 2014, it was stablished the directive 2004/113/EC for equal treatment of men and women, stating that the use of gender as an actuarial factor cannot influence individuals' premiums and benefits in insurance (EUR-Lex, 2004).

Although European citizens have the right to equal treatment, the European legal framework defined exceptions to this right, stating that financial products' prices (e.g. insurance) can vary by person based on age and health status, due to the Ex-ante profiling, that is related to actuarial factors (Finance Watch, 2019). Premiums must be set when clients acquire the insurance and the health status can only be discriminated in the moment of acquisition, and it cannot be changed due to health aggravation or diseases acquired after it (Interview B).

The Ex-ante profiling is a process that evaluates personal information to define a profile that corresponds to a specific level of risk based on probabilities, instead of on the actual costs incurred, and that the profile justifies the difference in the premium price (e.g. younger drivers paying more). The Ex-ante differences in insurance premiums are discriminative when they are based on identity characteristics and if differences in premiums allow some customers to

receive more economic benefits than others (Finance Watch, 2019).

The Ex-post differences in the insurance premiums based on behavioural factors are discriminative when they are not calculated based on the actual damages incurred. The analysis of customers behaviours should be severely regulated in order to avoid discriminative treatments and exclusions and should be done to guarantee the minimum access to the insurance needed to participate equally in society (Finance Watch, 2019).

Connected devices or cars used to innovate in insurance should be strictly used to allow discounts in premium prices and to guarantee the minimum insurance needed (Finance Watch, 2019).

- **Regulation for Data Privacy**

Insurers understand the importance of data protection, as data processing is an important part of their business, in order to analyse the risks that individuals want to cover and tailor their products based on it, for evaluating and paying customer's claims and benefits and for detecting and preventing fraud (Insurance Europe, 2019).

In May 2018, the General Data Protection Regulation (GDPR) has been implemented in Europe and insurers must consider it when making strategic decisions (EY 2019). The GDPR's concepts and requirements had to be clarified through guidelines and some of these have not been finalised yet, including the ones in regards to codes of conduct, that would facilitate insurer's compliance with GDPR with guidance on processing data and guarantees to consumers on how their data is being processed (Insurance Europe, 2019).

When it comes to the dualism between GDPR and innovation in insurance, the guidelines may prevent the development of innovative products based exclusively in automated techniques (e.g. real-time insurance through mobile phone apps) (Insurance Europe, 2019).

Companies in Europe have been limited by the GDPR for innovation, and if they want to create a personalized policy for their customers based on their data, according to this regulation, the data cannot have any type of PII (personal identifiable information) and documents cannot have anything that identifies customers as an individual, know what they are doing, in order to tailor their insurance based on it (Interview C).

4.1.6. Research Question 1: What is the impact that AI will have in the Insurance industry in Europe?

In 2019, Western Europe will be the second largest region with highest spending in AI (IDC, 2019). These new technologies are originating a digital change and bring new regulations, which will be a challenge for regulators, as insurers may be quicker to innovate than they can define new regulations (EY, 2019).

Regulation restricts innovation due to the burden and risk aversion that it has and there is a risk of regulators banning the use of technologies that they do not understand, leading insurers to limit innovations in areas prone to be legislated in the future. Yet, regulators in Europe are trying to adapt to technological changes (EY, 2019).

One of the most challenging regulation that has been applied in a European level for all industries was the General Data Protection Regulation, but despite this regulation, customers are willing to share data and insurers must focus on creating new flows of data and create data lakes to be used for improving their business (EY, 2019). The GDPR law will not be limitative if consumers know what their data will be used for and give consent (Interview B).

Having one to one policies can harm some clients due to their data, resulting in offering better or worse insurances. Public opinion is very sensitive to this kind of topics nowadays (Interview C) and as a result, the data cannot be used to harm consumers, but for giving benefits (Interview B).

European respondents would be willing to share their data from their smartphones, devices for health monitoring, car sensors and fitness trackers, and a solution that insurers could use to gather data with compliance with the GDPR could be creating new services and apps related to sports, health monitoring or driving behaviour, for instance, to complement their insurance and add value for customers.

Another limitation is regulation against discrimination in insurance. The EU law does not consider a price discriminative if the premiums are proportionate to the specific level of risk and the statistical data on which actuarial calculations are based is reliable (Finance Watch, 2019). However, according to the law, connected devices can only be used to guarantee discounts in premiums, and it can be a barrier for insurers to use it to personalize the whole policy.

Furthermore, the financial services sector in Europe, including insurance, has been gradually deregulated by the European Union to create a single European market (Fenn et al, 2008). In the future, this flexibility in regulation in EU countries could be applied in favour of the

disruption of a market of one in insurance.

According to the survey results, European customers would be willing to have personalized policies created by AI, and the top three categories that respondents would prefer for these innovative policies would be Health, House and Life (Appendix 5).

European governments are receding from providing pensions, health insurance and other services, and the ratio of government spending to GDP decreased from 50.1% in 2009 to 45.8% in 2017 (EY, 2019). Furthermore, in the future, life insurance may have the opportunities from the retreating role of the state and the growing need for individuals to guarantee their own retirement savings and income (EY, 2019).

As a result, these changes can be an opportunity that European insurers can tackle to innovate in their life and health insurance, with new offers for attracting new clients or improving its products for existing ones.

European insurers have been sluggish in adapting technology-enabled transformation and a solution may be partnering with InsurTechs for distribution and innovation (EY, 2019). The impact of the disruption of policies created by AI would be an added value for European policyholders and an opportunity for insurers to be more innovative and aligned with customers' expectations. However, European insurers must bear in mind the influence of the existing regulations, especially the most recent GDPR, and the possibility of new ones, which may be the biggest threat for the full effect of this disruption in the European market.

4.2. The future of the Insurance industry with the impact of AI

4.2.1. The current state of Artificial Intelligence

Artificial Intelligence is the capacity of a machine to perform tasks similarly or better than a human. Worldwide investment made in AI is expected to reach $79.2 billion in 2022 with a 5 years CAGR of 38% between 2018-2022 and Western Europe will be the region with highest investment in this technology (IDC, 2019).

Industries worldwide are being disrupted by technological advances, which comprises solutions based on Artificial Intelligence, that are being implemented by 61% of the companies interviewed by the Narrative Science in their businesses to leverage new opportunities that digitalization brings, such as new business opportunities (Narrative Science, 2019)

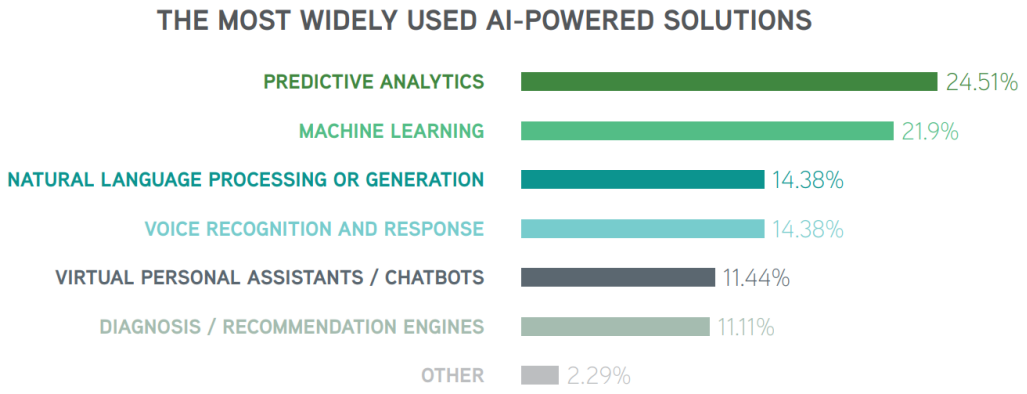

Figure 6 - Source: Narrative Science 2019

The respondent companies exposed that the benefits from using AI in their businesses are for "identifying business opportunities", "automating repetitive tasks", "improving workforce productivity" and "competing with peers" (Narrative Science, 2019).

4.2.2. Insurance state and main challenges

The insurance industry is growing worldwide and the improves on the financial results from insurers have been supported by a sustained economic growth, increasing interest rates and higher investment income, which will be the tendency on the following years (Deloitte, 2019).

The concept of insurance has been evolving over the years and insurers have an urge to rethink it, in order to keep aligned with the changes in customer's lifestyles and behaviours. This is conveying new risks and insights for insurers, incentivizing them to adapt their offers and rethink their business models (Interview A).

One of the challenge in insurance is the longevity of population, that is increasing the number

of diseases and the rise of costs in the health sector, which brings more expenses for insurers (Interview A; Interview B).

Customers are also more concerned with being healthier and make more use of their health insurance. In addition, they are more conscious about the environment and living a sustainable life, changing their mobility behaviours with new solutions that are less harm (e.g. shared scooters) and with other means of transport to avoid using private cars (e.g. uber).

There are different motivations for acquiring and using an insurance. In the case of the job accidents and auto insurance, it is mandatory by law and policyholders hope not to use it, but in the case of health insurance, consumers expect to make use of it more often (Interview A).

For younger customers, it is necessary to find new business models, as these generations want on demand services and show a tendency for being more conscious regarding where they spend their money. Hence, insurance must be accessible, make sense for their needs and add value (Interview A).

In insurance there are few points of contact and insurers observe a detachment from clients, resulting in a need to improve their service and increase engagement with customers (Interview B). Lastly, there has been a rise of new competitors from other sectors, other than financial ones, and it will bring one of the main changes in insurance, due to their disruptive business models. These competitors are native from the internet and digital services, have data from customers that can be leveraged and are willing to innovate in new services with shorter margins, to assess if they make sense for their business (Interview B).

All these new trends are resulting in new information for insurers, that will be a challenge when calculating premiums, as these are typically based on historical data (Interview A).

4.2.3. Stakeholders in insurance

In Insurance, there are several stakeholders with different importance and involvement. Starting with the Primary Stakeholders, the most prevailing are the Insurance Companies, as their acts influence all the other stakeholders involved. Secondly, the end consumers (policyholders), that may change the way they consume insurance policies due to the changes in the industry. Thirdly, the Regulators (e.g. European Union), that regulate insurers in a national, European and worldwide level. Fourthly, brokers and agents, as the way they sell insurance policies may change or be substituted. Lastly, the InsurTechs that came into the market with disruptive business models.

The secondary stakeholders are the employees, reinsurers, banks, firms and health providers.

4.2.4. How to create an insurance policy personalized by Artificial Intelligence - Technical Models

The creation of a personalized policy would be possible either by a Supervised Learning or Unsupervised Learning. The first one requires a training set based on past data with customer's characteristics and insures do not own it.

The Unsupervised Learning would require going beyond the basic information that insurers own and having a rich characterization of the person. The hardest part is to understand what the person effectively likes and doing the match between the policy created and the person. There is no training set with this type of personalized policies to be used in the system, as insurers only sell a set of generic policies (Interview D), and to tailor an offer based on a person's lifestyle and behaviours, it is necessary to have data and insurers would need to work in new actuarial and risk models (Interview B).

To create a personalized insurance policy, it requires a mechanism to generate policies with several parameters to create an infinite number of policies, an algorithm of parametrization to accept the generated policy and the person due to risk evaluation and create the training set to train the system (Interview D).

Algorithms work through the data and try to replicate the past, and to implement AI solutions on companies it is necessary to have data and some difficulties may be creating it and training the systems (Interview C). As insurers do not own the training set, some suggestions to create it are:

1. **Doing questionnaires with customers and simulating the past (Interview D):**

A way to create a training set would be simulating the past and doing questionnaires with customers to assess their preference from a set of possible policies. This way, it would be possible to create a personalized set of information to train the systems and for algorithms to learn from it, and insurers would know which policy a person with determined characteristics would prefer. If a person would choose its policy from an infinite possibility of policies, it could be used in the future for the system that would learn to offer policies to people.

2. **Create the training set with the help of agents and brokers (Interview D):**

In order to assess what their customers would want based on agents and brokers' experience and make a hypothetic generation of people with certain policies to evaluate it.

In the future, AI could collect additional data from customers and do non-trivial data mining to obtain further information about customer's preferences. The key information is the type of policy that the person wants and is the most difficult to obtain.

3. **Doing questionnaires exclusively for new policies:**

A third option could be implementing this strategy only for new customers who want to acquire a personalized insurance. This way, it would be possible to create their profiles with information provided by themselves in a questionnaire and adapt the policy over the times with AI and the data that they share from their devices and apps.

4.2.5. Limitations of Artificial Intelligence

Nowadays it is possible to understand the content of a text through AI, but that is not possible to do causality and make a reasoning of it. Companies can only be better in detecting patterns, not relating them (Interview C).

For Natural Language Processing, the results in English are better than in other languages because it is an easier language in the grammatical point of view and because there exists more noted data (Interview C).

4.2.6. Barriers for personalization of policies

- **Mutualism in insurance**

Mutualisation of risks is a key principle in insurance and any acts that reduce or limit it should be restricted to fair and relevant purpose and the differences in prices should incentivise less risky attitudes and increase the contribution of policyholders that had higher damages (Finance Watch, 2019).

The evaluation of risk of a person must be done in a cautious way, as it can result in policies that are impossible to afford for some consumers, because they need it and will have to cover their costs (Interview B).

- **Bias and ethical issues**

Machine learning has each time more utility but it is crucial to think about the ethical questions and the bias that might be registered in data. Algorithms learn from this data and in order to avoid having biases embedded, insurers must decide if they want to use the data as it is or apply techniques to change it. To change bias, companies must get the algorithm, clean or remove some data and add new falses to balance, so some variables are not statistically significant (Interview C).

Having one to one policies can harm some clients due to their data, as their insurance may be better or worse based on it (Interview C).

- **Data privacy**

One of the new strategic technology trends that will impact enterprises in 2020 (Appendix 12) is Transparency and Traceability, as the evolution of technology is originating a trust crisis, caused by customers becoming more aware of how their data is being collected and used and how companies are gathering and storing this data. Another issue comes associated with legislation such as the GDPR, that is having impact worldwide in organizations (Gartner, 2019).

- **Regulation in Insurance**

Regulation will be the main barrier for innovation in insurance with personalized policies created by AI. Firstly, for creating this kind of policy, it would require data from customers that may be hard to access due to the GDPR, especially in a European level. Secondly, according to the Ex-ante moral hazard, the differences in premiums cannot depend on identity factors and the Ex-post states that differences in premiums cannot give economic benefits to some customers based on their behaviours (Finance Watch, 2019).

4.2.7. Possible scenarios

Three possible scenarios to evaluate the impact of the disruption of policies created by AI in the insurance industry were created based on players' reactions and past actions, secondary research done and calibrated with expert interviews insights. Scenarios were attributed equal weights and calibrated to assess its likelihood to happen (Table 5).

Three Possible Scenarios				
Role		**Pessimistic**	**Neutral**	**Optimal**
Primary Stakeholder 1	**Insurers**	Loss of market share and impossibility to create personalized policies using AI and customer's data	Synergies with InsurTechs and Start-Ups enable to create personalized policies	Tech driven game, volume of insurance policies sold increases and margins tend to zero
Primary Stakeholder 2	**Policyholders**	Migrate to other alternative players (e.g. InsurTechs)	Maintain loyalty as custumers and seek for new innovations in insurance, as well for new categories	Stay with the same insurer and buy from new insurance categories, acquiring only personalized policies
Primary Stakeholder 3	**Regulators**	Regulation will forbid insurers from using data from their customers due to discrimination and data protection rules	Maintain current GDPR rules and laws against discrimination in insurance, but with possibility of higher flexibility	Incentives to modernization to boost economic growth and adaptation of current legislation
Primary Stakeholder 4	**Agents and Brokers**	Inadaptation to technology and the job is still indispensable to sell the products	The job is partially substituted as customers do not need the guidance to acquire the most suitable insurance and acquire through remote channels	Cross selling products with their expertise. In some insurers, the job will disappear, as acquisitions will be all remote
Primary Stakeholder 5	**InsurTechs**	Become Market Leaders	Just another player in the market. Possibility of being acquired by insurers or leveraged for business and product developments	Merge with insurers and improve performances
Secondary Stakeholder 1	**Reinsurers**	The premium prices that insurers will need to pay to reinsurers gets extremely high, as the risk of personalized policies is also higher	The initial premiums paid to reinsurers will be high, but as personalized policies get more on demand, the risk starts decreasing, as well as premiums prices	The risk of having personalized policies created with AI is low and the price paid from insurers is affordable
Secondary Stakeholder 2	**Banks**	Inadaptation to selling personalized policies. Some banks start selling InsurTechs solutions	Banks complement the acquisition of new insurance categories	The role of banks for selling insurance disappears
Secondary Stakeholder 3	**Firms**	Firms buy from InsurTechs their insurance alternatives	Firms start buying insurances to have with their products or services being sold	The majority of firms add the possibility of adding a personalized insurance to their products/services sold
Secondary Stakeholder 4	**Employees**	AI substitutes several jobs	Personalized policies require adaptations from several departments, as it is a completely new solution	The increasing revenues from this innovation benefits employees
Secondary Stakeholder 5	**Health Providers**	Costs from the health sector keep rising and the costs for insurers increasing	Personalized policies increase the number of policyholders with health insurance and helps to balance the rising costs for insurers	Health providers benefit from personalized policies due to the increasing number of new customers
Influencer 1	**Technology providers**	Shape disruption and extremelly difficult for implementation	Insurers can adopt these technologies into their strategies	Provide better services, softwares and borrow licences
Likelihood to happen (%)		30%	50%	20%

Table 5 – Likelihood of possible scenarios

Negative scenario

In a negative scenario, regulation will entirely prohibit insurers to make use of Artificial Intelligence to leverage customer's data in order to create the most suitable policy for them. The reasons are due to data protection and discrimination regulations that would make this innovation impossible to be implemented. Policyholders would also feel uncomfortable to have their data being used, being conscious about the risk of getting worst insurance premiums based on their lifestyle.

InsurTechs would revolute the market, especially for younger generations and firms, as these offer innovative insurance solutions that correspond to customer's expectations, such as some existing options in the market for usage-based insurance or micro coverage insurance, for example.

Positive scenario

In a positive scenario, insurers will adopt these innovations onto their strategies, premiums will increase and customers will be willing to share their data with insurers in order to get the insurance that suits their needs.

There is an increase of competition, the volume of policies sold increase and margins decrease to zero. Companies have access to a clients' database to get the right quotation and it starts a Tech Driven game, in which the insurer that is able to get the best offer and price is the one who will get customers.

As customers get more demanding and premiums are decreasing in Europe, regulators get more flexible in the regulation applied to insurance.

Policyholders would not switch for Start-Ups or InsurTechs because they trust on the traditional insurers' expertise. Agents and brokers will disappear and stop having preponderance, as customers would not need their expertise to buy the most suitable insurance.

4.2.8. Research Question 2: How is this industry going to look like in the future, once this disruptor has taken full effect?

Neutral scenario

Based on the past and current actions in the insurance industry, the most possible consolidated scenario to happen is the neutral one.

The Insurance industry has been already impacted by AI in several areas, such as fraud detention and claims processing. The insurance model will change substantially with new alternative players with disruptive business models and one of the main challenges in insurance is a tendency for industries to merge and consolidate and get insurance on demand. The new competitors from other fields have data from consumers, experience on the internet and can risk by entering in new markets with lower margins to evaluate its success (Interview B).

Insurers must seize opportunities by expanding their products portfolio based on the new trends in the market and increase their revenues with new products that will be less profitable on the beginning, as well as with new proposals to complement the existing ones (EY, 2019). Artificial Intelligence can be leveraged in insurance for being better at reaching segments, stablishing patterns and designing the insurance, as it brings better accuracy with less time of analysis, when compared to traditional models (Interview A).

Creating a personalized policy with Artificial Intelligence will be challenging, as it requires a

data set with characteristics from policyholders, and insurers still do not own it and will have to create it (Interview C). Besides, the most difficult task will be doing the match between the person and the insurance created and understanding what the person exactly likes to create the most suitable insurance (Interview D).

The three methods to create the data set could be (1) doing questionnaires with customers and expose them to a set of possible policies to assess which ones they would prefer, (2) creating the data set with the help of brokers and agents' expertise from their clients (Interview D) or (3) a third option could be implementing this strategy only for new policies and new clients, starting with questionnaires to build their profile.

Another opportunity may be using the data being generated from connected devices, that has been emerging, allowing companies to have a better understanding of clients and that can result in new product categories, more personalized prices and real-time service delivery. If a wearable device is connected to an actuarial database, it could calculate the client's risk score based on his daily activities and assess the probability and severity of potential events (McKinsey&Company, 2018).

In insurance, the amount of data being generated will lead to a necessity of creating open source protocols and data ecosystems, in order to guarantee that data can be shared and used across different industries and for different uses under a common regulatory and cybersecurity framework (McKinsey&Company, 2018).

Nevertheless, using customer's data and devices can only be used for benefiting customers and decreasing their premiums, so insurers must start by leveraging AI for adapting their offers to customers and reward them for their good behaviours, such as rewards or cashback to benefit policyholders for their good and less risky behaviours (Interview B).

Personalization of policies with AI will be accepted by customers but markets must move toward the same direction, so prices can be fair to avoid unbalance of the portfolio and guarantee the mutualism (Interview B). Moreover, it must be done in a midterm way, so the ones with less risk can subsidize the others with higher risk, otherwise clients would not be able to afford it. Artificial Intelligence will help to test and improve models and policyholders would want this personalization to be better served and to cover the risk they may have, knowing that the co-payments will be fair (Interview B).

The values that are most associated with an insurance purchase is price and the variety of services covered (Appendix 6), supporting the idea that personalization could be leveraged for these two factors.

The insurance industry is slower than other industries in making significant steps in the Artificial Intelligence field (EY, 2019), and traditional insurers will take longer to adopt this innovation and due to regulatory constraints it can be more difficult to make significant changes. Traditional insurers will also risk less because they already have a portfolio of clients, there is higher risk aversion due to uncertainty and the impact on revenues would be bigger than for start-ups and InsurTechs, that are gathering new clients and can test new models (Interview B). InsurTechs still do not address the whole value chain, only specific points such as claims management, which gives insurers a bigger opportunity in this field.

Talent is another cause of the main reasons for insurers to take longer to make significant steps, and new types of skills around data manipulation, analytics and other advanced technologies are needed (EY, 2019). It is becoming easier to implement AI solutions in companies, but it requires someone who understands about Machine Learning and Natural Language Processing, because there is the risk of companies applying algorithms without understanding the theory behind and the impact it will have (Interview C).

For the disruption of policies created by AI, some of the existing limitations can be mitigable. Starting with the limitation of data privacy, it can be surpassed with the fairness of the data being shared and having the agreement of clients for using their data for this purpose. The mutualism concept can be adapted if markets move towards the same direction, but there must be a way to avoid having some clients who could not afford it. The bias and ethical issues can be changed when building the data set. Finally, the regulation regarding the discrimination can be a roadblock and may take more years to be changed. However, if data proves that men have more accidents that women, for instance, using gender as an actuarial factor may be in the future not so discriminative and this limitation could be more easily surpassed.

With this disruption, the impact on agents will be more notorious than on brokers, because when prices and products get more easily compared, clients won't need advice so frequently. An example is the UK, where the number of acquisitions through the internet is increasing substantially. Brokers lead with big companies, in which risk evaluation is more difficult and options are not so easily compared (Interview B).

Leveraging AI and Machine Learning for reinventing products and business models will be key for insurers to be successful in the future (EY, 2019). The ideal future scenario of the insurance industry would be having bigger customization of offers, with products more directed to personal necessities, as well as having the possibility to go beyond traditional insurances, and using AI to have a personalized policy would be an interesting innovation (Interview D).

It is important to understand the potential of innovative and scalable solutions. In the future, once the disruptor has taken full effect, there are several alternatives on how the state of the insurance industry will evolve.

Some insurers are already creating ecosystems with relevant services to get customers more engaged, which can be a strategy to overcome the detachment from clients and be a source of customer's data. As a result, Artificial Intelligence can be used to make the necessary changes in the policy premium, based on data that proves these less risky behaviours from policyholders. For this, there would be a standard price of the existing policy that would be the maximum that customers could pay. The premiums would decrease based on customer's behaviours, having the guarantee of fairness from the data shared and would avoid having discrimination among customers.

Traditional insurers could also start by offering more options that some InsurTechs already have, such as the possibility of activate/deactivate their insurance, as this option was the one with highest preference in the survey. Furthermore, the options of selecting the services coverage based on what they need and the capital available would also be an added value for customers.

A more disruptive strategy would be some insurers selling B2B products, in which insurers would have a broker role, instead of selling to final customers. With this strategy, insurers would offer personalized products or services for companies, as a complementary product with standalone value (e.g. travel insurance personalized for the person).

Creating a tailor-made insurance with AI can be challenging and take some years, and insurers should start by testing new models to ensure that this strategy may be fully possible one day. As with Machine Learning it is still not possible to do causality with the data, in a short term these policies may be more basic and require some human expertise. For this, brokers and agents will be extremely necessary to adapt the created policy by AI with the opinion and acceptance of the customer about it. Additionally, for results in English it will be easier and faster to be implemented.

For executing the strategy of a market of one, insurers should stablish synergies with InsurTechs, to get access to their expertise in offering solutions that are more differentiated in the market and due to their lower burden of regulation applied.

Chapter 5. Conclusion

In the future, the concept of insurance will change substantially and traditional insurers must adapt to the changes originated from the technological advances and in customer's needs and lifestyles.

Insurance is a highly regulated industry and is considered as expensive, traditional and with low engagement by its customers. The response to the Research Question 1 is that the impact of AI policies in a European level will be made more difficult. European respondents would be willing to have this type of personalization and it could be a way to tackle the respondents who stated that they do not have an insurance because it is too expensive or unnecessary for them (Figure 4). However, due to the hurdle of the recent GDPR law, regulation will be the limitation that will be more difficult to mitigate.

In addition, to create a policy using Artificial Intelligence, it is necessary to have a data set with information from customers that would be used to design the most appropriate policy, based on the customer's exact needs. For this, several strategies can be taken, such as doing questionnaires with customers or with the help of brokers.

For Research Question 2, in a worldwide scale, the disruption of AI policies would be faster to be implemented. Traditional insurers will take longer to adapt this innovation due to the higher risk aversion related to regulation and to the portfolio of existing customers, as the impact in revenues of new innovations will be higher. However, partnering with Start-Ups and InsurTechs can be a strategy to improve and find new solutions to keep aligned with the demand for higher customization of polices. Additionally, it will be necessary to create protocols and data ecosystems to guarantee that data can be used and shared. Artificial Intelligence has still some limitations and for insurers working in English it may be faster to implement a market of one strategy, due to the higher amount of noted data and because it is an easier language.

In the future, insurers must be able to rethink their mutualism models and strategies in order to stay competitive with the new entrants in the market. For this, it is essential to develop services and ecosystems that improve the engagement with customers and that will be the source to get access to customer's data.

Telematics is already being used in car insurance, with a concept of "pay as you drive", in which premiums are based on the driving behaviour. It is a good indicator that other categories can move towards the same direction and use sensors to monitor customer's behaviours. InsurTechs also offer a concept of Usage Based Insurance and micro coverage insurance for technological items that be activated/deactivated, for instance, being one of the possibilities that European

respondents value the most.

A market of one in insurance policies can harm some clients due to their data, and it can be an obstacle. Public opinion is aware of these topics nowadays (Interview C) but if it is used for benefiting customers, it will be accepted (Interview B).

To conclude, the initial strategy should be doing adjustments in the premium paid based on customer's behaviours and with additional features for the insurance (e.g. possibility to deactivate it or change some coverages), because according to the current law, connected devices can only be used to benefit customers and reduce premiums.

However, in the future, insurers could develop to a more sophisticated model that would encompass the definition of the whole policy, but traditional insurers would need to move towards the same strategy and regulation would have to adapt to the changes that the advances in technologies and customer's expectations would bring.

Limitations and future research

Some of the limitations regarding the execution of this study are related to the primary data generated. The survey conducted had a preponderance of Portuguese respondents in the sample and there is also a higher percentage of younger respondents. The survey might have also some positive bias, regarding the characteristics associated with the insurance industry and the ownership of insurance categories that may be different in some countries or age ranges. For future research, it could be done a survey more unbiased and with more representation of different European countries. In addition, to assess the effect worldwide, it would also be interesting to do a survey with different countries across the world.

The semi-structured interviews were all with Portuguese expects and it was difficult to access foreign experts to participate in the study. For future research, having experts with different nationalities would also be an added value.

Moreover, doing a focus group with insurance customers and non-customers would be a way to present the idea of a personalized policy and understand the reaction and acceptance of customers in real time.

Since it is an innovation in insurance, there is still not much content regarding using AI for personalizing an insurance policy, and there are more studies related to using this technology for claims processing, fraud detention or automatizing tasks.

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Appendices

Appendix 1 - Survey

1) Do you own any type of insurance?

- ○ Yes
- ○ No
- ○ I don't know

Display This Question:

If Do you own any type of insurance? = No

1.2) If not, what are the main reasons?

- ☐ Too expensive
- ☐ Unnecessary for me
- ☐ Too complex to find the right one
- ☐ Bad experiences in the past
- ☐ I don't want to feel committed
- ☐ Other _____

Display This Question:

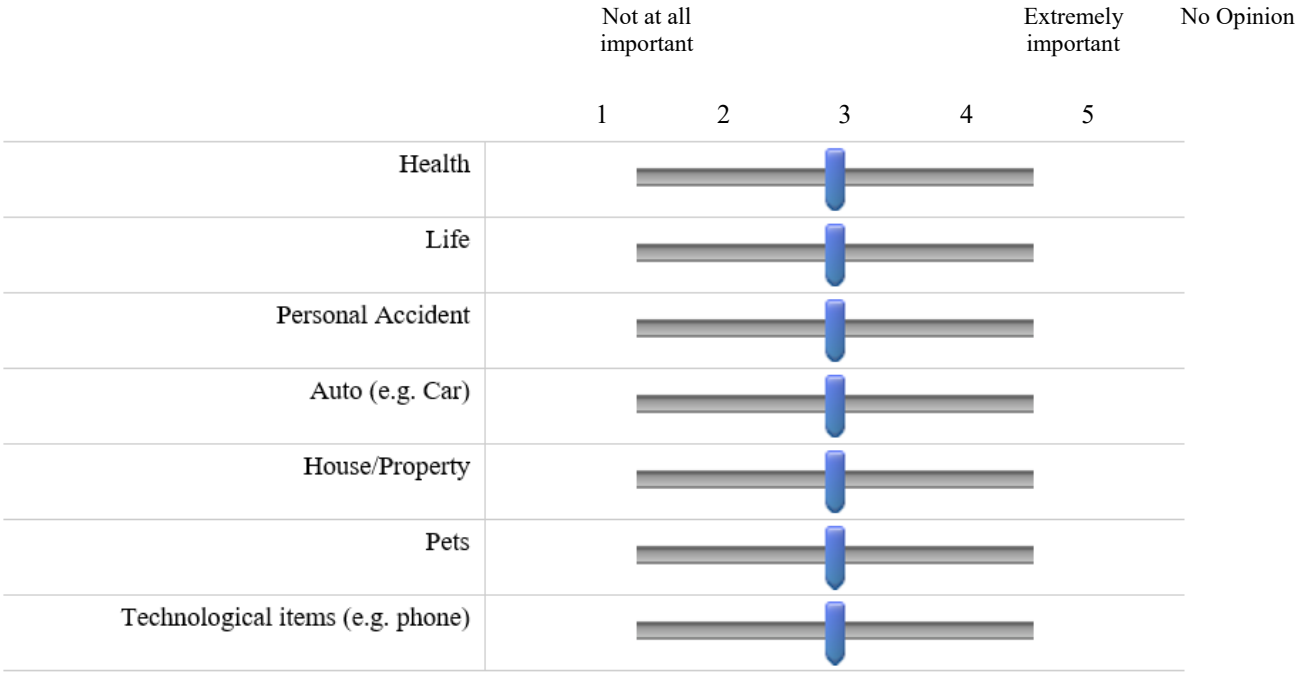
If Do you own any type of insurance? = Yes

Or Do you own any type of insurance? = I don't know

1.2) What type of insurances do you own?

- ☐ Health
- ☐ Life
- ☐ Personal accident
- ☐ Auto (e.g. car)
- ☐ House/Property
- ☐ Pets
- ☐ Technological items (e.g. phone)
- ☐ None

2) How would you classify the importance of the following insurance categories?
(On a scale from 1- Not important at all to 5- Extremely important)



3) How would you describe the insurance industry?

Please select the most appropriate	○ Traditional	○ Innovative
Please select the most appropriate	○ Useless	○ Useful
Please select the most appropriate	○ Empathetic	○ Apathetic
Please select the most appropriate	○ Cheap	○ Expensive
Please select the most appropriate	○ Irrelevant	○ Relevant
Please select the most appropriate	○ Simple	○ Complex
Please select the most appropriate	○ Trustworthy	○ Untrustworthy

4) What do you value when buying an insurance plan? Please order by importance

_____ Brand/Company
_____ Price
_____ Being in the same policy/plan as my family
_____ Variety of services covered
_____ Budget available for covered services
_____ Additional services available (e.g. health insurance with telemedicine)
_____ Having all my insurance plans in the same company

5) Now imagine you can have an insurance plan made specially for you.
How would you value the following possibilities in an insurance plan?

	Not interesting at all	Slightly interesting	Moderately interesting	Very interesting	Extremely interesting
Personalize the extent of covered services	○	○	○	○	○
Define the amount I need for my coverage	○	○	○	○	○
The price is defined based on my lifestyle	○	○	○	○	○
I can activate/deactivate it whenever I need/want	○	○	○	○	○
Select different categories of products being covered (e.g. phone, cameras, hair dryers)	○	○	○	○	○
Insurers using Artificial Intelligence to know me better	○	○	○	○	○

II. Insurers are using Artificial Intelligence (AI) to improve their businesses. This includes using AI techniques to know their customers better in order to personalize insurance offers.

6) To what extent do you agree with the usage of Artificial Intelligence techniques to create personalized insurance policies?

- ○ I Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

7) Now consider that a personalized policy made by Artificial Intelligence techniques would be able to define the services coverage based on your lifestyle, having what you need and at a price based on your purchasing power.
To do this, insurers would need information about yourself (e.g. information you share online).

To what extent do you agree with it?

- ○ I Strongly Disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly Agree

8) Which of the following information would you allow to be processed by Artificial Intelligence in order to personalize your insurance?

Driving behavior	○ Would not allow	○ Would allow
Social life habits	○ Would not allow	○ Would allow
Physical Activity	○ Would not allow	○ Would allow
Eating patterns	○ Would not allow	○ Would allow
Photos of myself	○ Would not allow	○ Would allow
Shopping behavior	○ Would not allow	○ Would allow
Social Media activity	○ Would not allow	○ Would allow
Other behaviors (e.g. smoking)	○ Would not allow	○ Would allow

9) From the following list, please order by which categories you would prefer to have a personalized insurance offer, created by Artificial Intelligence.

_____ House/Property
_____ Personal accident
_____ Auto (e.g. car)
_____ Life
_____ Pets
_____ Technological items (e.g. phone)
_____ Health

10) The devices you use are constantly generating information about yourself.
From the following devices, which ones would you allow to share information for AI processes?

- [ ] Smartphone
- [ ] Smartwatch
- [ ] Computer
- [ ] Car sensors
- [ ] Fitness trackers
- [ ] Payment methods
- [ ] Clothing with sensors
- [ ] Devices for health monitoring (e.g. blood pressure wristbands)

11) Gender

- ○ Male
- ○ Female

12) Age

- ○ 18 - 24
- ○ 25 - 34
- ○ 35 - 44
- ○ 45 - 54

- ○ 55 - 64
- ○ +65

13) Country

_____

14) Occupation

- ○ Student
- ○ Employed
- ○ Working Student
- ○ Retired
- ○ Unemployed
- ○ Other

15) Household composition

- ○ 1
- ○ 2
- ○ 3-4
- ○ 5-6
- ○ >6

Appendix 2 - Survey Sample

The survey was active for 10 days and was accessed by 206 participants. Partially finished surveys and responses from individuals living in countries outside Europe were not considered for the analysis, leaving a sample of 138 respondents.

Respondents were Female (62%) and Male (38%), living in nine European countries – Portugal, Germany, Austria, The Netherlands, Scotland, Italy, England, Ireland and Belgium. Ages varied between 18 and 65 or above years old.

The majority was Employed (60%), followed by Students (19%), Working Students (13%), Retired or Unemployed (2%) and Other (5%). Household composition varied between 3 and 4 people (48%), followed by 2 persons (22%), 1 person (15%), 5 to 6 persons (14%) and more than 6 persons.

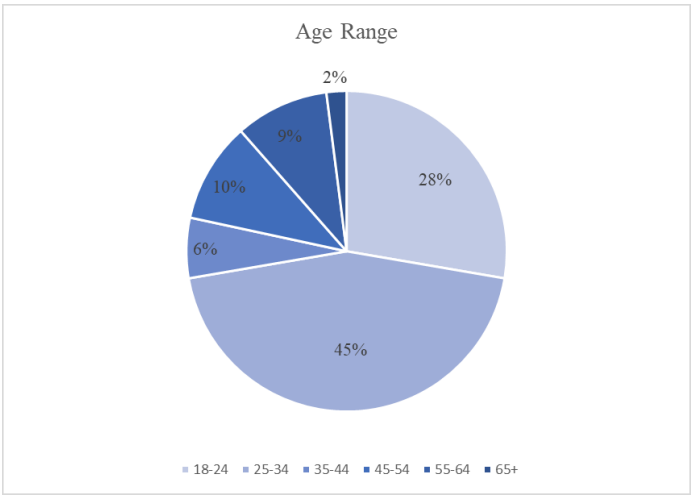


Figure 7 – Survey Age Ranges

Appendix 3 – Ownership of insurance

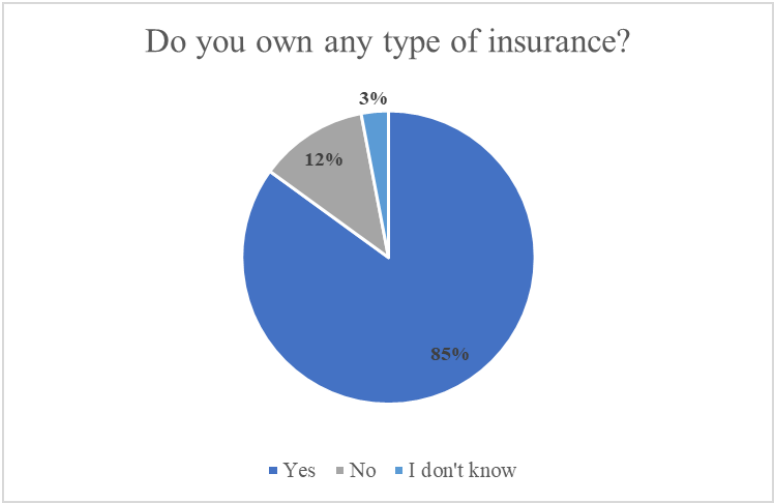


Figure 8 – Ownership of Insurance

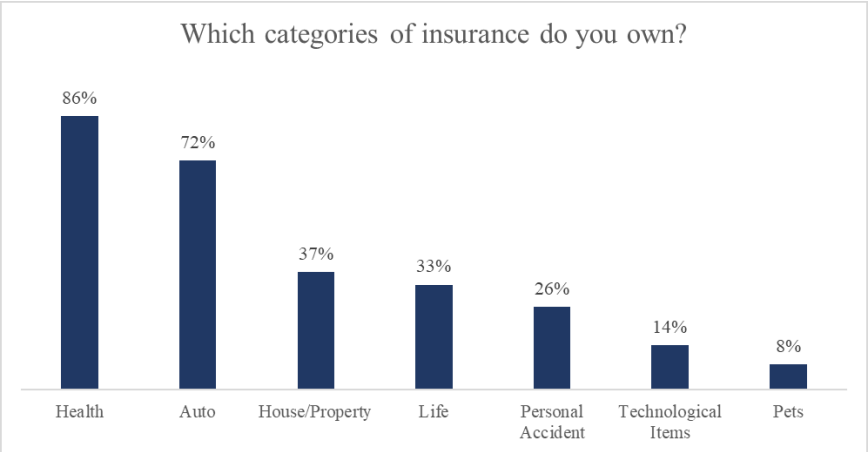


Figure 9 – Insurance Categories Own

Appendix 4 – Importance of insurance categories

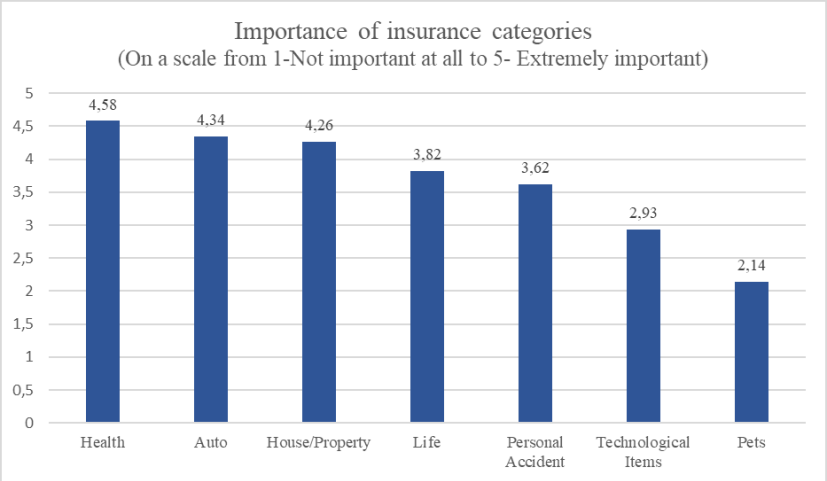


Figure 10 – Importance of Insurance Categories

Appendix 5 - Ranking of respondents preference order for personalized policies created by Artificial Intelligence:

1) Health
2) House
3) Life
4) Auto
5) Personal Accidents
6) Pets
7) Technologic items

Appendix 6 - The values that are most associated with insurance purchase by importance

1) Price
2) Variety Of Services Covered
3) Brand/Company
4) Budget Available For Covered Services
5) Being In The Same Policy/Plan As My Family
6) Having All My Insurance Plans In The Same Company
7) Additional Services Available (e.g. Health Insurance With Telemedicine)

Appendix 7 - Expert Interview Multicare I

Date: 30th October 2019 | **Duration:** 45 minutes

Expert: Interview A | **Company:** Multicare Health Insurances (Fidelidade) | **Position:** Health Knowledge Management Director

The insurance concept has been evolving over the years. Insurance policies and premiums are based on the probabilities of risks for a group of people having determined claims. Having risks without probabilities would mean that insurers would need to charge clients the amount that they would effectively use. There is a principle of mutualism, in which insurers mutualize the premium that each person pays.

The insurance industry is going through a moment in which there is an urge to rethink it, in order to respond to changes in people's lifestyles. Hence, insurers are rethinking the mutualism model based on this trend.

Some of the main challenges in this industry is the longevity of population that is causing an increase of diseases and consequent costs. As premiums are based on historical data and customers' behaviour over times, in the future it might be a challenge to calculate premiums, as these trends and costs are still new for insurers.

Another challenge comes with changes in customer's mobility behaviours, that seek to be healthier and better for the environment. This is generating new risks for the auto insurance, as people find new ways of transport (e.g. shared scooters or uber instead of private car). In these new means of transport, the risk of accidents increases and there is a higher exposition to personal accidents.

Some years ago, some activities were excluded from insurances because they were too risky. Nowadays, insurers are responding to customer's behaviour and adapting their personal accidents insurance to support expenses that incurred from their lifestyles.

Regarding the creation of a personalized policy by AI, it is very difficult to design an insurance for an individual, with specific coverage and capitals. The commercial approach could be based on segmentation, responding to group needs, otherwise prices would be impossible to afford. Artificial Intelligence can help to reach these groups, as it brings a more efficient capacity to stablish patterns and design the insurance. Traditional models for data analysis are inferior in terms of time and accuracy of analysis, when compared with AI.

Insurance categories have different utilization and motivation to acquire. In the case of auto insurance, customers avoid the need to use it and have claims, but in health insurance, customers

seek to get healthier and use it more often. Job accidents and auto insurances are mandatory and defined by the law, and there is a tendency for acquiring what the law determines. Regulation borders these insurances as customers tend to acquire what is defined by law. Insurers must be able to understand their differentiator factors, how to add value and go beyond the law.

In the case of house insurance, it must be adapted to age ranges' needs. For instance, younger generations are probably more interested in technological issues, while older generations concern more about security issues.

In health insurance, the grace period might be a barrier to get new clients, because an insurance is for a probability and not for an assurance of disease.

There is an increasing necessity to respond to client's expectations and purchasing power. Insurers must be able to build the public opinion about the differentiator value of insurances being more expensive.

For younger generations, it is necessary to find new business models, as they are more conscious about their money and want on demand services. Processes to acquire an insurance are still complex and should also be more remote. Insurances must be accessible, make sense for their needs and add value.

Appendix 8 - Expert Interview Multicare II

Date: 13th November 2019 | **Duration:** 30 minutes
Expert: Interview B | **Company:** Multicare Health Insurances (Fidelidade) | **Position:** Head of Business Development

One of the main challenges in the insurance industry is the detachment from clients, as it is an industry with few points of contact, which is leading insurers to improve service excellence, customer experience and increase engagement. In health insurance, one of the main issues is the rise of costs in the health sector, that bring more costs for insurers. Rewards, benefits or cashbacks can be a way to attract new customers, regarding their good and less risky behaviours.

New competitors from other sectors, other than financial ones, will impact this industry and bring the biggest changes. The insurance model will change substantially, and there will be new alternative players with disruptive business models. There is a tendency for industries to merge (e.g. Google or Amazon offering insurance) and to get insurance on demand, as these companies already have access to their clients and are natives from the internet and digital services. Besides, they have data from customers that can be leveraged and are willing to have new services, with shorter margins and experience new innovations to assess if they work, as

insurance is not their focus of activity.

Mutualism is fundamental to have a balanced portfolio of clients, so some customers can cover the costs that others will have. Having the most appropriate evaluation of risk for a person would be good for the insurer and the client, but it must be done in a cautious way, because it can be too expensive for those who really need and will have to cover the costs.

There are some limitations for innovation in insurance and in Portugal the premium must be set when clients acquire the insurance and cannot depend on gender to guarantee fairness. For health insurance, the only discrimination is the health status in the moment of acquisition and cannot be affected due to health aggravation or diseases acquired throughout life.

Using Artificial Intelligence for proposing the best insurance model for the person being well covered can help sustainability in the industry but must be made in a balanced way. Tailoring the offer based on the person's lifestyle and behaviours would be a big step, and for that data will be needed and insurers would need to work in new actuarial and risk models.

To gather additional data, if people give consensus and know what their data will be used for, the GDPR law would not be so limitative. However, the data cannot be used to harm clients, but for giving benefits, and if AI is used to benefit customers it will be less problematic.

The flexibility of personalized policies by AI will be accepted by clients, but markets will have to move towards the same direction, so prices can be fair to avoid unbalance of the portfolio and maintain the mutualism concept. Policyholders would want this personalization to be better served by the insurance, covering the risks that they can have, as they would know the risk they have and be certain that the policy will cover any accident and that the co-payments would be fair.

However, this innovation must be a midterm, so the ones with less risk can subsidize others with higher risk, otherwise these clients could not afford the insurance. In this sense, data and Artificial Intelligence will help a lot, for testing and improving new models.

Traditional insurers will take longer to get to these new models and will risk less, when compared to Start-Ups and InsurTechs, because they already have a portfolio of clients and there is more risk aversion due to uncertainty. These new competitors are gathering new clients from the beginning and can test models and change, as the impact on revenues is not big.

Regarding brokers and agents, the impact on agents will be more notorious because if products and prices get easily compared online, clients won't need advice so frequently. For instance, in the UK the number of direct acquirements online is increasing substantially.

Brokers lead with big corporates and risk evaluation for each is more complicated and options

are not so easily compared. As a result, brokers are more needed to know what the company needs and won't be so affected by this innovation.

Appendix 9 - Expert Interview Unbabel

Date: 31th October 2019 | **Duration:** 30 minutes
Expert: Interview C | **Company:** Unbabel | **Position:** CTO

Nowadays it is easier to understand the content of a text through Artificial Intelligence but there is still no semantic context. It is not possible to make a reasoning about it and do causality, and it is still in a lot of investigation. Companies can only be better in detecting patterns, but not in relating patters between them.

Natural language processing varies with the language and results in English are still much better than in others, as English is easier grammatically and there exists more noted data.

Algorithms work though data and try to replicate the past. Each time more it is easier to implement AI solutions in companies, but it is also needed to have someone who understands about Machine Learning and Natural Language Processing, because sometimes companies apply algorithms without understanding the theory behind and the impact it will have. Furthermore, to implement these solutions, it is necessary to have data and some difficulties might be associated with creating it and training the system. If a company has a specific problem and there are a data set for it, it can train and apply it. In opposition, if there is no data set for it, it is necessary to think on how to create it, which data will be available for training, which ones will be noted, among others.

In the insurance case, if there is a set of policies and insurers want to forecast if they should cover a service or not, the problem must be solved by using the past history of policies in which the coverage was offered and the company knows if the result was positive or negative, and forecast if "yes" or "no".

One to one policies' have the risk of ethical questions associated. Machine Learning has each time more utility in everything, but it is crucial to think in the ethical issues and in the bias of data that might have been registered. If companies want to do an algorithm that will forecast something, there is the option to use data as it is, and keep discriminating people with determined characteristics, or rebuild the data from the past, applying techniques to change it. The algorithm will learn what is in data and companies must define if they want to learn what the past was or build a better future scenario and if they want to have positive bias or not.

Past data has information associated with race, gender, among others, and validations done

nowadays have these biases associated. The way to change bias is to get the algorithm, look at the data, clean or remove some data and add new falses to balance, so that some variables are not statistically significant anymore. There are cases in which bias make sense to enterprises and it will depend on what they want to do.

In order to define the insurance premium based on a person's characteristics, insurers can use data from the past and do something fairer. It is important to think about the privacy laws, for example, the GDPR. In Europe it can be a barrier to create a product because according to this regulation, the data cannot have any type of PII (personal identified information), and documents cannot have anything that identifies people as an individual, know what they are doing and give a worse insurance policy based on that.

Insurers have a lot of internal data that can be leveraged to use, and private data have to be discovered. Having one to one policies and harm some clients due to their data won't be positive and public opinion is very sensitive to this kind of topics nowadays.

Appendix 10 - Expert Interview IST

Date: 12th November 2019 | **Duration:** 40 minutes
Expert: Interview D | **Company:** Instituto Superior Técnico (Engineering University) | **Position:** University president, author and investigator

In order to create a personalized policy using AI, there must be a parametrized mechanism to create products, a way to evaluate the risks inherent, a combination of the risks of the various coverages and a way to make the matching of the policy with the characteristics of the person.

Doing the match between the policy and the person is the most difficult task, because there is no training set with this type of personalized policies to be used in the system, as insurers only sell a small set of generic policies.

There are two ways to create a personalized policy with Artificial Intelligence: through Supervised or Unsupervised Learning. Supervised Learning must have a training set based on past data from customer's characteristics and insurers do not have it, since the data from customers is very basic and the policies' offers is few.

This type of personalization of policies using AI would be an Unsupervised Learning and won't be easy to implement. It requires going beyond basic information, having a rich characterization about the person, and understanding what the person likes is the main challenge.

A way to overcome it would be simulating the past and doing questionnaires with customers to assess what they would prefer, from a set of possible policies, to create a personalized set of information to train the systems and for algorithms to learn from it. This way, insurers would

know which policy a person with determined characteristics would prefer.

Starting with questionnaires, in future years, Artificial Intelligence could collect additional data from customers and do non-trivial data mining to obtain more information about what they are interested in. Besides the characteristics of the person or family, the key information for the training set is essentially the type of policy that the person wants, which is an information that is difficult to obtain.

Hence, to create personalized policies, it would require three mechanisms: a mechanism to generate policies with several parameters to create an infinite number of policies, an algorithm to parametrization to accept the generated policy and the person due to the risk evaluation, and lastly create the training set, to train the system.

If a person would choose its policy from an infinite possibility of policies, it could be used in the future for the system that would learn to offer policies to people. Part of the problem is not the learning, but the mechanism to obtain the training set, to further generate policies and parameter by costs, benefits, among others.

Another way to create the training set would be with the help of agents and brokers from insurers, to assess with them what would their customers want, based on their experience, to make a hypothetic generation of people with certain policies and further evaluate it.

Some problems that might rise is regarding risk evaluation of policies that can lead to exclusions and regarding client's privacy and discrimination.

It is important to take into consideration regulation, such as laws against discrimination in insurance and individuals defence in insurance. The GDPR may be a problem because gathering data from certain sources is a usage that may violate this law. Unless people gave explicit consensus, it would be data that would be used for other objectives and were not ceded.

Personalized policies with AI could be applied to all categories, especially personal and family insurances, because it would combine diverse types of categories and that would be the added value.

As an insurance customer, in the next 5 or 10 years, the insurance industry should have bigger customization of offers, with products more directed to personal necessities, as well as having the possibility to go beyond traditional insurances, and using Artificial Intelligence to have a personalized policy would be an interesting innovation.

Appendix 11 - Main challenges in Insurance

The insurance concept has been evolving over the years and insurers have an urge to rethink it, in order to keep aligned with the changes in customer's lifestyles. Hence, insurers are rethinking the mutualism model (Interview A).

Customers are changing their lifestyles, which is conveying new risks and insights for insurers, incentivizing them to adapt their offers and rethink their models (Interview A). Customers are more concerned with being healthier, making more use of their health insurance. In addition, customers are more conscious about the environment and living a sustainable life. Their mobility behaviours are changing, with new solutions that are less harm (e.g. shared scooters) and other means to avoid using private cars (e.g. uber). In contrast, these new trends are resulting in new information for insurers, that will be a challenge when calculating premiums, as these are typically based on historical data (Interview A).

For younger customers it is necessary to find new business models, as these generations want on demand services and show a tendency for being more conscious regarding where they spend their money. Hence, insurance must be accessible, make sense for their needs and add value (Interview A).

One of the main challenges in this industry is the longevity of population, that is increasing the number of diseases and the rise of costs in the health sector is bringing more expenses for the insurers (Interview A; Interview B).

There are different motivations for acquiring and using an insurance. In the case of the auto insurance, it is mandatory by law and policyholders hope to not use it, but in the case of health insurance, consumers expect to make use of it and use it more often. Job accidents and auto insurances are mandatory and defined by law, and insurers must be able to have a differentiator factor and add value, so customers can go beyond the mandatory insurances (Interview A).

The detachment from clients is another challenge that the industry is confronting, due to the few points of contacts, that make insurers need to improve their service and increase engagement with customers (Interview B).

In addition, there has been a rise in new competitors from other sectors and will be one of the main changes due to their disruptive business models. These competitors are native from the internet and digital services, have data from customers that can be leveraged and are willing to innovate in new services with shorter margins, to assess if they make sense for their business (Interview B).

Appendix 12 – Gartner's new strategic technology trends that will impact enterprises in 2020

One of the new strategic technology trends that will impact enterprises in 2020 is Transparency and Traceability, as the evolution of technology is originating a trust crisis, caused by customers becoming more aware of how their data is being collected and used and how companies are gathering and storing this data. This trend requires the elements of trust related to ethics, integrity, openness, accountability competence and consistency and another issue comes associated with legislation such as the GDPR, that is having impact worldwide in organization's rules (Gartner, 2019). Artificial Intelligence security is also considered a trend for 2020, as involving technologies, besides offering transformational opportunities for businesses, also create security vulnerabilities. Security teams must be aware of these challenges, and act for example by protecting AI-powered systems (Gartner, 2019).