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The business opportunities of implementing wearable based products in the health and life insurance industries

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ABSTRACT

Title: The business opportunities of implementing wearable based products in the health and life insurance industries.
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The ability to collect biometric data continuously was recently enabled by the development and massification of wearable technologies - computers that are incorporated into items of clothing and accessories which can be worn on the body - unlocking huge opportunities for health and life insurers. Although a great deal of research has been done regarding the technical aspects of these devices, very few works explore the business and managerial implications of implementing wearables into insurance products. Through the combination of secondary data and in-depth expert interviews, this work analyses the impact of wearables and wearable data in the insurance value chain, identifying the main opportunities and challenges to leverage such a technology.
This research concludes that in spite of the current narrow use of wearable devices as engagement tools in insurance wellness programs designed to drive user loyalty, this technology has the potential to accelerate the underwriting process, support preventive care, expand the customer base, enable dynamic pricing and enhance the customer experience as part of a connected health ecosystem. Customer adoption, data privacy and legislation are some of the main obstacles for insurers to leverage this technology, on top of the necessary IT infrastructure and data management capabilities which insurers are acquiring mainly through partnerships with innovative players.
By implementing wearables technologies, health and life insurers may benefit from reductions in operational costs, new revenue streams and ultimately gains in competitive advantage.

SUMÁRIO

Título: As oportunidades de negócio de implementar a tecnologia dos wearables em produtos de seguro nas indústrias de saúde e vida.
Autor: João José Rego Barbosa.
Palavras-chave: Wearables, Seguros de Saúde, Seguros de Vida, Cadeia de valor da indústria de seguros.

A recolha contínua de dados biométricos foi recentemente possibilitada pelo desenvolvimento e massificação dos wearables – computadores incorporados na roupa e acessórios que podem ser vestidos – que representam uma grande oportunidade para as seguradoras de vida e saúde. Apesar de já existir bastante pesquisa sobre os aspetos técnicos destes dispositivos, o mesmo não se verifica ao nível do negócio e da gestão, na implementação de wearables na indústria seguradora. Através da combinação de dados secundários e entrevistas a experts da indústria, este trabalho analisa o impacto dos wearables na cadeia de valor das seguradoras, identificando as principais oportunidades e desafios da sua implementação.
A pesquisa conclui que apesar da atual aplicação dos wearables ser limitada, visto que são utilizados como pontos de contacto com o consumidor em programas de bem-estar promovidos pelas seguradoras para reforçar a lealdade à marca, esta tecnologia tem o potencial para acelerar a subscrição de seguros, promover ações de cuidado preventivo de saúde, expandir a base de clientes, possibilitar a prática de preços dinâmicos e melhorar a experiência do consumidor integrados num ecossistema conectado de saúde. A adoção, a privacidade de dados e a legislação são alguns dos principais obstáculos aquando da implementação destes dispositivos, a par da infraestrutura de TI e capacidades de gestão de dados que as seguradoras têm adquirido maioritariamente via parcerias com novas empresas.
A implementação dos wearables pode assim contribuir para a redução de custos operacionais, criação de novas fontes de receita e ganhos de vantagem competitiva para as seguradoras.

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LIST OF ACRONYMS

(In order of appearance)

IoT	Internet of Things
LR	Literature Review
CAGR	Compound Annual Growth Rate
PPG	Photoplethysmography
ECG/EKG	Electrocardiogram
METs	Metabolic Equivalents
EE	Energy Expenditure
UBI	Usage-Based-Insurance
PAYD	Pay-As-You-Drive
PHYD	Pay-How-You-Drive
P2P	Peer-To-Peer
HR	Hear Rate
GDPR	General Data Protection Regulation
AI	Artificial Intelligence
CVC	Corporate Venture Capital
IM	Intrinsic motivation
EM	Extrinsic motivation
MGA	Managing General Agents
BM	Business Model

CHAPTER 1: INTRODUCTION

1.1 Background and problem statement

The phenomena of digitalization – the integration of the analogue and digital worlds through technologies – has disrupted many industries over the years (Kane, Palmer, Phillips, Kiron, & Buckley, 2015). While insurance is being disrupted by new technology-driven entrants (Jubraj, Watson, & Tottman, 2017), industry experts argue that the degree of disruption is yet small comparing to the susceptibility of future disruption (Abbosh, Moore, Moussavi, Nunes, & Savic, 2018; Mueller, Naujoks, Singh, Schwarz, & Schwedel, 2015). No insurance company was able to fully harness the potential of digitalization yet (Tanguy; Catlin, Lorenz, Sternfels, & Willmott, 2017).

One of the main drivers of disruption has been the increasing availability of personal data, which can enable insurers to better predict risk and price accordingly (McCrea & Farrell, 2018). Among the novel emerging data sources there is the Internet of Things (IoT), a network of intelligent devices connected via the internet (Madakam, Ramaswamy, & Tripathi, 2015). Among them, there are smartphones, connected cars and the interest of this study, wearable technologies. While the concept of "Quantified Self" – self-knowledge through numbers – proposed in the early 2000s (Wolf, 2009) seemed only accessible to a few, in 2018 178 million wearable devices where shipped globally. This number is expected to more than double by 2022 (Gartner, 2018). Wearables unlock multiple ways to monitor health and therefore represent an unprecedent opportunity for life and health insurers in the way they relate to their customers and assess risk (Quah, 2018).

The problem statement to solve is the business opportunities of wearable technologies in the life and health insurance industries.

1.2 Aim and Scope

The overarching goal of this dissertation is to make a comprehensive assessment of all the dimensions in which wearables can affect the life and health insurance businesses. To achieve that, a thorough analysis is made, firstly to wearables from the technological perspective, secondly, to the business opportunities that wearables represent to insurers, thirdly, to the challenges inherent to implementing such a technology and finally, to the distinct ways in which insurers are integrating it.

The following research questions are addressed:

RQ1: What are wearable technologies?

RQ2: What opportunities do wearable technologies present to life and health insurers?

RQ3: What are the current challenges wearable-based insurance products face?

RQ4: How are insurers incorporating wearable technologies in their products?

1.3 Research methods

In order to answer the research questions presented in the previous section, both primary and secondary data were used. The secondary data consists of a revision of the existing academic literature on wearables, from the technological and business perspectives, on insurance and on innovation. Secondary data is mainly used during the literature review (LT) but also to support some of the conclusions. The primary data consists of 9 in-dept interviews with leading experts from the insurance industry, conducted between 23rd April and 9th August 2019. The diversified profile of the participants is aligned with the aim of collecting a broad set of opinions from key stakeholders in the industry.

Thus, this research crosses the academic and business perspectives on the application of wearables in the life and health industries.

1.4 Relevance

(Rothschild & Stiglitz, 2004) noted that not many studies have been made to assess the empirical role of innovation in the financial services industries, in particular, in insurance. (McShane, Cox, & Ge, 2012) suggest that researchers have been overlooking the role of product innovation in financial services because of the difficulty of firms like insurers to build effective barriers to entry, making innovation a profitable behavior. In addition, research on IoT devices has been focusing mainly on technical aspects and less on managerial ones (Kiel, Arnold, Collisi, & Voigt, 2016) and the existing managerial literature has pointed out that identifying the mechanisms in which IoT devices create value for businesses is critical (Metallo, Agrifoglio, Schiavone, & Mueller, 2018).

Wearables have the potential to open a new chapter in the history of life and health insurance. While other insurance markets, such as auto insurance, have been widely studied, even in regards to connected devices (telematics) (Baecke & Bocca, 2017; Desyllas & Sako, 2013; McFall & Moor, 2018; Vaia, Carmel, Trautsch, Menichetti, & DeLone, 2011), research on wearables in insurance is scarce which makes this research relevant not only from its innovative character in academia but also to decision makers in the insurance industry who want to

understand the state of play of this technology and the variables to consider when rolling out such an innovative solutions.

At a broader level, this research also raises important questions regarding data privacy, continuous health monitoring, the quantified self and some of its implications for businesses, all pressing subjects in modern days.

1.5 Dissertation outline

The next chapter presents a LR divided into 4 sections, concerning wearable devices, the opportunities for insurers to implement wearable technology alongside their value chain, the challenges inherent to its implementation and the different paths for its integration. Chapter 3 presents the methodology through which this research will address the research questions. Chapter 4 presents an analysis of the results obtained in the interviews and Chapter 5 concludes with the main insights, the limitations alongside recommendations for further research.

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Wearables

The aim of this section is to provide an overview of wearable technologies, from a product evolution perspective, to main features, market trends and adoption rates.

Wearables fall into a larger network of internet connected devices called IoT (Burgess, 2018). By 2025 there will be more than 50 billion connected devices, a fourfold increase since 2010 (McKinsey & Company, 2019). This technology is being considered so transformative because it allows for the physical world to be transcribed into measurable digital data points which in turn can be used to create value for society in numerous ways.

2.1.1 Wearables definition

Despite the different terminology used alongside the word "wearable" such as "wearable technology", "wearable device" or the commonly used "wearables", all these expressions refer to electronic technologies or computers that are incorporated into items of clothing and accessories which can be worn on the body (Tehrani & Andrew, 2014). Currently, most devices are worn on the wrist, although the technology is available in other forms such as jewellery, glasses, clothing or shoes (Quah, 2018).

The first account of a truly wearable computer came to appear in 1961. The MIT researchers Edward O. Thorpe and Claude Shannon developed a device incorporated into a shoe that could determine with some accuracy where a ball would land on a roulette table. Thorpe reported a 44% increase in winning bets (Winchester, 2015). Since that time, wearables evolved a great deal, but we cannot look at its development in a linear fashion. The devices commercialized today are the result of the evolution and convergence in electronics, communication, computing and display technologies as demonstrated in Appendix 1 (Ballard, 2016).

Between 2006 and 2013, some of the most iconic wearable devices were released, including Nike+, Fitbit and Google Glass. 2014 was considered the year of wearable technology by several media outlets. At CES 2014, the biggest tech fair in the world, wearables were described as the "poster child" of the year (Lanxon, 2014).

2.1.2 Wearables market overview

"Wearables will become the world's best-selling consumer electronics product after smartphones" (Chandran, 2015).

The worldwide wearables sales are expected to grow 11,6% (CAGR) over the next 5 years, reaching about 190 million units in volume and 27 billion + dollars in value by 2022.

Smartwatches and fitness trackers will account for 87.5% of the market share by 2022 (IDC, 2018). In 2017 Apple, the leader in the smartwatch category, sold 16 million Apple Watches while the fitness tracker segment, the second larger, registered 40 million units sold. Fitbit and Xiaomi account for 80% of global shipments. (CCS Insight, 2018).

(A. Spender, Bullen, Hajat, & Altmann-Richer, 2018) divide the market of wearable devices into 3 categories: Wrist-borne wearables; Clothing and shoes and Other wearables including jewellery.

Wrist-borne wearables dominate the market for wearable devices. Average prices range between 30€ and 400€. Appendix 2 provides a list of the top 5 wearable companies worldwide.

Clothing and shoes show great potential due to the frictionless experience they can provide to users (Bell, 2017). While wrist-borne devices can be considered supplementary - one needs to choose to wear them - people can't leave home without clothing or shoes. Under Armour SpeedForm Gemini 3 are a great example of a pair of running shoes which contain an incorporated accelerometer to measure multiple running metrics and Bluetooth connection which connects the shoes to an app in the smartphone and allows for the data to be recorded (Under Armour, 2018). Appendix 3 provides examples of wearable technologies integrated into day-to-day clothing.

Other wearables including jewellery gathers the wider range of commercially available devices which are selectively wearable for specific purposes, mostly related to health and wellbeing, but that many times lack medical approval. OURA ring is a reference in the market for general wellbeing as it combines sleep tracking, activity count and heart rate monitoring with a high degree of fidelity (OURA, 2019). There are also devices specialized in blood sugar measuring for people with diabetes, posture while sitting, among others. Appendix 4 gathers a list of examples.

IoT and Medical Devices are also referenced, but their study goes beyond this research although the potential for these devices to be applied complementary in health and life insurance is worth noting. In case of medical devices in the form of healthcare wearables, they usually require the patient to be in clinical premises so that measurements can be performed and/or are not sufficiently small to be worn comfortably (Abraham, 2016). Ingestibles and embeddables are also excluded as the first consists of a digital tool that is ingested, and the latter is implanted under the skin (Connect2HealthFCC, 2019).

2.1.3 Sensors and Measurements Available

Data is collected continuously via a multitude of sensors and usually stored in a smartphone app through Bluetooth connection. Algorithms are then used to process, analyse and combine the data so that it is transformed into meaningful information. Table 1 presents the different measurements enabled through the sensory data collected. The most common sensors in wrist worn devices are the accelerometer and the photoplethysmography (PPG) (Henriksen et al., 2018). PPG sensors use a light-based technology to sense the rate of blood flow as controlled by the heart's pumping action (Tamura, Maeda, Sekine, & Yoshida, 2014).

The insights stem from a combination of sensory data with algorithms. Appendix 5 presents a collection of measurements enabled by wearables.

Table 1: *List of sensors featured in wearable devices (A. Spender et all., 2018)*

Sensor	**Measures**	**Current Uses**
Accelerometer	3D Movement	Steps, other movement
Compass/magnetometer	Orientation	Direction
EEG biosensor	Brain waves	Sleep
ECG biosensor	Heart performance	Sleep, heart health, fitness
Galvanic skin response	Skin conductance	Stress monitor
GPS	Location	Distance travelled, tracking
Gyroscope	Movement	Activity, use of phone
Hear rate monitor	Heart rate	Sleep, fitness
Oximetry monitor	Blood oxygen levels	Respiratory issues
Skin temperature	Body temperature at surface	Infection

2.1.4 Biometric Data Prediction Capabilities

"Everything that can be measured will be measured" (Kelly, 2016).

This section explores exiting literature concerning the relationship between biometric data and mortality/morbidity risk, to assess the potential usefulness of wearable data for risk prediction.

2.1.4.1 Biometric data: A predictor of mortality/morbidity risk

The World Health Organization recommends that adults aged 18-64 should do at least 7,5 METs/hours [1]per week of moderate aerobic exercise, which includes swimming, mowing the lawn or running (WHO, 2015). Individuals reporting less than the recommended are 20% less likely to die compared to those who report no leisure time physical activity. At activity levels equivalent to one to two times higher than the recommended guidelines, the reduction in mortality risk is 31% (Arem et al., 2015). Across all inactivity levels, individuals who sit more than eight hours per day have higher mortality rates (Ekelund, Steene-johannessen, Brown, & Fagerland, 2016). Thus, research seems to point out to a negative correlation between physical activity and mortality risk.

Step count is one of the main measurements used to assess physical activity by commercially available wearable devices because not only is effective at stratifying mortality risk but can also play an important role as a risk predictor, in particular, in identifying high mortality risk for sedentary individuals (Chefitz, Quah, & Haque, 2018). Higher daily step count is associated with lower all-cause mortality (Dwyer et al., 2015).

Sleep also seems to produce positive effects on mortality risk. Both short (< 5 hours) and long (> 9 hours) duration of sleep are significant predictors of death (Cappuccio, D'Elia, Strazzullo, & Miller, 2010). People who sleep 5 hours or less per night see their mortality risk increase by 10% and at 9 hours per night or more, by 14% (Liu et al., 2017).

2.1.4.2 Are Wearables reliable data collectors?

It seems that metrics such as step count, sleep and physical activity can be used to measure health condition and mortality. However, literature is divided regarding the ability of current wearable devices to provide reliable data compared to measurements done in a clinical setting. Fitness trackers and smartwatch brands have been encouraging research in a quest for medical accreditation and trust from consumers.

Wearables seem to yield strong results in relation to heart rate monitoring and arrhythmias detection, especially when wearable data is combined with analytics engines (Chen, 2018;

[1] Researchers usually use metabolic equivalents (METs) as a measure to compare different types of activity. One MET is defined as 1 kcal/kg/hour and is roughly equivalent to the energy cost of sitting quietly (Ainsworth et al., 1993). 7.5 METs/hours per week is the equivalent of the WHO guidelines. Appendix 6 presents MET-hour equivalents of various physical activities.

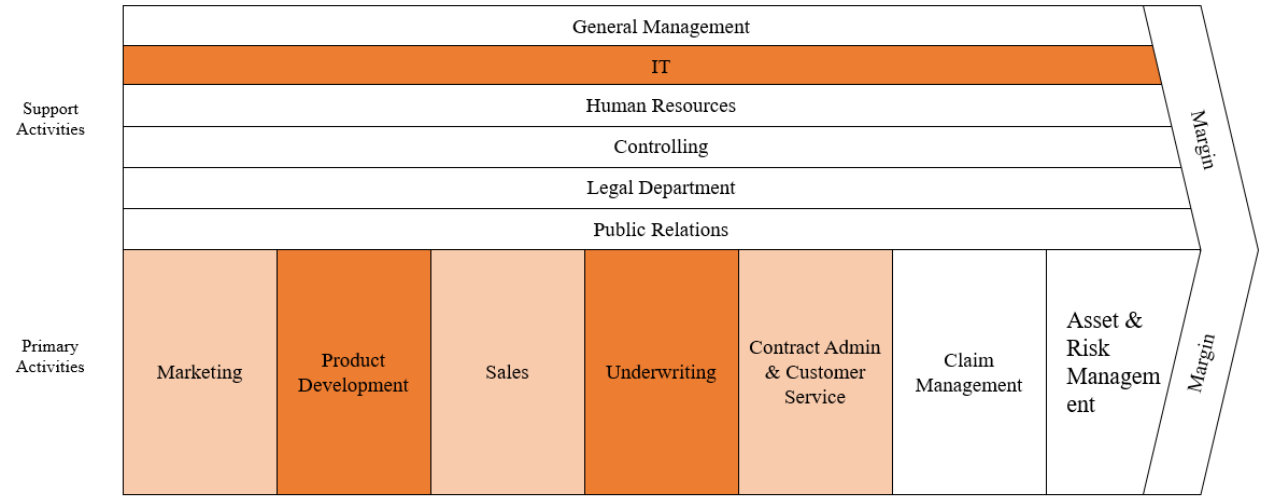
Dunn, Runge, & Snyder, 2018; Wu, Li, Cheng, & Lin, 2016). Energy expenditure (EE) on the other hand, registers errors of at least 20% across devices, especially in high intensity scenarios (Bunn, Navalta, Fountaine, & Reece, 2018; Shcherbina et al., 2017).

Although existent, overall research on the accuracy of wearables is still considered scarce. Wearable manufacturers such as Fitbit seek to provide researchers with the necessary aggregated data so that more studies are done. To date, Fitbit supported 500+ studies (Williams, 2018). Section *2.3.1* will describe some of the data accuracy limitations that wearables present. For now, it's safe to affirm that significant discrepancies between measurements from different devices exist. As well as discrepancies between those measurements made in and outside of controlled scenarios. However, as the technology matures and more research is conducted, we can expect the errors to decrease and the line between medical and non-medical devices to become more blurred (A. Spender et al., 2018).

2.2 Opportunities

This section is dedicated to exploring the business opportunities of applying wearables in insurance. For that purpose, this research recurs to Porter's value chain, a conceptual framework which distinguishes between the primary and supporting activities necessary for a firm to deliver a service or product (Porter, 1985), and in particular, to the insurance specific value chain by (Rahlfs, 2007).

Figure 1: *Insurance-specific value chain based on (Porter, 1985) and (Rahlfs, 2007)*



(Eling & Lehmann, 2018) identified Underwriting, IT and Product Development as the areas where IoT will have direct impact in the value chain. Nevertheless, the following sections also explore how wearables can impact other activities, namely Marketing, Sales and Customer Service. Except for IT, all these activities are primary activities, a strong indicator of the broad yet relevant role wearable devices and wearable data can play in the insurance value chain in the years to come.

2.2.1 Underwriting

Underwriting is used by insurers to assess the potential risk profile of policyholders prior to the policy subscription. Typically, the proponent fills a questionnaire to assess key variables such as age and health records and is assigned a risk level and a standard rate. Proponents with higher risk levels will undergo additional underwriting. A percentage of them will be accepted under non-standard terms (such as additional waiting periods or higher premiums). The remaining proponents will be declined as they represent a risk too high for the insurer to bare (Abraham, 2016; McCrea & Farrell, 2018).

The current process is deemed as slow, costly and with a disproportionate focus on non-standard policy holders compared to the level of scrutiny of standard customers. The value of continuous monitoring far exceeds a filled questionnaire and, in some cases, a medical test, allowing insurers to develop a more granular assessment of risk levels and assign proper rates. Wearable data becomes especially relevant in case of low risk proponents which currently represent a relatively high operational underwriting cost compared to higher risk policyholders (Abraham, 2016; Becher, 2016).

Real-time wearable data combined with traditional underwriting practices enhances both insurers' underwriting capabilities and the customer experience. Appendix 7 depicts the underwriting value chain - data gathered from wearables serves as an input for behaviour-driven models used in submission matching, file setup and information gathering.

Current underwriters only spend a fraction of their time assessing risk because collecting, merging and filling documentation is still done manually in many cases. By considering more data in their analysis, the underwriters will be able to considerably improve performance by making more accurate risk assessments, identifying cross-selling opportunities and retaining existing policyholders, leading to higher profits and lower costs (KPMG, 2017a).

Continuous monitoring not only enhances underwriting processes at the intake but also presents huge opportunities in pricing, another key component of the underwriting value chain, as described in the following section.

2.2.2 Marketing, Sales and Customer Service

Pricing has always been a key ingredient in the marketing mix (Borden, 1964). Pricing is in fact the only revenue generator among traditional marketing elements (LaPlaca, 1997; Shipley & Jobber, 2001). According to (Morris, 1987), *"one of the more basic, yet critical decisions facing a business is what price to charge customers for products and services."* There are several distinct pricing strategies, from cream skimming (Noble & Gruca, 1999) to bundling, promotion or complementary pricing (Gijsbrechts, 1993).

2.2.2.1 Pricing

The classic pricing models and predictive algorithms can be enriched through the integration of new key variables, enabling insurers to reflect changes in consumer's health risk through evidence-based pricing (Capgemini, 2015). Insurers able to exploit this opportunity can identify overpaying/underserved customers with increased accuracy, achieving competitive edge in comparison to players which are not fast enough in updating their prices due to adverse

selection (Cather, 2018). Wearables contribute therefore to reduce information asymmetry between policyholders and insurers. Information asymmetry leads to two classic economic problems vastly studied in the literature, Adverse Selection and Moral Hazard. The next section is dedicated to understanding the degree to which wearables help in solving those issues.

2.2.2.1.1 Adverse Selection

Information asymmetry leads to a problem of adverse selection which in the insurance industry happens when insurers have less information about the risk level of their potential customer than the customers themselves (Akerlof, 1970). High-risk individuals have an incentive to conceal their true risk level so that they can buy insurance at a lower price that their level of risk would presuppose (Cather, 2018).

Typically, insurers protect themselves by reducing their exposure to large claims - limiting coverage or raising premiums. Wearables can enable insurers to reduce exposure by promoting preventive measures based on real time data so that health issues are treated at earlier stages when treatments are cheaper; and by indexing premium amounts to policyholder's behavior.

(Rothschild & Stiglitz, 1976) argued than even in cases where insurers are not able to distinguish between high and low risk customers, customers self-organize themselves by the amount of insurance they buy, signaling the insurer their true risk level. In spite of its strong theoretical support (Dionne, Doherty, & Nathalie, 2000) literature has struggled to find consistent empirical evidence (Cohen & Siegelman, 2010). In the case of wearables, if biometric data is used in the underwriting process, the self-selection mechanism proposed would also be ruled out.

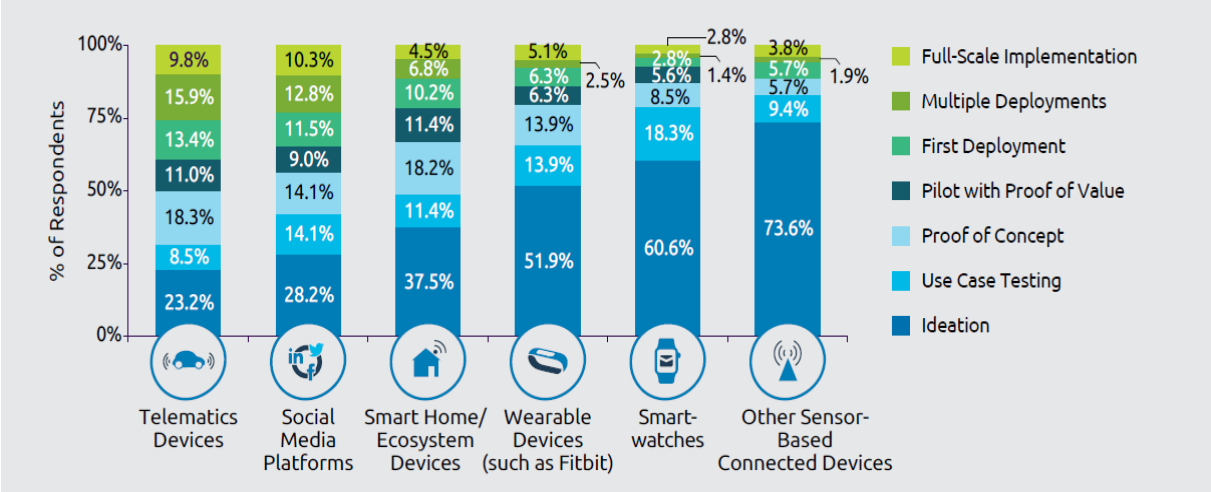
A second line of research on adverse selection focuses on cream skimming. In this situation, adverse selection emerges when an insurer has less information about the risk level of their customers than its competitors. When insurers find innovative ways to incorporate more information about the customer in their pricing models, they are able to outperform competition (Cather, 2018). While the first line of research seems to focus on accurately screening and pricing high risk individuals, cream skimming looks more to how to sustain and capture low risk individuals (Thomas, 2007), suggesting a bigger fit with wearables' characteristics.

2.2.2.1.2 UBI Models

While the deployment of products incorporating wearable data is still low (13.9%), the auto insurance industry is far ahead in the incorporation of real time customer data (39.2% of auto insurers deployed at least one product that incorporates telematics data) (See Figure 2). This

data is used in Usage-Based-Insurance (UBI) programs, which are expected to grow from 4.5 million users in 2013 to 160 million by 2020 (Tselentis, Yannis, & Vlahogianni, 2016). The use of telematics in auto insurance is therefore a good proxy to understand novel pricing models that wearables might unlock.

Figure 2: *Tools for Real-Time Customer-Data Capture: Stage of Adoption (%), 2018 (Capgemini & Efma, 2018)*



The aim of study UBI models is to develop a pricing system which integrates behavioural/exposure data into risk analysis and ultimately charges customers based on that risk (Tselentis et al., 2016). There are different UBI programs: Pay-As-You-Drive (PAYD) is based on driver's exposure to risk. The premium is adjusted according to simple variables like location and distance driven, which makes it easier to implement. Pay-How-You-Drive (PHYD) is based on driver's driving behaviour. The premium adjusts to variables such as breaking intensity or maximum speed per trip, which enables more refined risk assessments (Baecke & Bocca, 2017). Both programs are especially attractive to low-risk drivers (drivers who drive safely and/or don't drive often), but their implementation can also force risky drivers to alter their driving behaviour and access better premiums (Tselentis et al., 2016).

There are several similarities between these models and current wearable insurance applications. Existing insurance wellness programs, like telematics programs, use simple variables to assess risk profiles and drive customer behaviour. In addition, it seems that low risk customers (healthy and active) have incentives to change towards a usage/behavioural based model to access better conditions while riskier customers to alter their behaviour and escape higher premiums. This phenomenon would result in a general decrease in individuals' risk exposure, enabling insurers to decrease premiums and compete for lower risk individuals,

broadening their client base. This conclusion also seems to match the cream skimming thesis described in the previous section.

2.2.2.1.3 Price comparison and switching costs

Even when insurers are able to develop pricing innovations, research has shown that policyholders don't compare prices against competitors too often. They usually stick with their insurance program (Cather, 2018). For consumers to switch, the perceived benefits must outweigh the perceived costs (Laske-Aldershof et al., 2004; Scanlon, Chernew, & R. Lave, 1997). (Duijmelinck, Mosca, & van de Ven, 2015) propose the key determinants that influence switching benefits and switching costs in the health insurance industry (Table 2).

Table 2: *Determinants of the switching benefits and costs (Duijmelinck et al., 2015)*

Switching benefits	**Switching costs**
Price	(Pre-switching) transaction costs
Service quality	(Post-switching) learning costs
Contracted provider network	Uncertainty costs
Benefits of supplementary insurance	Cost of (not) switching to another healthcare provider
(Financial) welcome gift	Sunk costs

Looking into switching benefits, wearables can have a direct effect not only on price but also on welcome gifts, through reward schemes and premium discounts; and service quality, as wearables become an additional touch point during the customer experience. In regard to switching costs, wearables can help customers reducing transaction costs by decreasing the time and effort of searching for alternative solutions, through a push notification suggesting a tailored insurance for one's condition, for example. They can also help reducing learning costs by providing timely information in an intuitive fashion as part of a refreshed customer experience. In case of the costs of (not) switching to another healthcare provider, if the proper systems are in place, wearable data might be transferred seamlessly from one healthcare provider to the other, reducing that burden for the customer.

It appears that wearables have the potential to increase the switching benefits and decrease the switching costs. Thus, they can make a strong case for customers to change insurer.

2.2.2.2 Wellness Programs

Although the impact of wearables in underwriting and pricing seems promising, insurers seem to be focusing their efforts in using wearables and wearable data to increase loyalty. Biometric data is measured, healthy behaviour rewarded, and wearables become a new channel for customer service and cross selling activities. To drive adoption, insurers have been subsidizing or even offering wearables. Customers share the data collected by the device and when some targets are met, are rewarded with vouchers or premium discounts.

John Hancock's Vitaly program launched in 2015 was one of the first programs to emerge as such (Abraham, 2016). The insurer operates in South Africa, the US and Australia and currently offers two modalities: Vitality Go and Vitality Plus. The first has no additional cost for the policyholder which benefits from discounts at Amazon.com, fitness tracker devices and free wellbeing content. Vitality Plus offers a free Fitbit device, enlarged amazon discounts, free access to mindfulness and meditation apps or discounts in healthy food from a network of +16,000 grocery stores, including Walmart (John Hancock Insurance, 2019). Originally targeted to younger and healthier consumers, the Vitality program was extended recently to include people with ages between 71 and 90 years old. (Golia, 2018).

Insurers worldwide have been following similar strategies. MLC, in Australia, offers 5% discount on the policy premium if the customer is able to meet a weekly target of 37,500 steps for 30 weeks out of a 40 week monitoring period (MLC Limited, 2019). AIA, in Singapore, uses wearable devices to reward customers with points which can be redeemed for discounts in airline carriers, hotels or movie tickets (AIA Vitality, 2019). In China, Ping An is already collecting data from 1.5 million customers every day (Loder, 2019).

These programs address not only individual policyholders but also companies' work force. Corporate wellness programs can increase fitness levels, mood and job satisfaction among employees (Falkenberg, 1987), contributing to increase employee productivity (Deloitte, 2018b), although some authors argue the contrary (Spicer & Cederström, 2015).

Companies can save $83 to $103 in annual medical costs per person through a 1% reduction in four leading health risks – weight, blood pressure, glucose and cholesterol (CDC, 2016). Appirio claimed savings of $300,000 in 2014 (Dart, 2015). On top of individual targets, employees also benefit from collective discounts such as renewal-rate caps, which limit the increase in insurance premiums (between 6% to 8%) (UnitedHealthcare, 2019).

As in traditional loyalty programs, insurers are investing in welness programs to reduce churn and increase customer touch points, reinforcing healthy behaviour (Capgemini, 2015). John Hancock reported engaging on average 21 times per month with Vitality customers.

Wearables can support customers in staying on track with their health goals and alert them in case of potential adverse signs (Quah, 2018). Striiv, for example, established a partnership with the pharmacy chain Walgreens to send medication reminders and reward points for healthy behaviour through wearables (SwissRe, 2018).

John Hancock reported that participants in health programs reduced claims by 16%, are 64% less likely to lapse they insurance and have up to 53% lower mortality rate than non-participants. In addition, the unhealthiest participants reduced risk by 22% (Dart, 2015).

While these results look promising, research on the outcome of this strategy in the long term doesn't exist. Between customer engagement, data collection or better underwriting capabilities, it's still not clear where the biggest value proposition is.

2.2.3 Product Development

This section analyses new ways in which insurers can leverage wearable technology to (1) expand their customer base, (2) explore new business models and (3) target specific market niches.

(1) *Expand the customer base:* Increasing insurability both at the bottom and at the edge of the risk profiles: Wearable data provides insurers with a more stratified risk assessment. The continuous flow of information might enable insurers to adjust premiums to levels which were not possible before, attracting low risk customers which until now couldn't afford health/life policies. On the other end of the risk pool, there are typically individuals considered too risky to be covered, due to conditions such as diabetes, hypertension or HIV. These conditions signal a high chance of premature mortality and are harder to predict. However, by following appropriate treatment protocols, they are manageable and wearables can play a key role in enabling a degree of monitoring which increases prediction capabilities and decreases risk exposure (Abraham, 2016).

(2) *Explore new business models:* Peer 2 peer (P2P) insurance pools: bring together individuals with similar interests/lifestyles putting them in charge of managing their policy collectively. Contrary to traditional insurance, the excess in premiums is refunded to members or allocated to other ends (RGA, 2018). Wearable data can unite members with similar health conditions/lifestyles, such as a running group with similar cardiovascular health. P2P insurance encourages therefore transparency, accountability and discourages fraudulent practices (RGA, 2018). Teambrella, for example, has the policy holders voting on the value

to be paid when a claim is filled under the presupposition that people will treat each other in the same way they would like to be treated (Teambrella, 2019). Lemonade allows policy holders to select a charity of their liking and has distributed more than $500,000 to charity just in 2019 (Lemonade, 2019).

(3) *Target specific market niches:* Better risk assessment and claims processes for work accident related policies: Wearable solutions are also appearing at industrial settings to mitigate injury costs for manual labor intensive tasks, which according to (Deloitte, 2018b) reached almost $60 Bn in the US in 2018. Wrist bands, armbands or exoskeletons can inform production managers on fall incidents, bad body posture and other risky behavior (Strongarmtech, 2019; Triaxtec, 2019). This information can enable insurers to better access risk and pricing as well as process faster claims in industrial settings.

2.3 Challenges

The implementation of wearable devices in insurance products raises a few challenges from the technology, business and consumer perspectives. Some of those challenges will be explored in the following section.

2.3.1 Technology reliability

At the current stage of development, wearables still register discrepancies between measurements collected from different devices, brands and in controlled vs non-controlled environments. In some cases, customers still need to recur to medical grade devices to record measurements accurately (A. Spender et al., 2018).

Wrist worn devices accurately measure heart rate (HR) but perform poorly in EE (Wallen, Gomersall, Keating, Wisløff, & Coombes, 2016), especially in light and moderate physical activity stages (Dooley, Golaszewski, & Bartholomew, 2017). Studies have also been done to assess discrepancies in different age groups (Straiton et al., 2018) and to assess accuracy in monitoring particular conditions such as Parkinson (Lamont, Daniel, Payne, & Brauer, 2018). The research for both HR and EE is vast and seems to point to existing discrepancies across the board (Dunn et al., 2018).

Researchers identify several causes for the errors observed such as design, materials and engineering specifications. There is room for improvement both in hardware and software (Feng, K. Wong, Janeja, Kuber, & Mentis, 2016). The utility of the measurements relies on the algorithms used to analyse the data collected (Witt, Kellogg, Snyder, & Dunn, 2019). Research suggests that errors from indirect measures are greater than those from direct measures (A. Spender et al., 2018).

Regarding sleep tracking, the results follow the same direction. When comparing Oura ring to a clinical sleep exam, while sleep detection seems accurate (96%), sleep stage detection performs much poorer (61% to 65,5%) (de Zambotti, Rosas, Colrain, & Baker, 2019). (Evenson, Goto, & Furberg, 2015) found that both Fitbit and Jawbone over-estimate total sleep time while (Gruwez, Libert, Ameye, & Bruyneel, 2017) recommend researchers and providers to work on improving algorithms' accuracy based on reliable sleep physiology.

Wearable manufacturers tend to overstate testing accuracy. Misinformation hinders the use of these devices in clinical and healthcare settings and hinders wider adoption (Dunn et al., 2018). However, improved hardware and software is expected in coming years which will result in longer and more accurate monitoring periods, higher adoption rates and higher sampling rates (Dunn et al., 2018).

2.3.2 Wearable data and risk scores

There are not many studies proposing ways of incorporating data collected from wearable devices into risk scores. In fact, (McCrea & Farrell, 2018) were the first and only using solely data collected from wearables to create a comprehensive model based on factors like resting heart rate, sleep and walking duration. For the time being, telematics can be a good proxy to understand the benefits of using sensory data to augment prediction and pricing capabilities.

The value of wearable data rests on the ability to establish a clear link between metrics measured and the current and expected health of an individual. Metrics related to blood pressure or heart rate are more understood as research has been done in clinical settings. Physical activity related metrics don't enjoy the same amount of research, although existing research does point to a link. The granular nature of that link will fully unfold as more data is available and studies are done (Abraham, 2016).

2.3.3 Data privacy and security

Data privacy and security represent one of the challenges insurers face to drive the success of wearable based insurance products (Casselman, Onopa, & Khansa, 2017). Understanding how wearable data is shared, secured or who has ownership over it is key for insurers. (Banerjee, Hemphill, & Longstreet, 2018) identified a few challenges when sharing wearable data: ambiguous legal status, encryption and hardware connectivity, cloud storage vulnerability, data brokers, corporate alliances, liability minimization.

To illustrate, (Barcena, Wueest, & Lau, 2014) conducted an experiment where they were able to extract personal information from wearable devices through the use of a Bluetooth scanner and a raspberry Pi. The constant data flow between wearable, mobile devices and cloud storage makes data vulnerable to security breaches. In 2015, 6/10 biggest healthcare data breaches happened to Blue Cross Blue Shield Insurance associations (Munro, 2015).

Problems with data have a direct impact in the relationship between the business and the customer (Lo & Campos, 2018). 82% of participants on a wearable related survey reported feeling convinced that healthcare wearables compromised their privacy (PwC, 2014). Consumers perceive the devices as a threat to their health and well-being due to fear of data mismanagement (Marakhimov & Joo, 2017) and can feel uncomfortable with the intrusive character of excessive self-monitoring (Piwek, Ellis, Andrews, & Joinson, 2016; Redmond et al., 2014; Wu et al., 2016) However, many times consumer are not aware of privacy laws, of the granularity of their personal data and the extent to which companies are able to bundle

different data sources, including public and private domains, to build personal profiles (Cheung, Bietz, Patrick, & Bloss, 2016).

There have been judicial cases where wearable data was used to disprove witness testimonials (Olson, 2014) in a phenomena called e-discovery (Banerjee et al., 2018). In addition, in the same way hackers were able to change drug administration remotely in hospitals, hacking a wearable can drive potential dangerous behaviour such as misleading drug dosages (Mills, Watson, Pitt, & Kietzmann, 2016).

Companies and researchers have mitigated privacy concerns in the past by de-identifying sensitive health information. However, there is evidence that the process can be reverted (Malin & Sweeney, 2001). Companies like HumanAPI are exploiting this opportunity by offering customers a centralize platform to manage and share health data with insurance carriers securely (HumanAPI, 2019).

2.3.4 Legislation

As businesses consolidate their digital transformation journey, their dependence on IT systems and interconnected devices increases their exposure to cyber-attacks and data breaches, among others (Insurance Europe, 2018). Since the Cambridge Analytica scandal in 2016, policymakers have given concrete steps to mitigate these risks, in particular in Europe, through the General Data Protection Regulation (GDPR), which came into force on 25 May 2018.

Under GDPR, insurers are obliged both to implement proper security measures and data protection policies as well as being proactive in communicating they are being compliant with legislation (Insurance Europe, 2018). Companies who fail to comply may face fines up to 4% of their annual turnover. Google and Central Hospital of Barreiro Montijo where already fined in €50 million and €400,000, respectively (Irwin, 2018; Meyer, 2019).

GDPR gives individuals more control over their own data. The right to data portability can therefore influence dynamics between insurers. Finally, as insurers and other third parties become more liable over data issues, insurance policies will need to start reflecting the new risk exposure (Dunn et al., 2018).

2.3.5 Fraud

An estimated 5-10% of all insurance claims are fraudulent (Tanguy Catlin & Lorenz, 2017). Vitality recently reported that *"The fitness devices and apps adidas miCoach, Moves, RunKeeper, Strava, MapMyFitness and Timex either do not distinguish between third party data or self-reported data, or utilize an unreliable integration. These apps compromise the*

accuracy and verifiability of the fitness data we receive, so we will no longer allocate Vitality fitness points for using these apps from 2 April 2016". Wearable data can easily be falsified in order to achieve the necessary metrics to enjoy rewards and discounts. A common example of data falsification consists in strapping a wearable device to a dog to generate the necessary daily step count (Munich RE, 2015).

2.3.6 Perception, adoption and behavioral change

Consumers consider technology, health and privacy factors in their decision to adopt wearable technology, although consumers who use wearables for fitness reasons seem to value different aspects than those who wear the device for medical purposes (Yiwen, 2015). (Yang, Yu, Zo, & Choi, 2016) argue that usefulness, enjoyment and social image are relevant factors in the perceived value of the device prior to its acquisition.

Data regarding wearable usage and retention rates is scarce and miscellaneous. Daily usage seems to start high (smart watch: 67%; fitness trackers: 60%) (Deloitte, 2018a), and decrease considerably after 6 months (32% to 33%) (Dong, Chen, & Wang, 2019; Ledger, 2014). In 2015, Fitbit only considered 50% of registered users as active users (Goode, 2015).

(PWC, 2016) reported that money or loyalty points would encourage 80% of survey respondents to use wearables daily. Other factors influencing customer adoption are cost and inter-operability across different platforms (Dunn et al., 2018). Insurers have been keen in offering rewards, sponsoring devices and assure the integration of a wide range of apps and devices to encourage adoption. (Izmailova, Wagner, & Perakslis, 2018) argue that the growing wearable market provides strong evidence that the current adoption challenges are not significant.

Research indicates that the use of wearables seems to positively influence healthy behaviour, especially if combined with behavioural challenges (DiFrancisco-Donoghue et al., 2018). The extended use of wearables contributes to increased step count and employee wellbeing, which should remain a priority for corporate wellness programs (Giddens, Leidner, & Gonzalez, 2017). Users share daily and total step count to motivate themselves and to receive motivation from peers while sharing sleeping records is driven mainly by a will to record life (Dong et al., 2019). However, (Etkin, 2016) points out that although measurement increases activity output, it can jeopardize the individual's intrinsic motivation to perform those physical activities, reducing enjoyment and creating a sentiment that exercise is work, which can ultimately lead to a continued decrease in engagement in activity and wellbeing, even in the absence of external motivations.

2.4 Business Integration

This final section aims to identify some of the necessary capabilities that health and life insurers need to incorporate in their value chain in order to fully leverage wearable devices and wearable data.

2.4.1 IoT, Big Data and AI

Companies who can collect data, make sense of it and implement it in their products in a seamless way are disrupting industries and achieving competitive advantage (Comella-Dorda, Krishnakanthan, Maurone, & Shenai, 2017).

If IoT sensory devices allow businesses to access more data than ever before, making sense of that data plays a fundamental role in transforming the investment in data collection into actionable insights (Lo & Campos, 2018). Big Data is commonly described as the ability to collect, process and analyze large amounts of data. When a business has the capacity to derive meaningful insights from data there is potential to create competitive advantage (Constantiou & Kallinikos, 2015; George, Haas, & Pentland, 2014; Newell & Marabelli, 2015). (SNS Telecom and IT, 2018) estimates that global insurance investment in Big Data will hit nearly $ 3.6 Bn by 2021.

There are several definitions of Artificial Intelligence (AI) in and outside academia (Marr, 2018). Amazon defines AI as *"the field of computer science dedicated to solving cognitive problems commonly associated with human intelligence, such as learning, problem solving, and pattern recognition."* AI serves both consumers - enhancing the insurance experience via chatbot/personal assistant (McKinzey, 2018); and insurers - data processing power and task automation, better risk monitoring and enhanced predictive capabilities (Bratteli, 2018). The global insurance investment on cognitive and AI systems will reach $ 77.6 Bn by 2022 (Daquila, 2018).

One can look at these three technologies in a very intertwined way: IoT is about data collection, Big Data is about data processing and AI is the underlying force behind these technologies, holding also the executive power. Appendix 8 illustrates the complementary relationship between the three technologies.

2.4.2 The insurance value chain

The traditional insurance value chain has been owned by insurers, except from distribution, handed mostly to brokers; and a fraction of the risk capital, handed to reinsurers. The digitalization of the value chain has led to an increase in brokers and service providers, as data

and IT capabilities grow in importance. These companies support insurers in collecting, managing and making data actionable but also compete, for example, in the offering of fully automated underwriting. Nevertheless, these players rely on risk carriers to manage risk associated with their policies (Deloitte, 2016). Table 3 provides examples of new players which entered the insurance value chain in recent years. Moreover, customers play an increasingly active role in the value creation process. They provide data and manage their policies digitally, which saves them time and resources to insurers.

Thus, as traditional insurers increase their dependence on tech providers by outsourcing the relationship with customers, the risk of parts of the value chain being lost alongside profit margins increases with it (Eling & Lehmann, 2018).

Table 4: *Types of capabilities' integration*

Business Model	**Company example**
Insurer outsources the collection, analysis and integration of (wearable) data	**Vivametric** developed vScore, a personalized biological age metric which integrates new data sources from wearable devices and smartphones to assess mortality and critical illness risk. Insurers can make use of wearables to stratify risk, support customer engagement, and provide a deeper understanding of the customer.
Insurer outsources the collection, analysis and integration of (wearable) data + the customer digital interface	**Fitsense** enables Health & Life insurers to personalize products and services by: • Integrating, processing, and safekeeping data across devices and apps • Turning raw data into specific customer and risk profiles • Building custom white label products using a data platform
Digital insurer with external risk carrier	**Mutumutu** gives back up to 30% of the policy premium to clients which meet certain activity metrics such as daily step count, running or cycling. The insurer is covered by Komerční pojišťovna, from Société Générale Group.

Acting both as data collectors and as a customer communications channel, wearable devices seem especially tailored to leverage Tech companies' position to enter the health and life insurance industries (Eling & Lehmann, 2018). Apple, for example, has been incorporating medical capabilities in the Apple Watch while Google recently bought a participation in the watch maker Fossil (Heater, 2018). On the other hand, regulation, industry expertise, more

attractive investment opportunities or the risk of damaging the relationship with customers might hinder these companies in entering the market or partnering with incumbents (Eling & Lehmann, 2018).

2.4.3 Open Innovation

In order to develop the necessary capabilities to successfully integrate wearable data, insurers are following different innovation strategies. InsurTech refers to technology-led companies that entered the insurance sector by using new technology to exploit digitally savvy underserved customers and niche markets (McKinsey & Company, 2017). According to CB Insights, InsurTech´ funding has raised from $46 Bn in 2013 to $202 Bn in 2017, and is expected to continue growing (Catlin et al., 2017; Jubraj et al., 2017) (See Appendix 9).

InsurTechs fit into the overall category of financial technology-led companies, "Fintechs". According to (EY, 2018) the majority of investment (61%) is aimed at "enabling the insurance value chain" instead of "disrupt" (9%) or "disintermediate" (30%). This data shows the weight and influence of the larger established players which in fact are the leading investors in InsurTech firms. 83% of InsurTech deals involve an insurer or reinsurer as an investor.

On one hand, developing new technology capabilities from scratch can be expansive and slow for established players. On the other, gathering the required capital and legal compliance can kill the chances for new tech-led entrants to strive. Existing research indicates that partnerships are a top priority for startups's success (Kask & Linton, 2014; Pangarkar & Wu, 2012; Teece, 2010).

Direct investment in InsurTech firms falls into a larger innovation strategy undertaken by established players described as Open Innovation, *"a distributed innovation process based on purposively managed knowledge flows across organizational boundaries."* (Chesbrough & Bogers, 2014). This area of research has been well documented in academia (Bogers, Chesbrough, & Moedas, 2018; Chesbrough & Bogers, 2014; West & Bogers, 2014). Established firms opt for this solution as a response to the pressure to develop disruptive products and services, by sponsoring, partnering, outsourcing and collaborating with new ventures and startups (Gans, 2016; Kohler, 2016; J.-C. Spender, Corvello, Grimaldi, & Rippa, 2016). Through this type of interaction, they hope to take advantage of the knowledge, creativity and innovative capacity (Eckblad & Golovko, 2012; Zhao, Sun, & Xu, 2016).

Some of the novel interaction means between corporates and startups are corporate venture capital funds (CVC), internal incubators, strategic alliances and joint ventures (Richter, Jackson, & Schildhauer, 2018). According to (KPMG, 2017b), 62% of insurance industry

executives indicated that their company either already had or was planning to launch a CVC to invest in Insurtech. Moreover, 87% said they would partner for new operating capabilities, 64% would use M&A and 76% would partner to gain access to new technology infrastructure.

In order to increase product alignment between startups and corporates, decrease risks associated to acquisition or product integration/partnership, accelerate the innovation process, identify products and threats to existing products or extend the growth options it is also becoming increasingly common to see established players running Corporate Accelerator programs (Christensen, 2013). In fact, many times it is associated with a CVC.

"The emergence of the corporate accelerator appears to have arisen from a desire by many companies to bring themselves closer to innovation and gain access to windows on emerging technology, thus staving off the gale of creative destruction."(Hochberg, 2016).

Allianz X, for example, is the digital investment unit of the Allianz Group and to date manages a fund of € 1 Bn and has invested globally in +15 companies (Alianz X, 2019). AXA launched AXA Venture Partners in 2015 and now manages $ 425 M of direct investment in different areas related to insurance and asset management (AXA Venture Partners, 2019). Appendix 9 presents a list of the top existing insurance innovation programs in the world.

In conclusion, the ability to roll-out wearable-based insurance products seems to be a function of an efficient orchestration of complementary data technologies and industry expertise. Insurers have the expertise and are investing in innovative models to source the necessary technological capabilities. Data companies master the tech but lack industry experience and might not have the right incentives to do it on their own. Wearables seat in the middle of the two worlds, feeding information to a larger health data ecosystem.

CHAPTER 3: METHODOLOGY

3.1 Research Approach

The research aims to understand the business opportunities of wearable technologies in the life/health insurance industries, providing insights, through qualitative methods, on the opportunities, challenges and implications of launching wearable based insurance products. The qualitative approach was chosen due to the inability of quantifying the broad, complex and uncertain character that wearables represent for health/life insurers and other relevant industry stakeholders.

The research is based on two methods – the collection and analysis of secondary data and primary data. The secondary data is mainly used in the literature review (Chapter 2) and throughout the results and discussion (Chapter 4). It's mainly composed of published materials and databases. The primary data consists of a set of in-dept interviews with leading industry experts. Both methods will be further discussed in the following sections.

3.2 Secondary Data

The secondary data was gathered to provide a theoretical ground on the topics of wearable technologies, the insurance value chain and the implications of the implementation of this technology. The data gathered allowed a structured mapping of both opportunities and challenges that insurers face when considering the integration of wearable devices and wearable data in their business. It also supported the understanding of the distinct ways in which insurers can acquire/develop the necessary capabilities to launch these products successfully.

Research papers, consulting industry specific reports, web articles, journal articles, online video content, online data bases and books in the fields of technology, insurance, management, information and innovation compose the dataset used for this research. The data sources are therefore external.

3.3 Primary Data

After building a solid understanding of the state of play of wearables in the insurance industry through secondary data, the primary data fueled the extension of the existing knowledge in the field. The expert interviews not only supported a more pragmatic understanding of the secondary findings, but also raised novel angles of discussion not identified previously that positively contributed to fully answering the research questions.

3.2.1 Data Collection

A total of 9 interviews were conducted between 23rd April and 9th August 2019. The interviews were led either by phone or video call and their duration ranged between 30 minutes and 1 hour. A unique questionnaire (script) was prepared for each interview in order to leverage the distinct professional profile of each interviewee. However, questions related to (1) identifying the opportunities and challenges of wearable devices; (2) understanding the threat of new entrants in the insurance space; (3) comparing the market conditions in Europe, the US and China; and (4) exploring collaborations between incumbents and InsurTech startups; where common to all interviews.

3.2.2 Participants

The participants were chosen with the intent to have a broad and diverse representation of opinions from key stakeholders in the insurance industry. All of them work directly with wearables and/or insurers in companies spread across Europe with the exception of one participant, from the USA. Seniority was also important in the context of this research. All of them are experienced professionals and occupy leadership positions. There are tech investors, startup founders, corporate leaders and innovation experts. A complete description of the participants can be found in Table 4.

Table 5: Participants' List

Participant	Name	Company	Country	Position
Participant 1	Stefaan de Kezel	Ageas	Belgium	Director Innovation and Business Development
Participant 2	Thamar van Damme and Sébastien Labourdette	Plug and Play Tech Center	Germany	Corporate Partnerships Manager and Venture Analyst - Insurtech and Enterprise 2.0
Participant 3	Lukas Ammann	Dacadoo	Switzerland	Vice President, Sales EMEA
Participant 4	PND*	Multinational Re-Insurance company	USA	Vice President, Customer Experience
Participant 5	Peter Evans	Deloitte UK	United Kingdom	Insurance and Asset Management Research Lead
Participant 6	João Bôto Gonçalves	Tranquilidade	Portugal	Head of Integration and Transformation
Participant 7	Jindřich Lenz	Mutumutu.cz	Czech Republic	CEO and Co-Founder
Participant 8	Mehrdad Piroozram	InsurTech.vc	Germany	Founder and Partner
Participant 9	Lisa Lang	Elektro Couture and The PowerHouse Group	Germany	Founder and CEO

(PND* - Prefers not to disclose)

CHAPTER 4: ANALYSIS AND DISCUSSION

This chapter launches an analysis and discussion over the business opportunities of wearables for life/health insurers, by crossing the literature review with the qualitative data collected during the expert interviews. Some of the opportunities and challenges are revisited through the lenses of the expert's opinions steering the discussion to new models emerging in the industry and how wearables play a part in that change. The chapter concludes with some of the future trends expected in this space.

4.1 Opportunities and Challenges Revisited

Customer Adoption

Several participants raised customer adoption as one of the main challenges to overcome when introducing wearable-based products. Fitness trackers were the first wearable devices to gain traction in the market precisely because they were used by very active health conscious individuals. When individuals are conscious about their health problems, they are motivated to use information technology to improve their health (Ahadzadeh, Pahlevan Sharif, Ong, & Khong, 2015; Ross, Ross, Rahman, & Cataldo, 2011).

These consumers are driven to wear the device continuously out of an intrinsic motivation of measuring and enhancing wellbeing, not because of extrinsic rewards such an amazon voucher (Participant 1). Intrinsic motivation (IM) refers to behavior that is inherently satisfying and not contingent upon any outcome separable from the behavior itself, while extrinsic motivation (EM) refers to behavior that is fundamentally contingent upon the attainment of an outcome separable from the action itself (Legault, 2016). When insurers try to promote healthy behavior among individuals which don't have that IM, several concerns emerge: consumers will demand higher rewards because they don't perceive the personal benefit of exercise (Participant 1); and consumers might raise privacy concerns because they are distrusted towards insurers (Participant 7) and perceive the reward scheme as a coop, where the insurer will enjoy far more benefits then they will, leading to resistance (Participant 1, Participant 4).

Cultural aspects are also an important variable driving adoption. While in Germany adoption is problematic because people are extremely privacy concerned (Participant 2), in Japan the adoption might be higher in corporate settings where the CEO promotes the use of wearables (Participant 3). Factors such as tech savviness and age group were also highlighted (Participant 3, Participant 5, Participant 6, Participant 7) Older generations are more health conscious then younger ones (Participant 3).

The cost of the device has been one of the barriers to adoption that insurers have tried to mitigate, by partly or fully subsidizing it (Participant 7). Although the ability of insurers to do so is questionable considering their business profit margins (Participant 6). The majority of wellness programs are based on discounts in third party providers, however, some players are betting on premium discounts (Participant 7).

Finally, and in-line with the LR, social image and interoperability are important when considering wearable adoption. If wearables are not designed properly, they run the risk of marking their owners as "sick people" which would decrease their perceived value (Participant 9). Users who already use a certain wellness app don't want to change because of their insurance (Participant 7).

Legislation

Participants consider legislation a relevant challenge in the implementation of wearable-based insurance products not only from the personal data and privacy perspectives but also regarding the ability of new entrants to compete in the insurance market.

It seems there is a direct relationship between perceived costs and privacy concerns. Clear and up-to-date legislation not only increases consumer's trust but can also be a source of competitive advantage (Participant 9). Common legislation across territories such as GDPR or closely working with the government like in China (Participant2, Participant 6) seems to facilitate the roll-out of insurance products which use wearable data comparing to other territories where legislation is fractured, such as the US (Participant 4).

Legislation also contributes to define how incentives are awarded. (Participant 2) reported that decreasing policy premiums is less complex comparing to increasing them, legally speaking.

Data regulation affects the way incumbents interact with third party providers (Participant 3). In case of GDPR, if the insurer has access to the customer through a partnership for example, there has to be a clear opt-in button where the customer agrees to share the data with the insurer, otherwise the insurer will only have access to a small fraction of anonymized data (Participant 1, Participant 3).

Finally, insurance is traditionally known for its high legal standards (Participant 5). This seems to be one of the variables protecting incumbents' position as risk carriers, giving rise to Managing General Agents (MGA) where *"is the startup that takes care of risk assessment, the on-boarding of the customer, also customer acquisition, etc…but the risk carrier remains the insurance company."* (Participant 2).

Pricing

Dynamic pricing mentioned several times in the LR is an opportunity worth exploring, however it seems that a model similar to PAYD/PHYD in auto insurance is far way in the health/life space due to the complexity and lack of access to data. According to (Participant 7) the insurer would need to develop their own wearable device or have access to raw data and be able to model different data sensor combinations at a level that today does not exist.

UBI models also reflect the problem of the perceived benefits not outweighing the perceived costs, as the annual amount of savings is not enough to make people switch policies and/or give up personal data (Participant 5, Participant 6). (Honka, 2014) found that in the auto insurance industry search costs, the main driver of retention, range from $35 to $170 while the average switching cost is $40. Perceived costs are especially high for high risk individuals, such as people with chronic diseases (Participant 9).

4.2 The renewed insurance value chain

Threat of new entrants

As mentioned in section 2.4.2, the growing importance of managing new sources of data as opened up space for new entrants to compete in the insurance value chain. Legislation can be a barrier to enter the market, especially for small players, however, big tech companies have the capital, technical data know-how and most importantly, own the digital channels of communications with customers. Acting both as wearable hardware manufacturers – the case of Apple – and app providers – the case of Google, tech companies seem to have all the conditions to enter the market successfully. Nevertheless, participants presented some counter arguments that question this reasoning.

Firstly, let's consider Branding. Due to the long-term character of insurance products, customers look for brands which are recognizable and trusted (Participant 9). Startups are seen as risky and week in terms of brand (Participant 2), while tech companies not only lack the track record in insurance but might not want to jeopardize the relationship they already have with customers as insurance is not a product that people generally like or seek unless something bad happened (Participant 5, Participant 6, Participant 8). Then there's the question of insurance not being an attractive market for these companies, which might prefer to allocate their resources elsewhere, where profit margins are more attractive (Participant 5, Participant 6). Lastly, the lack of know-how in the insurance field would require massive investments from

these companies. The combination of these arguments might therefore explain why insurers and tech companies have chosen to partner with each other predominantly.

Partnerships - the way to go

The Apple card developed with Master Card, Google Nest's partnership with Liberty Mutual and Amazon's partnership with Mapfre in Spain where some of the examples given by participants to support the opinion that insurers and tech companies prefer to work together as opposed to being competitors (Participant 2, Participant 5, Participant 6, Participant 8).

Understanding the dynamics between these players is very important in the context of wearables and wearable data but also falls into a larger discussion over insurer's general data strategy.

Some insurers will prefer to (A) bet on a strategy that combines proximity with the customer with ownership over the data collected. They can opt for (A.1) in-house development of both data capabilities and interface with the user (app); (A.2) outsourcing of data capabilities linked to the integration and treatment of data, while maintaining their proprietary app or (A.3) outsourcing of data capabilities and white labelling of the app. In-house development seems to be the less advantageous option because it can be very expensive and not produce the expected results, especially for insurers which are limited by old legacy systems (Participant 2).

Ping An, the largest insurer in the world, defies this reasoning as it developed most of their digital infrastructure in-house paired with some strategic acquisitions and partnerships. However, several participants argued that the market conditions that allowed it to scale are fundamentally different then in the west. Dacadoo is a great example of a third-party provider which couples both front-end and back-end solutions: *"As a platform company, we always start with our backend where we have all the features in, and from there either we do full customized solutions for our clients, were we build the solutions for them: they get their own domain, app, content. So that's white labelling: frontend and backend. Then we have the backend API possibility, when the insurer already has a digital proposition in the market."* (Participant 3).

Other insurers prefer to (B) hand the contact with the customer to InsurTechs/partners who better explore certain market niches and to focus entirely on the risk transfer business (Participant 1, Participant 2) giving birth to the MGM models described above.

When questioned about which of the two strategies better sustains competitive advantage over the long term, it seems there's not a right answer. On one hand, acting just as risk carriers poses the risk that the service becomes commoditized and competition will only be based on price, leading to a race to the bottom where many insurers might disappear. However, there are examples in other industries where competing on price can still be profitable (Participant 1).

On the other hand, managing the relationship with customers is tough, and although wearables and wellness programs seem like a good channel for insurers to enhance the interaction levels, insurance is not a product that people seek willingly and the new digital landscape shifted the ownership of the direct channels of communication outside of the insurance space (Participant 4, Participant 5).

(Participant 2) refers to this strategy dilemma as the invisible vs personalized insurance: "*Do you bet on the insurer which is your partner in life not only on insurance but in all the important parts of your life, and invest heavily on brand and other services? Or is life insurance just a price issue and the insurer makes it as simple and easy as possible so that it can be integrated in other industries such as banking or retails."* Regardless of the strategy chosen, the future of insurance seems more concentrated, with less but larger players, some incumbents and some new entrants (Participant 2).

A final aspect to take into consideration is the conjugation of different but complementary data-led technologies, also mentioned in section 2.4.1. The well-functioning of the technology value chain depends on the seamless integration of the pieces of the chain, from the collection through sensors (i.e. wearables) to the integration of that data into risk models. *"If one part of the chain is not working, it doesn't matter how accurate your wearable is, because you will not be able to extract value from it."* (Participant 2). Open innovation programs such as Accelerators, Incubators and CVC are being used to discover, test and integrate tech solutions in each part of the chain (Participant 1, Participant 2, Participant 8).

From platform to health ecosystem

Most participants, in line with section 2.2, seem to agree that the biggest business opportunities for wearables in the life/health are in providing continuous data to enhance underwriting and pricing capabilities and on increasing customers' touch points and driving healthy behavior through wellness programs.*"At this moment [wearables] are more suited to incentive schemes than to be part of the core of insurance products"* (Participant 8). However, (Participant 5, Participant 6) argue that examples of wearables applied to work accident related policies are slowly appearing and may be a more attractive business proposition due to potential bigger savings and more alignment between insurers and policyholders (employers). Although (Participant 9) alerts that managing unions and workers would be a significant barrier to surpass.

Current wearable devices seem to perform well in measurements related to physical activity, but poorly at measuring sleep (LR). (Participant 3) argues that respiration rates, body

temperature and upper body movements are necessary measurements to track sleep accurately, which current wrist worn devices don't offer. LR also pointed out to the ability to sell and cross-sell insurance products and interact with customers through push notifications through wearable devices. (Participant 5, Participant 6, Participant 7) share this view.

If wellness programs today seem very similar to traditional loyalty schemes where the main goal is to drive up loyalty, the continuous data monitoring can present huge opportunities in health prevention which would significantly reduce insurer's risk exposure. Wearables' expected growth in adoption and in medical capabilities is empowering insurers to shift their value proposition from wellness platforms to entire health ecosystems.

Oscar, a health insurance startup that provides affordable, personalized and digitally enabled health insurance policies to families and businesses (Oscar, 2019), found out that in spite of step tracking having positive effects on user engagement, the data is not utilized for building actuarial models because it's not a good reflection of someone's physical health (Comstock, 2016). This example seems to reinforce the idea that wearables are not yet suited to go beyond customer engagement and that wearables need to be part of a bigger ecosystem of personalized health information.

Appendix 11 illustrates how wearables are positioned as an interface between the insurer and the customer, enabling real-time information sharing for policy servicing and customer service. It also shows that wearables work alongside multichannel marketing and distribution intermediaries, which stresses the need for interoperability between wearables, health/fitness apps and third-party providers.

Another aspect that supports the transition to health ecosystem is the introduction of mental health and stress level monitoring where wearables can already provide useful data (Participant 7). Oscar is not alone in the bet for this type of service. The British health insurer Bupa, AXA or Aetna all launched digital apps that allow users to monitor wellbeing as a function of physical activity, mental health and nutrition, where wearables data can easily be integrated (Austin, 2019; AXA, 2019; Bupa, 2019).

CHAPTER 5: CONCLUSIONS AND LIMITATIONS

The following chapter presents the main findings and conclusions of this research by answering the proposed research questions, followed by a discussion over its managerial implications through the use of a framework. It concludes with a reflection both on the limitations and the future research on the topic covered.

5.1 Main Findings & Conclusions

In this section, the proposed research questions are answered.

RQ1: What are wearable technologies?

Wearable technologies are all computer devices which can be comfortably worn on the body. They serve both as data collectors and user interfaces and are usually reliant on an app connection so that users can harness the full potential of the information gathered. Fitness trackers and smartwatches are the first set of wearable devices to hit mass market, although the commercialization of wearables used in other parts of the body for narrow and broad purposes will follow soon. As more sensors are integrated into commercial devices and complementary algorithms are developed, the simplistic measurements available today will be replaced by more complex, health-a-like actionable insights. Wearables might disappear in the future as computer devices go under our skin, into our brains and all around us, however the revolution in the collection of biometric data wearables started will far exceed them.

RQ2: What opportunities do wearable technologies present to life and health insurers?

As in other industries where there's a relationship between buyer and seller, insurers face information asymmetry, which in case of life and health, gives rise to adverse selection – when the policyholder is better informed over his risk level then the insurer, and moral hazard – when policyholders lead less healthy lives because they are being covered by insurance. By providing means of collecting continuous personalized information and interacting with the policyholder, wearables enable insurers to narrow the information gap, mitigating both the adverse selection and moral hazard phenomenon. From a business perspective, wearables' main use cases for life/health insurers are around underwriting, marketing, sales and customer service, although their impact spreads all around the insurance value chain. Continuous health monitoring can enable insurers to assess risk faster and more accurately, make better price discrimination and customer targeting, and act preventively by promoting healthier behavior. These actions

decrease risk exposure, save costs and expand the customer base, contributing to increase the business' profitability.

RQ3: What are the current challenges wearable-based insurance products face?

Several challenges were identified during this research however some seem to be more instrumental then others to the success of wearables in life/ health insurance products. Customer adoption is among them and it seems that for people to use wearables consistently, they need to be intrinsically committed to adopt a healthier lifestyle, otherwise the perceived costs over data privacy and security and the lack of motivation might outweigh the rewards offered. Legislation also plays an important role, not only in reassuring individuals that their data is protected but on laying the ground for smaller innovators to compete fairly. Complying with regulation in a pro-active and transparent manner seems to increase trust and can be a form of competitive advantage in the traditionally highly regulated insurance industry. Finally, the current state of technological development and ability to integrate wearable data seem to hinder insurers from exploiting the biggest opportunities that wearables present. Current devices fail in accurately measuring some important risk predictors such as sleep or EE. In addition, insurers need to have the proper information systems in place to treat, analyze and integrate wearable data into actuarial models. Big Data and AI are therefore important technologies to complement the use of wearable devices.

RQ4: How are insurers incorporating wearable technologies in their products?

Existing insurers leveraging wearable technology have been focusing on driving user engagement by increasing customer touch points and gamifying the insurance experience under wellness programs. These programs reward policyholders for healthy behavior and can be offered to individuals under personal or collective working contracts. Typical rewards include shopping vouchers, premium discounts and health-related product subscriptions for achieving certain daily activity milestones. In recent years, wellness programs have been growing alongside the mass consumption of wearable devices and broadening their scope to address not only physical but also mental wellbeing. As wearable devices continue to evolve into the medical realm and insurers develop their digital capabilities, wellness programs are making the transition to health ecosystems, where wearable data becomes part of a larger pool of data sources shared among key stakeholders to provide a seamless experience to the customer. Most insurance players now depend on other service providers to be up to date with the latest

technological developments and consumer digital standards and have invested capital and time over recent years to strengthen their relationship with innovators.

Wearables are the second mass market devices to collect biometric data, after smartphones. However, many more devices will come, inside and around people, that insurers can leverage on. Wearables will be part of a family of devices and contribute to a network of data that will keep shaping the future of life/health insurance as more connected, integrated, data driven and customer centric.

5.2 Managerial / Academic Implications

In order to conclude on the managerial/academic implications of implementing wearable based insurance products, an adaption of the framework that analyzes IoT enabled business models (BM) proposed by (Suppatvech, Godsell, & Day, 2019) is used in the following section.

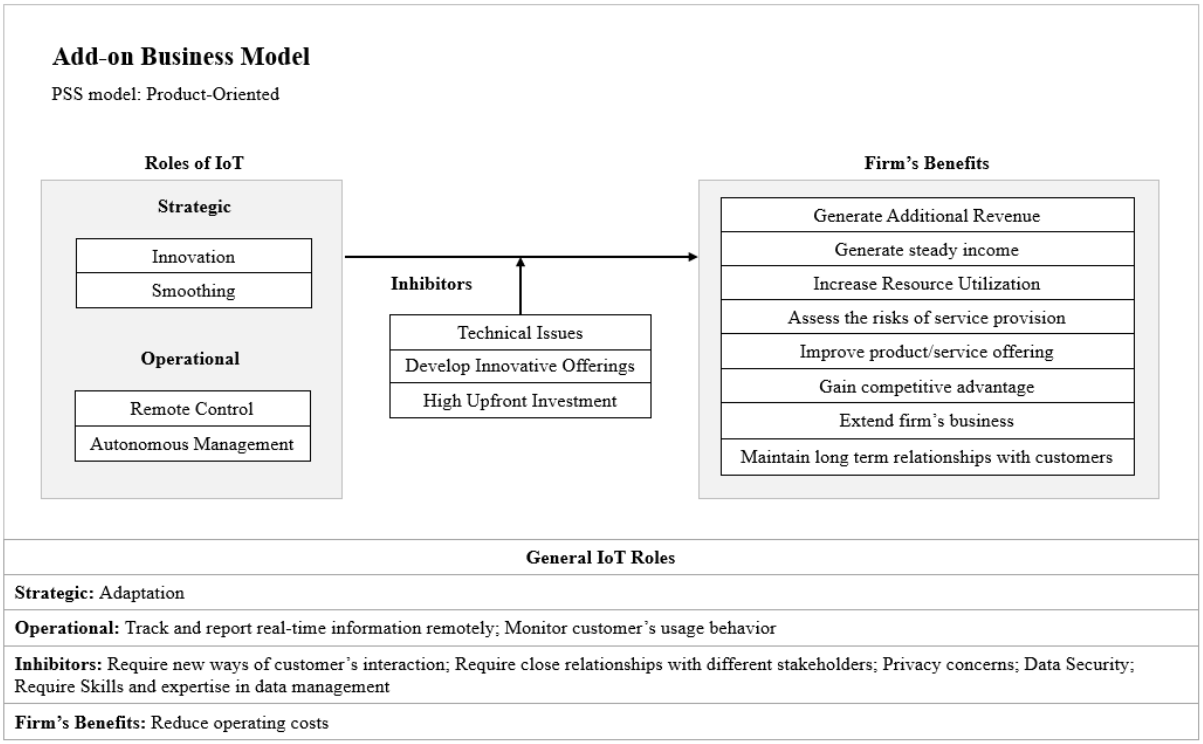
Among the 4 different BM identified by the authors: Add-on; Sharing; Usage-based and Solutions Oriented, the Add-on - *a BM that uses IoT in enabling additional functions or adding personalized services to the existing physical products or service* – seems to be the BM which better captures the business opportunities of wearables in insurance identified in the LT and validated in Chapter 4. The framework (Figure 3) identifies the strategic and operational roles that IoT devices play in the Add-on BM as well as the inhibitors to its implementation and the benefits to the firm.

There are some strategic and operational roles that are common to all IoT enabled BM, namely adaptation – the ability of IoT devices to significantly increase the value proposition of a product/service without becoming the main value driver – and the ability to collect and monitor user behavior, characteristics which surely fit wearables' value proposition for insurers. Concerning generic inhibitors, it seems that some of the challenges identified in the LT such as privacy concerns, data security and data management expertise are not exclusive of wearable based products, but common to all IoT enabled BM. Operational cost reduction is a benefit that IoT devices bring across all enabled BM.

Regarding the specific characteristics of Add-on business models, the strategic role of wearables seems to be in innovation - *IoT is used to enable the functionalities of product or service that have not been previously offered* – such as personalized premium discounts; and in smoothing - *IoT is used to help initiate and facilitate the service and transaction, which reduces overall transaction costs* – enhanced underwriting capabilities for example. The operational role highlights the ability of insures to track and engage with customers at a distance, driving healthy behavior for example. The specific inhibitors pointed out - technical issues such as

interoperability, high upfront investment and development of innovative offerings – are actually challenges that insurers already started mitigating by subsidizing and integrating several wearables and apps in their wellness programs. Finally, from all the firm's benefits presented, generate steady income seems to be the only one that could be taken out as the insurance business is already characterized by steady income flows, thus wearables don't imply an improvement in that matter.

Figure 3: *IoT-Enabled Servitized Business Models, adapted from (Suppatvech, Godsell, & Day, 2019)*



General IoT Roles
Strategic: Adaptation
Operational: Track and report real-time information remotely; Monitor customer's usage behavior
Inhibitors: Require new ways of customer's interaction; Require close relationships with different stakeholders; Privacy concerns; Data Security; Require Skills and expertise in data management
Firm's Benefits: Reduce operating costs

5.3 Limitations and Further Research

Although a great deal of existing literature was covered both regarding insurance and wearable devices, the broad scope of this dissertation has limited the nature of its conclusions. In addition, the qualitative research method chosen does not provide the necessary quantitative insights to support any practical decisions on the implementation of wearables by the insurer, other than a reflection on the potential opportunities, challenges and some of its likely outcomes. It is also important to note that, in spite of the diverse and international character of the interview participants, the sample size is not big enough to ensure the completeness of the outcomes presented.

This dissertation brought to light a comprehensive assessment of the main opportunities and challenges for insurers who want to leverage wearables technologies. The main roadblocks related with legislation, customer adoption and technology accuracy are already being mitigated and are expected to be overcome in coming years, as they belong to a wider societal change driven by digitalization that is taking place across industries. Future research can thus explore the "how" and the "when" of implementing the opportunities identified.

Some topics that were briefly covered and that are worth exploring include: a comparison between telematics-based and wearables-based insurance products; a new actuarial model that incorporates wearable data; pricing strategies using wearable data.

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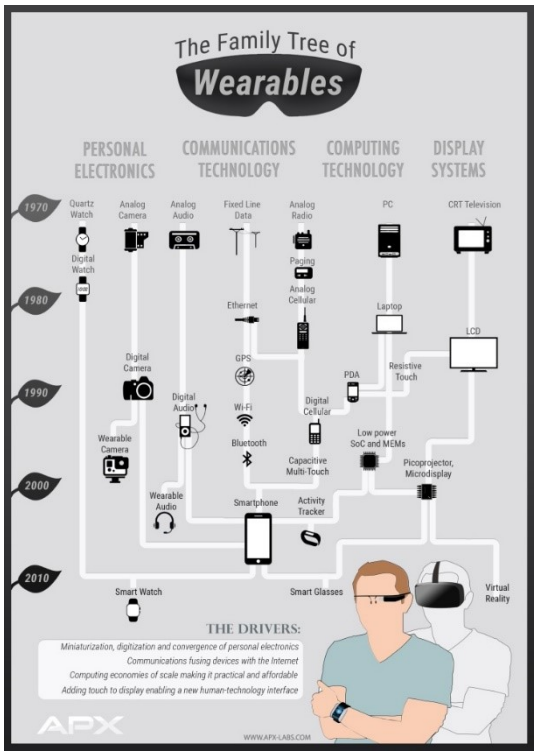
APPENDICES

Appendix 1: *The Family Tree of Wearables (Ballard, 2016)*



Appendix 2: *Top 5 Wearable Companies by Shipment Volume, Market Share and Year-Over-Year Growth, Q4 2018 (shipments in millions), (IDC, 2019)*

Company	4Q18 Shipments	4Q18 Market Share	4Q17 Shipments	4Q17 Market Share	Year-over-Year Growth
1. Apple	16.2	27.4%	13.3	29.6%	21.5%
2. Xiaomi	7.5	12.6%	5.2	11.6%	43.3%
3. Huawei	5.7	9.6%	1.6	3.6%	248.5%
4. Fitbit	5.5	9.4%	5.4	11.9%	3.0%
5. Samsung	4.0	6.8%	2.0	4.3%	105.6%
Others	20.3	34.3%	17.6	38.9%	15.6%
Total	**59.3**	**100.0%**	**45.1**	**100.0%**	**31.4%**

Appendix 3: *Examples of technology integrated into day-to-day clothing (A. Spender et all., 2018)*

Type of clothing or shoes	Example manufacturers and product	Typical use
Smart shoes	Altra IQ (running)	Running
	Under Armour SpeedForm Gemini 3	Running
	IoFIT	Golf
Insoles for shoes	ATO-Gear Arion	Running
	Digitsole Run Profiler	Running
	Unforgettable GPS SmartSole	Elderly/dementia
Underwear	OMBra	Running
	Myant Skiin	General wellbeing
Accessories	WELT smart belt	General wellbeing
Clothing	Levi's Commuter Trucker Jacket with Jacquard	General wellbeing
	Ralph Lauren PoloTech Smart Shirt	General wellbeing
Sports wear	Lumo Run smart running shorts	Running
	Athos shirts and shorts	Athletics
Babywear	Mimo Babygro	Sleep & Activity

Appendix 4: *Examples of other wearables technologies (A. Spender et all., 2018)*

Type of wearable	Example manufacturers and product	Typical use
Ring	OURAring	General wellbeing
	Moodmetric	Stress management
Headsets	Kokoon Technology	Sleep tracker
	Sleep Shepherd	Sleep tracker
	Muse headband and earphones	Meditation
	Modius Health	Weight management
Sleep mask	Neuroon	Sleep tracking
Mouthguards	Prevent Biometrics	Concussion monitoring
Wearable patches	Lifepatch	Sleep tracking
	Abbott Labs Freestyle Libre	Blood sugar
	Dexcom G5	Blood sugar
	Bloomlife	Pregnancy
Arm straps	Qardio Arm	Blood pressure
	Omron RS8	Blood pressure
Finger clip	iHeart	Heart health
Chest straps	Qardio Chest	Heart health

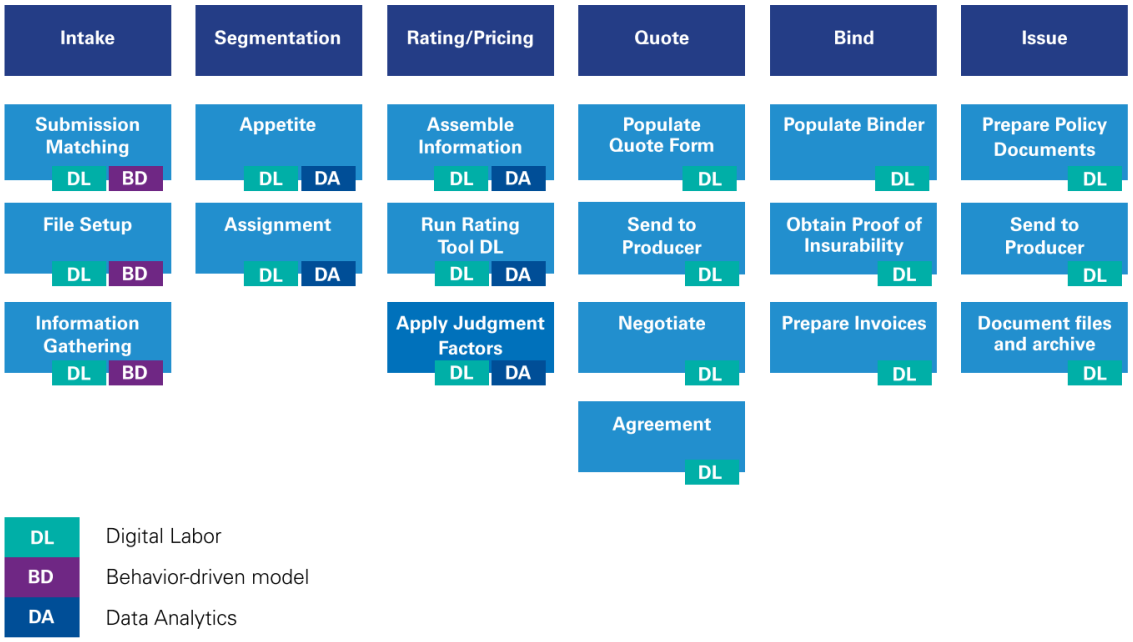
***Appendix** 5: Measurements available with current technology (A. Spender et all., 2018)*

Measurements current available			
Activity time	Coughing	Goal progress	Respiration rate and patterns
Ankle curvature	Distance	Heart rate/pulse	Sleep duration
Ascent/Decent (Floors)	ECG/EKG	Heart rate variability (HRV)	Sleep quality (N3/light/REM)
Blood pressure	EEG	Impacts to head (forces)	Steps
Blood sugar	Falls (in the elderly)	Light exposure (pre-sleep)	Swimming lengths
Body composition	Fitness (Cardiovascular)	Location	Swimming strokes
Body temperature	Focus/attention	Pace/speed/cadence	UV exposure
Calories	Galvanic skin responses (emotional health)	Pollution	V02 Max (derived from HRV)
Contractions	Girth	Posture and balance, pressure distribution and weight shift information	Weight

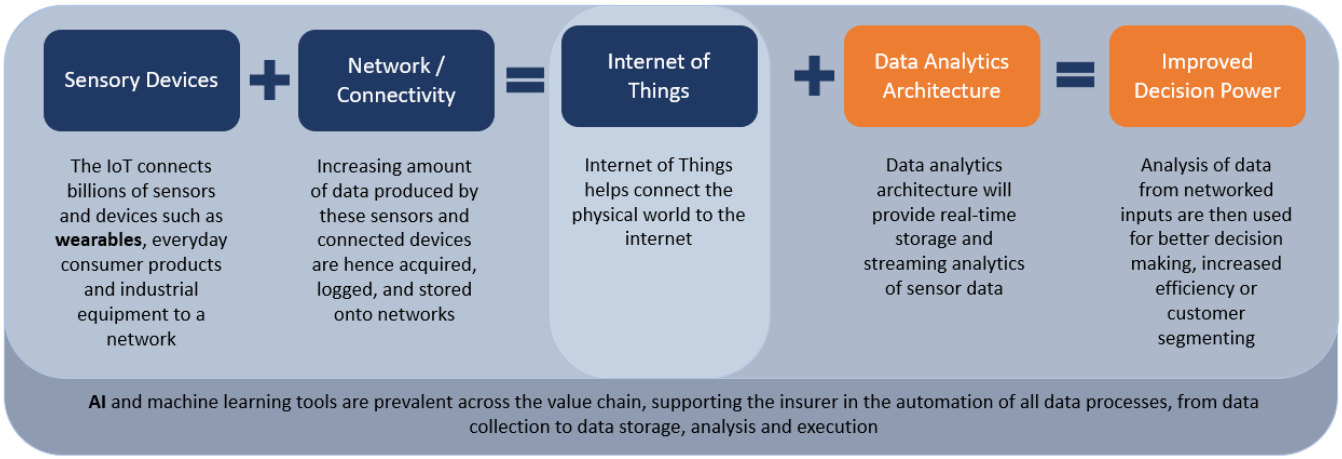
***Appendix 6:** MET-hour equivalents of various physical activities, (Mccomb, Carnero, & Iglesias-Gutiérrez, 2014)*

Physical activity intensity	MET
Light intensity activities	<3
Sleeping	0.9
Watching television	1.0
Writing, desk work, typing	1.8
Walking, 1.7 mph (2.7 km/h), level ground, strolling, very slow	2.3
Walking, 2.5 mph (4 km/h)	2.9
Moderate intensity activities	3–6
Bicycling, stationary, 50 W, very light effort	3.0
Walking 3.0 mph (4.8 km/h)	3.3
Calisthenics, home exercise, light or moderate effort, general	3.5
Walking 3.4 mph (5.5 km/h)	3.6
Bicycling, <10 mph (16 km/h), leisure, to work or for pleasure	4.0
Bicycling, stationary, 100 W, light effort	5.5
Vigorous intensity activities	>6
Jogging, general	7.0
Calisthenics (e.g., push-ups, sit-ups, pull-ups, jumping jacks), heavy, vigorous effort	8.0
Running jogging, in place	8.0
Rope jumping	10.0

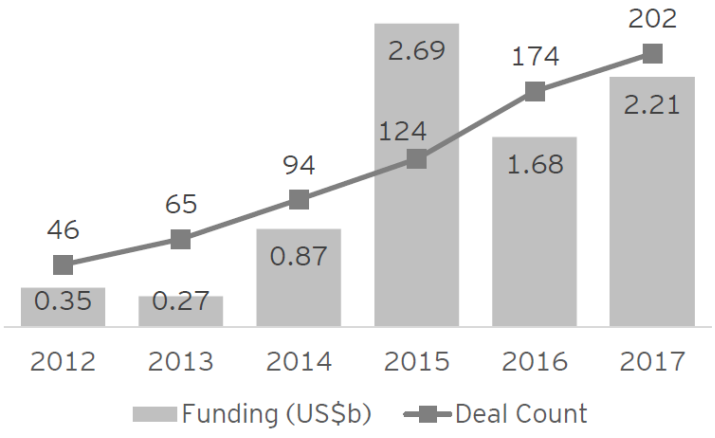
Appendix 7: *Opportunities in the underwriting value chain (KPMG, 2017a)*



Appendix 8: *The connected insurer, adapted from (Bartteli, 2018)*



Appendix 9: *InsurTech deal volume and value (US$b), (EY, 2018)*

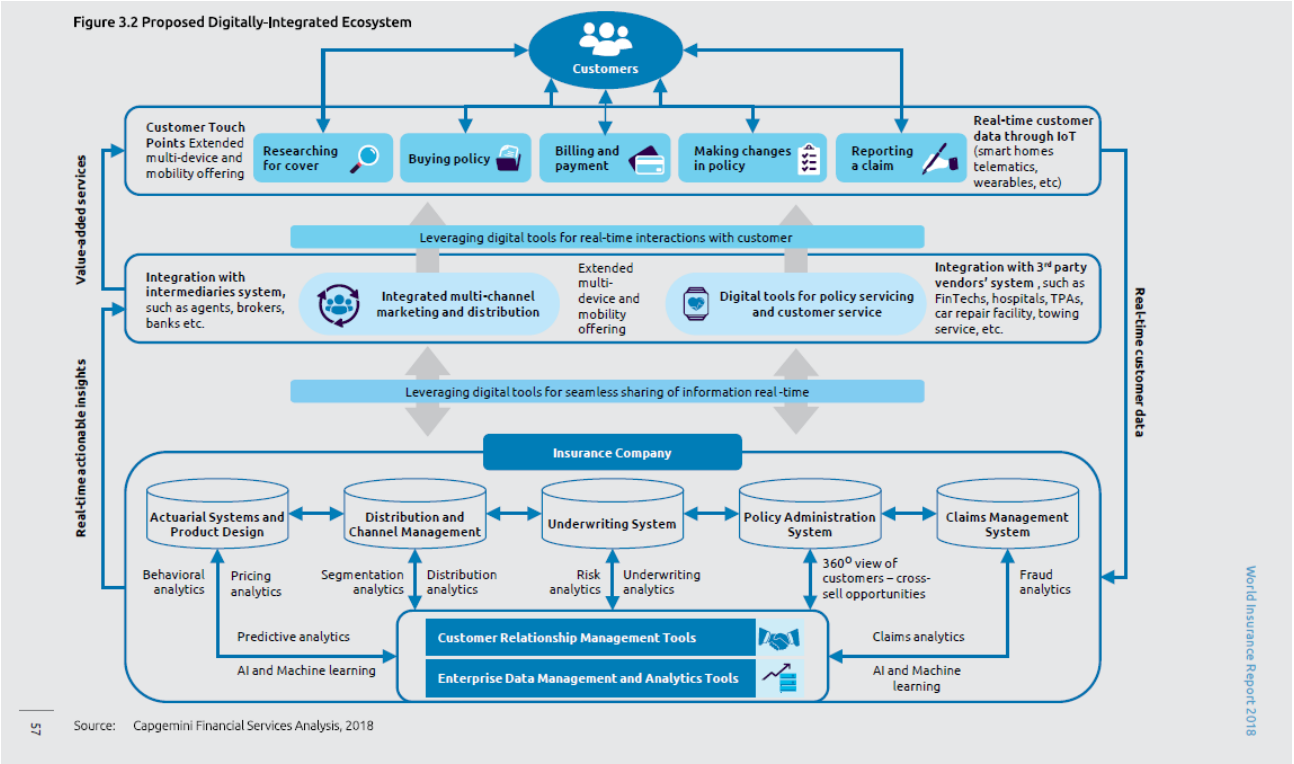


Share of InsurTech deals involving an insurer/reinsurer as an investor.

Appendix 10: List of existing top insurance innovation programs

Program	Country	Program Type	Investors / Partners
InsurTech Gateway	United Kingdom	Incubator	Co-investment from Hambro Perks, Lumleys, and supported by a panel of Reinsurers and Angel Investors from the insurance sector
F10 Fintech Incubator & Accelerator	Switzerland	Incubator / Accelerator	SIX, Baloise Group, Julius Baer, R3, Generali, Raiffeisen, PWC, among others
Nestholma Blockchain & Fintech Accelerator	Finland	Accelerator	Banks in Spain, UK, Finland, Dubai, Singapore, among others
Kickstart Accelerator	Switzerland	Accelerator	AXA, Swisscom, Swiss Healthcare startups, Credit Suisse, PWC, Creathor Venture, Emerald Technology Ventures, among others
Protechting	Portugal	Open Innovation Program	Fidelidade, Fosun, Beta-I, Hauck & Aufhäuser and Hospital da Luz
The Factory Accelerator & Incubator	Norway	Accelerator / Incubator	Nordea, DLA Piper, KPMG, Santander, Evry, Nets, Kredinor, Tink, among others
L'Atelier BNP Paribas	France	Corporate Accelerator	BNP Paribas
Collab	Singapore	Open Innovation Program	Metlife and Lumenlab
Silicon Valley Insurance Accelerator	USA	Open Innovation Program	Insure Soft, Majesco, Covenir, Redhawk
Startupbootcamp Insurtech	United Kingdom	Accelerator	Admiral, Allianz, Confused.com, ERGO, Exponential Ventures, HDI, Intesa Sanpaolo, Lloyds Banking Group, Munich Re, Old Mutual, PwC, Swiss Re, Zurich, among others
Plug and Play Insurtech	Germany	Open Innovation Program	Swiss Re, Allianz, Maiden Re, HDI, Aviva, State Farm, Delloite, Muniche Re, AON, Zurich, Progressive, Generali, among others
MetLife Digital Accelerator powered by Techstars	USA	Accelerator	Metlife, Techstars
DMZ powered by Aviva Canada	Canada	Accelerator	Aviva
AXA Venture Partners	France, UK, USA	Corporate Venture Capital	AXA
Allianz X	Germany	Corporate Venture Capital	Allianz
Cigna Ventures	USA	Corporate Venture Capital	Cigna
Barclays Ventures	UK	Corporate Venture Capital	Barclays
Aviva Ventures	UK	Corporate Venture Capital	Aviva
Ping An Ventures	China	Corporate Venture Capital	Ping An
Kamet	France, UK, Israel	Insurtech Startup Studio	AXA
MundiLab	Spain	Accelerator	Muniche Re and Mundi Ventures
OnRamp	USA	Accelerator	Allianz, Gener8tor and Securian Financial

Appendix 11: *Digitally Integrated Ecosystem (Capgemini & Efma, 2018)*



Appendix 12: *Interview Answers – Main Insights*

Interview 1

Name: Stefaan de Kezel

Company: Ageas

Position: Director Innovation and Business Development

Country: Belgium

Company Overview

Ageas is a Belgian multinational insurance company co-headquartered in Brussels. It offers international insurance services such as life and non-life, disability, and medical to individuals and groups in countries all over the world. In Belgium, it is the main shareholder of AG Insurance, the No. 1 player in the Life insurance market and No. 2 in Non-Life. At the group level, Ageas´ innovation department works on R&D and scouts for tech companies throughout the world in fields such as healthtech, regtech and insurtech.

Interview Highlights

How is Ageas navigating its digital transformation process?

"As we have companies in Europe and Asia there is not a single answer. Our approach tends to change according to the country, and the reason for that its customers and customer behavior, which drives everything we do and sets the basis for our digital transformation journey. As an example, customers in Asia tend to be much more mobile, have different kinds of distribution channels and a higher adoption rate for chatbots while in Europe, customers expect similar digital experiences as in e-commerce, they value transparency and easy ways to communicate with the insurer."

From a business model perspective, some insurers are moving away from the direct contact with customers, focusing on financial activities such as re-insurance, leaving the B2C market to partners and new entrants, while other insurers are working closely with partners to incorporate new technologies and provide great digital experiences. Which strategy in your opinion is more likely to succeed in the long run and why?

"That is a strategic question, which depends from insurer to insurer. There are insurers that say: I will start partnering with other players which are very good at the customer relationship. Other insurers say: I will try to do it myself. Which in the case of wearables has the advantage of allowing the insurer to have a much more frequent contact with the customer on topics that are relevant to the customer, such as health or mobility. Other insurers are partnering up with insurtechs which seem to have better approaches towards certain customer segments like millennials. There are insurers which say: the risk transfer is the core of my business, so I'll will put myself in the back and become a "white label factory", selling my product to different players" … "I tend to agree that in the long term, the issue with this last strategy is that you always need to compete on price, which originates a race to the bottom, not usually a winning strategy. However, if we look into other examples in other areas, having a value proposition focused on price can mean a profitable business (example of Ryanair)."

What are the predominant uses cases for wearables in the insurance industry today? What comes next?

"There are two predominant use cases: The first one related to the additional data which can be used in the underwriting or pricing process; The second one more related to loyalty schemes, which helps building customer loyalty by creating touch points with the customers in topics that he/she appreciates." … "On the prevention side, insurers will start playing a more active

role on informing customers on how they can change their behavior to becoming either healthier or to avoid big risks. Such as the apple watch 4 which can inform people on their heart condition. Typically, customers perform a heart exam only sporadically or in case of an incident, while here through the watch they are able to monitor their heart rate continuously." … Insurers can for example use the information to provide you with tips & tricks to lead a healthier life or develop reward programs linked to the actual behavior of the customer.

Do you believe technology accuracy is one of the main barriers for insurers in adopting this technology?

"I don´t think so. The gain in continuous information flow largely overcomes the inaccuracy in measurement, which is expected to reduce over time." … "The big issue is customer adoption. Fitness trackers paved the way for wearables, and are used by active, sporty, healthy people which like to measure their health status. People who don´t move a lot, which are not active or health conscious, they never adopted these devices and have no reason to do so. Thus, if their insurer tells them to, they will start raising issues such as privacy concerns. That´s why you see companies like Vitaly which developed a rewards program to nudge people into healthier living" … "Pushing a user to adopt a device to get a discount on his/her premium is not the best way forward. That cannot be the main driver for adoption, because it will not last."

When it comes to the collection and management of data, how can insurers structure their business to take full advantage of information and protect their competitive advantage?

"As an insurer you need to decide what is the service you want to provide. Then you decide what kind of data you need in order to provide that service, not the other way around." … "The next step is deciding how do you structure the relationship with the partner who has the customer relationship. If you are the owner of the relationship, you need to ask the customer whether he/she is willing to share data for a predefined purpose, there is quite a bit of regulation around that nowadays with GDPR. If you have a partnership with the distribution channel which has direct access to the customer, then there´s two things which need to happen: The first is the GDPR aspect and the second is to understand if that partner is willing to share that data with you. If the partner is not willing to share or just provides you with some aggregate data, then you are in a very bad spot because you will only be able to develop something which is enforced by the partner. If the partner decides to go with someone else, you run out of business because you have no customer relationship and no data."

Looking at the example of Ping An in China, which locks the customer in a digital ecosystem of health, insurance and financial services, do you believe the market in Europe and the US will evolve in the same direction?

"In China there's this very interesting example of what I call extreme customer convenience. Ping An has been successful not just because of its strategy but also due to the specific economic, social and cultural context. When exporting this business model abroad they will face a different context and remains to be seen whether the same level of success can be achieved. … "The move to a more convenient digital environment will surely happen in Europe. The reason it has been slower in comparison with China as to do with the existing infrastructure and distribution channels which were already in place in Europe and which Chinese companies didn't had to deal with. The second thing as to do with the eighty twenty rule. In China, if something is 80% working, they move with it while in Europe there is this idea that things need to work 100% well to move it to market, which results in slower implementation." … "You can´t expect Ping An's model in Europe soon because regulations and conditions are different." And of course, quite a few things actually work really well in Europe so there is less appetite for change even from a consumers pov.

Once the adoption rate challenge is overcome, where do you see the business case for wearables moving?

"Wearables will grow and be adopted more broadly. The first move was to target sporty people and now those devices are selling less. In contrast devices which expand to the health arena are increasing." … "Data was always important for insurers and in the past they were used to use proxy data. Today, wearables provide data which allow for personalized service offering. Insurers will enter the Google model which is: we give you a lot of services in exchange for your data which enable us to provide you those services. Off course customers concern about privacy, but I they get good services, they will be more than willing to share data." … "Proactive health advice, better health services, reward systems. Health will be the future for wearables."

How is Ageas developing its digital strategy?

Digital strategy is part of business strategy. Business strategy is different company by company. The corporate strategy is about Ageas acting as a synergy manager so we make sure we can share & accelerate what happens in the various companies across the Group. The changing nature of the way business is done (more and more focus on ecosystems, integrated use of

technologies …) implies for us that we also extend our partnerships to new players with whom we probably did not partner that much in the past. For example, technology companies or e-commerce players.

Interview 2

Name: Thamar van Damme and Sébastien Labourdette
Company: Plug and Play Tech Center
Position: Corporate Partnerships Manager and Venture Analyst - Insurtech and Enterprise 2.0
Country: Germany

Company Overview

Headquartered in Sunnyvale, CA (USA), and with over 20 locations worldwide, Plug and Play Tech Center is an innovation platform which connects startups and large corporations in industry specific verticals by providing acceleration programs, corporate innovation services and investment in businesses at different stages of development. Plug and Play Insurtech is an acceleration program based in Munich focused on the insurance industry which works with startups and a large network of corporate partners such as Allianz, Swiss Re and AON to name a few.

Interview Highlights

How do you establish the relationship between corporates and startups?
"We run acceleration programs to give our partners an overview of the new solutions in the market" … "Our corporate partners provide us with problem statements or business challenges" … "we link them to startups which are scouted by the venture team" … "we have a database of 11.000 startups in Europe, but we also leverage on other locations." … "In the insurance sector we have over 80 corporate partners. When a startup is part of the Plug and Play, it gets access to a distribution channel, a seat at the table with the right decision maker."

Do you often co-invest with the corporate partners?
"It happens sometimes, but most of the times, the corporate partners are mainly interested in becoming clients of the startups" … "We co-invest in startups from the acceleration program and outside the program, mainly with VCs and sometimes with corporate venture capital funds.

What are the biggest business opportunities for wearables in insurance as well the biggest obstacles to its implementation?

"The largest opportunities we see are in the health and life insurance. Typically, you can use the data collected by wearable devices to influence the perception of risk, such as the likelihood of having a particular disease, and based on this you are able to create adaptive pricing for life insurance. However, you cannot change the price of the policy itself due to regulation. You would need to sign a contract every time you changed the policy price, which is terrible in terms of user experience. It´s ok to decrease the price of a life insurance policy, but to increase the price is complicated." … "An interesting use case is a startup called Mutumutu where you get a stable policy price and then get policy discounts based on healthy behavior." … "That´s the main trend."

Do you agree that wearables' user adoption is a problem for insurers trying to incorporate this technology?

"It depends on demographics and nationality. Look at the German market. It´s not catching up because people are extremely protective regarding their privacy." … "Then you have insurance companies which push people to adopt a certain lifestyle. Customers get gym subscriptions, apple watches and so on, but it's not really adaptive pricing."

Is technology accuracy a challenge for insurers who are thinking about using wearables, or is there something else?

"Looking at the technology value chain, first you need to collect the right data, for that you need the right devices in terms of accuracy and convenience. Then, you have the underwriting capabilities: first you need to have the right algorithm to model risk accurately according to the data you feed him with. This is a technological trend in itself. Startups such as PAI Health have access to very large databases which enable them to model extremely accurate risk profiles. Then you have to integrate the data you receive with your database, which then feeds the algorithms that model risk. This is a huge challenge. If one part of the chain is not working, it doesn't matter how accurate your wearable is, because you will not be able to extract value from it."

Based on your description of the value chain, how do you think Insurers are moving? Are they developing solutions for the different parts of the value chain themselves, or looking for external solutions?

"There are different strategies. Some insurers opted for in-house R&D which so far led to very expansive projects with results which are not very convincing." … "Then you have white label where you take the technology of the startup and integrate it and then sell it as your own" … "or you can use MGA models, Managing General Agents. Typically, is a startup that takes care of risk assessment, the on-boarding of the customer, also customer acquisition, etc…but the risk carrier remains the insurance company."

Among the strategies you described, which is the one that is able to better sustain long term competitive advantage?

"There are 2 important components. The first one is Branding. Established insurance companies have strong brands, they are too big to fail, so when a customer looks for life insurance, it's a 30+ year-old commitment, so you really want to trust that these companies will pay you when you need. Startups are weak in terms of brand, history, reputation, capital. This is where regulation is quite important, in helping startups to get regulatory licenses to become full stack insurers. The second one, which relates with the first is the question of whether you see the future of insurance as invisible or more personalized. Do you bet on the insurer which is your partner in life not only on insurance but in all the important parts of your life, and invest heavily on brand and other services? Or is life insurance just a price issue and the insurer makes it as simple and easy as possible so that it can be integrated in other industries such as banking or retails."

Ping An in China fits your description of a highly personalized insurer. Do you see Europe and the US moving in the same direction?

"Ping An was built from scratch as a tech company, so far incumbent insurers to be at the same level of digitization, it's a tremendous challenge." … "For a digital transformation to succeed you need a sense of urgency. Established insures seat on top of enormous amounts of capital. They are not on a threat of survival or at least they don't perceive it as such. Thus, change is happening slowly."

Apple watch series 4 already has ECG capabilities. Could Apple start offer health insurance soon? If so, I would they do it?

"I would say that right now, if they want to do it, they need to partner up with someone. If you look at the recent Apple credit card, it was built in partnership with Master Card. Another thing to pay attention too is the fact that all of this tech companies are building financial subsidiaries

in Ireland: Microsoft, Apple, Facebook, all of them. They are slowly getting the regulatory approvals to work with financial services. When you are a startup it's very difficult to fulfill the requirements to become an insurer. However, if you´re a multibillion-dollar company and they ask for 10M EUR of minimum capital requirement, that's ok."

Interview 3

Name: Lukas Ammann
Company: dacadoo
Position: Vice President, Sales EMEA
Country: Switzerland

Company Overview

Founded in 2010 by the experienced Swiss entrepreneur Peter Ohnemus, dacadoo offers leading digital solutions for companies in the insurance sector as well as for corporate health promotion and wellness. dacadoo's digital health engagement platform motivates its users with a playful approach to a healthy lifestyle and makes health individually measurable, through the Health Score, an individual metric which incorporates different data, including wearable data. Insurers can use the platform as a white label, license the backend technology for developing their own Apps and access the Health Score Risk Models for underwriting.
The company has headquarters in Zurich, Switzerland, a US subsidiary, dacadoo americas, inc. based in Boston and an office in Sydney, Australia.

Interview Highlights

What is the impact of the wearable data in your overall health score?
"The health score is a holistic view of health where we not only look into activities, which you can measure through wearables, but also to areas of lifestyle, emotional wellbeing, nutrition etc. The insurers we work with want to paint the full picture of health, not just how active one is." … "you can be a very fit athlete and run marathons, but if you have mental issues or an unhealthy diet, it will obviously have a great impact on your health. Wearables playone part only, but we need more information if we want to score health holistically."

What factors influence the adoption of wearables? Does age play a role?
"Off course, it also depends on the population you are launching the solution. If you are launching it in an IT company, they'll have techy people which will have no problems in

connecting their devices." … "There's a big cultural aspect also. In Japan if a CEO launches this to his employees, he will have a much higher adoption rate culturally comparing to another country in western Europe."

Should an insurer focus on a niche segment then to scale a solution like this? Perhaps a focus in younger generations?

"I wouldn´t agree. People below 25 don't care too much about health yet, because they are healthy anyways and don't care what´s coming when they are 50 years old. We see more the older generation being interested on this, between 35 and 70 years old, where people actually have more time to play around with a health solution, they worry about what's coming. I wouldn't bet on younger generations just because they know how to use wearables."

Can you describe dacadoo's product offering?

"As a platform company, we always start with our backend where we have all the features in, and from there either we do full customized solutions for our clients, were we build the solutions for them: they get their own domain, app, content. So that's white labelling: frontend and backend. Then we have the backend API possibility, when the insurer already has a digital proposition in the market, for example a mobile app where they do claims management and wants to include dacadoo features. In this case we serve as backend partners and deliver our services via our API." … "dacadoo works as B2B2C, so we never sell directly to the final user".

Who as the ownership of the data across your different products?

"It´s always the user. As you know companies need to follow GDPR in the EU, which gives the user the power to decide which data he/she wants to share with the insurer. So, if the user decides not to share data with the insurer all the insurer gets is anonymized data for them to see the health trends of a certain population for instance. If insurers want to connect this with dynamic pricing, they obviously need an opt-in from the users to say – yes, I'm willing to share my data with my insurer in order to get something in return – that's as simple as that and it's also how we do it. We cannot give the data to anyone else obviously."

Do you believe wearables are accurate enough to provide meaningful data today?

"The devices are getting better and better and more precise. But, if you look for example into the sleep tracking that currently some wearables present, they tell you how well you slept based on a device on your wrist, which in my opinion is nonsense. If you want to do a proper sleep

analysis, you need respiration rates, body temperature, upper body movements which is all not possible with the device you wear on your wrist." … "Wearables already play a part. There is data which they can measure accurately, and which is relevant. Other data, not yet. But wearables will become better and platforms as well."

How do you see the insurance market evolving in Europe?
"Many insurers who do not take the digital needs of their members seriously and who do not adapt to the changing customer behaviours will disappear very soon. You'll have large insurance players, and probably new disrupters coming. This is definitely a trend I can see."

Interview 4
Name: Preferred not to disclose
Company: Large Re-Insurance company
Position: Vice President, Customer Experience
Country: USA

Interview Highlights
What are the current expectations that customers have regarding life insurance? Can wearables help meet those expectations?
"The expectation in general is that it's easy to purchase the policy, it's easy to make a claim and it's transparent." … "but consumers don't buy a life insurance policy with the expectation that the insurance company will help them live better." … "There are opportunities to incorporate wearables into a wellness platform that customers can relate to and have better life insurance experiences, but I don't know if that's what clients are expecting."

Do you believe the program Vitality, from John Hancock has proven successful? If so, why don't we find more examples like this in the industry?
"They've been kind of successful. Otherwise, why isn't everybody else doing it? Consumers are not expecting it; they are not even saying: this is what we want. Is the insurance company that created that and said: we are going to give you what we think you want" … "By implementing wearables what is that that the insurance company wants to do? Most likely, they want the data, so that they can do better underwriting and better pricing. So, they have to figure out what they have to give the consumer so that they trust the insurance with their data and then to incentivize that behaviour." … "If I want to buy a Fitbit to track my health, why do I need

the insurance for? Maybe they can offer me the Fitbit but then I have to give them my data? Maybe I'm not willing to do so. I already don't want to give it to Apple, Facebook or Google."

What are the main characteristics that enable insurers like Ping An in China to scale and become dominant players? Do you see the same happening in Europe and the US?
"They have 1.3Bn people in their market. So, they can build ecosystems on a huge scale. They can pilot a product with 20M people." … "Legislation also plays a role. In the US you have different states with different laws. In China its China."

How do you see wearables evolving over the next decade? And their integration in the insurance space?
"As data privacy becomes more a topic of conversation across the board, people will feel more confident about sharing their data and there will be protection around it." … "This data will not only help on underwriting and pricing, but it's going to help from a prevention standpoint."

Interview 5

Name: Peter Evans
Company: Deloitte UK
Position: Insurance and Asset Management Research Lead
Country: United Kingdom

Company Description

Deloitte is multinational company which provides audit, consulting, financial advisory, risk management and tax services to select clients in over 150 countries worldwide. Deloitte's insurance group brings together specialists from actuarial, risk, operations, technology, tax and audit. These skill sets, combined with deep industry knowledge, allow the firm to provide a breadth of services to life, property and casualty, reinsurers and insurance broker clients.

Interview Highlights

When did Insurers start integrating novel data sources to feed their prediction models?
"The first ever example that I read that made me sit up and think was in early 2015. A French re-insurance company using social media data to set reserves." … "And at that point the only world-renowned example in the context of wearables was Vitaly. One thing I heard at the time

was that it was more of a marketing strategy then a way to personalize pricing. The wearable data was not actually used to price the insurance. I think that's changed though."

There aren't that many cases like Vitality in the market. Why do you think that is the case?
"Remember wearables not only apply to health insurance. It applies to worker's compensations as well." … "for example, wearables can alert a truck driver to take a break, because he hasn't moved, it can alert builders when they are bending in a dangerous way, it can alert factory workers when they enter a dangerous zone."

What are some of the barriers to implement a wearable based insurance product?
"Number one, inertia: People don't really care about insurance. They do care about Apple watches, but Vitaly had to market the product very hard. Number two, cost: If the insurer offers the wearable, that's expansive. Number three. Lack of knowledge: people don't know about it."

Apple watch series 4 already enters the realm of medical devices. Could Apple or other wearable manufacturers enter the insurance market soon?
"Not really, I could be wrong, but I haven't seen that. The reason why that is, and which applies to all of the big tech companies and their position on insurance, is that profit margins in insurance are much lower and that regulation is much higher in some ways. For example, consumer protection regulation for financial products. Thus, it's not high in their priority list. They could do it, but they have other things to do first." … "Now China is different, there are spectacular examples where they have done it already."

Taking the example of Ping An in China and how they are building a digital ecosystem where they move across services, from health to finance and insurance. Do you see this movement happening in Europe?
"I think it's a really interesting example and I do think there are examples of it emerging in the UK, Europe and the US. This has embedded a couple of things: I buy a product, or a service and the insurance is automatically included; I buy a product or a service and while I'm doing so, I have the option to add insurance. Both of those exists and the key difference between that and regular insurance is that a non-insurance player is selling the insurance or providing access to it." … "There are a couple of small examples in the UK. One of the reasons its much smaller than China is down to differences in the structure of the economy. In China there is a small number of very large providers, which I'm not sure why that is but suspect it comes from a

variety of reasons such as the level of state intervention in China, which makes it easier to be a big player; good contacts with the government which help navigate the Chinese regulatory system and actually work with the government. That's way you have a few massive companies in China like Alibaba, Baidu." … "Also, younger, more tech savvy consumers, which are faster to adopt new products. And remember that if you want to do this in the US, you have 52 sets of regulation, one in each state, so it´s much harder."

In a context of digital transformation where insurers need to acquire/develop new capabilities, they are faced with the decision of controlling the direct relationship with the customer or outsource it. What do you think is the best strategy?

"Both are viable. But, if I look into the most promising examples, the customer interface tends to be owned by the tech company. If you look into homeowner's insurance in the US, which is a market you can compare to wearables, you can buy a Nest. Nest is a smart smoke alarm owned by Google that is internet connected, it has smoke, heat and carbon monoxide detection imbedded. You can buy it online with a big discount if you buy it with insurance from Liberty Mutual. The only catch is that you need to agree in sharing data from the smoke alarm once a month with Liberty. The data is very much owned by the customer and Nest, not Liberty. It's only a small segment of that data which is shared with permission." … "Tech companies are in a better position to have deeper relationships with customers. In general, people don't want a relationship with their insurer. Insurers are trying really hard to come up with good reasons to why they should have more contact with their customers because they think this is the way to drive up loyalty, but I'm deeply sceptical. There needs to be good reasons for more contact." … "Could for example a voice assistant provide information, discounts, advice or reminders related to risk? Maybe, that might work, a bit like Amazon Alexa. I think it makes much more sense do something in a commercial setting, commercial property. The business owner is spending a lot of money on managing the building, so he has a big incentive to save money. You can use sensors to manage the building in a far more efficient way."

Where do you see the biggest opportunity for wearables, in commercial or retail insurance?

"Well, the first thing that will motivate people or businesses or both is the size of the saving on offer. Is it a big saving on offer for the insurance company but a very small saving on offer for the retail customer? Then it's not going to work. That's why motor telematics is still very small in the UK for example. The annual policy costs around 500£. You save 50£, which in absolute terms is not much. So, people don't want to share their personal data, feel that someone is

monitoring their driving, so they don't use telematics." … "The point I'm trying to make is that on retail insurance all of these examples under the heading of IoT such as wearables, smoke alarms, telematics, they will be niche because there is not enough of an incentive to use them, unless you find some very specific groups who pay a lot or have a very specific need for information from the device. On the commercial side however, there are far bigger savings. It's a far more attractive market and the type of customer is different. The customer has a bigger incentive to manage costs because it's a business, not a person."

Interview 6

Name: João Bôto Gonçalves
Company: Tranquilidade
Position: Head of Integration and Transformation
Country: Portugal

Company Overview

Tranquilidade is a multinational insurer with headquarters in Lisbon and operations in Portugal, Angola and Mozambique. It serves both retail and commercial customers in the sectors of life and non-life, in which it is the second biggest national provider.

Interview Highlights

Do you think wearables present a higher business opportunity for the B2B or B2C market?
"When you think about telematics used in the auto insurance for example, one of the reasons why it hasn't picked up as to do with the amount of savings the customer gets versus the amount of data he/she needs to share, plus installing the telematics device in some cases. The reward is just not big enough. Regarding wearables used in work-related accident insurance policies, there are some use cases popping up in the market including devices who measure your posture during manual labour for example, but the technology is not there yet. You also need to consider who pays for the device. ardware devices are expensive."

When Tranquilidade decides to develop a new product with a technological component, how does the development process work? Does Tranquilidade opt for in-house development, outsourcing, partnerships or other forms of collaboration?
"At Tranquilidade we usually develop new products in house. When specific technical capabilities are needed, we choose partnerships as the way to go."

When looking into the Chinese insurance market, where companies such as Ping An are scaling highly digital insurance products and achieve competitive positions through platform ecosystems, what are the characteristics behind it? Do you see the European or the American market heading in the same direction?

"I believe there are two main characteristics that enable such developments. On one side, the size of the Chinese market. Companies are able to scale products to a digital mobile friendly population of more than one billion people. Testing and rolling out new features become easier as well. On the other side, the support of the Chinese government. Typically, these big companies work in close relationship with the government, which aligns interests from the legislation and funding perspectives. As these two conditions are not verified in the same way in western markets, it´s unlikely that they will develop in the same way.

However, when I think about the role of the insurers in the future, I do believe they will go behind the curtain when it comes to owning the relationship with the customer. Historically, it´s hard to sell insurance, its usually not something that people seek, unless they have a problem. Some insurers nowadays are trying to build more intimate relationships with their customers, but it's hard."

Nowadays, hardware and software companies such as Apple own the main digital channels in which the relationship with the customer is established. What is stopping these companies to start selling insurance?

"Insurance may not be an easy catch for these companies. On the one hand, the technical skills, processes, the value chain and regulatory requirements are very different from what they do. On the other, there might always exist more profitable ways for them to allocate their capital. Having said this, it is indeed a possibility they go down this road. I just don't believe they will go on alone, without a traditional insurer as a partner."

Google Nest and Liberty Mutual Insurance partnered to provide a smart smoke detector which can be bought at a discount if the client decides to subscribe a Liberty policy and share additional data with the insurer. Do you believe the same model can be applied to wearables?

"Yes, I believe partnerships is the way to go. Typically, in these cases you see the insurance being sold at the moment of the purchase of the product or suggested in specific moments of usage of the product."

Interview 7

Name: Jindřich Lenz

Company: Mutumutu.cz

Position: CEO and Co-Founder

Country: Czech Republic

Company Description

Mutumutu is an online life and income protection insurer which gives money back to customers who are living healthy. Through Mutumutu's mobile application customers can easily manage their insurance policy and receive up to 30% cash back from their insurance policy premium by doing healthy activities such as running, biking or not smoking. The startup is currently based in Czech Republic, in which has been operating for the past 7 months. It manages a portfolio of 500 customers and raised a seed investment of € 1.4 M.

Interview Highlights

Mutumutu offers up to 30% cash back to customers who live healthy lives instead of bonuses or tokens like other wellness programs. Why is that?

"We asked customers what they wanted and they said cash mostly, because they can spend it freely. Another important aspect as to do with trust. Customers don't trust insurers, so they don't want to be tied to vouchers and other rewards like that." … "20 of the 30% cash back is given every 3 months because we also believe giving cash back frequently increases engagement and makes our customers more loyal." … "Next year we want to implement a feature where customers can choose to donate the refund value to charity and Mutumutu will donate a similar amount."

Mutumutu allows customers to integrate third party activity and wellness apps such as Straava or Runkeeper, which contain wearable data. How do you integrate the wearable data and how relevant is it to your risk and pricing models?

"We learned during our research that customers who already use a sports or wellness app don't want to change because they are used to it. So, we built our product in a way that it can integrate data from third party providers. In fact, our mobile app does not collect any data itself, it gathers data from aggregators such as Apple's iHealth or Google Fit in the android market, which are connected to 90% of the all apps in the market. We can access this data for free and our software is able to standardize the different data in an actionable way." … "Our mathematical scoring

model was built with 80+ global studies that compared non active people with people that run, cycle and live a healthy life and we concluded that they will have a lower hazard ratio of about 30% compared to the general population. This is the value that our risk carrier uses and the value that we give back to our customers."

Do you see Mutumutu's product evolving into a pay-as-you-go model through the use of wearable devices, such as in the auto insurance market?
"For the pay-as-you-go you would need to be the one developing the wearable device or have access to the raw data, so that you could build algorithms to describe different motions. This is something very complex to do."

What other functions can wearables perform in the context of your product? As an example, the ability to send push notifications.
"We are currently testing giving wearables for free to understand if that increases conversion rate. So far it seems it does." … "Push notifications are a great way to talk to customers and motivate them to achieve the maximum discount amount. In addition, we want to expand into the mindfulness space because mind health and stress levels are very important in explaining overall health and companies such as Apple, Fitbit and Garmin are already moving into that direction. Once the Apple Watch heart rate capabilities are approved in Europe, we will incorporate some new things as well."

What is your target group?
"Our target group are people between 30 and 45 years old, young families and people with mortgages. Overall people come to us because of the insurance. Sports trackers and wearables are gamifications and they can help us reduce churn and increase engagement. Still, if people don't want the insurance, they will not become clients, this is a key aspect."

Interview 8
Name: Mehrdad Piroozram
Company: InsurTech.vc
Position: Founder and Partner
Country: Germany

Company Description

InsurTech.vc is an umbrella brand for an angel investment portfolio, financed by Mehrdad Piroozram, around € 3M, with a focus on Insurtech. The average ticket size is € 50 k. The German based VC invested to date in companies such as Neos, Sherpa or Insurers.ai.

Interview Highlights

Do insurers struggle in incorporating new technologies such as wearables?

"In general, insurance companies are heavy technology companies compared to other industries. So, integrating technology, such as wearable data, is not something new for insurers. The real question is how they are going to manage legacy systems and develop customer centric products. This is probably solved by partnerships."

Considering that tech giants such as Apple or Amazon are moving into the wearable devices market, do you believe there's a chance they will start providing insurance products?

"Apple care[2], for example, is already a form of insurance. Amazon and Mapfre recently partnered in Spain to provide insurance products in Amazon´s e-commerce platform. So, probably they will enter soon."

What is the impact that wearable data can have for insurers?

"Insurers usually come into play after the claim is done. Instead of paying for treatments that are costly for the insurer and unhealthy for the patient, it would be beneficial to invest in prevention and early detection of diseases and risks. Wearables can be a great tool to gather data beforehand to assess the risks and then lower the probability of damages, both for the insurer and for the customer." … "however, it's not enough to gamble on wearable data. Insurers need much more then wearable data so that they can actually make use of it. Calculating risk based on wearables is difficult. At this moment it´s more suited to incentive schemes than to be part of the core of insurance products."

[2] AppleCare+ for Apple Watch and Apple Watch Nike+ is an insurance product that provides up to two years of expert technical support and hardware coverage, including up to two incidents of accidental damage, each subject to a £49 excess fee. In addition, you'll get 24/7 priority access to Apple experts by chat or phone. Coverage begins on your AppleCare+ purchase date (Apple, 2019).

Can you give some examples of startups who are helping insurers integrating wearable data?
"Steppie and Yas.life are great examples of startups which reward customers for staying active and healthy. *FitSense* offers a data analytics platform collecting users' health data from different devices. This data is then analysed to build user profiles. A white label health engagement app has been launched as a first product that enables insurers to offer their own self quantification, health management and incentive program. FitSense is currently developing underwriting and direct purchase of insurance products based on the data collected and analysed on the platform which can be utilized to assess customer health and offer tailored products."

Interview 9

Name: Lisa Lang
Company: Elektro Couture and The PowerHouse Group
Position: Founder and CEO
Country: Germany

Company Description

Founded in 2013 by the visionary Fusionist Lisa Lang, Elektro Couture brings the beauty of light together with the intelligence of wearable technology. In 2016, Elektro Couture founded The Studio (Fashion Tech Manufacturing & Residence Program), The Fashion Tech Academy (Education Program for Fashion Tech) and
The Lab (Biotechnology & Material Science). In 2017, Elektro Couture founded The PowerHouse, a B2B service agency for Fashion Tech, Wearable Technologies, Internet of Things (IOT), Industry 4.0 and Smart Textiles Manufacturing. Lisa also serves as Technology Adviser for Creative Industries at the European Parliament, among other advisory roles.

Interview Highlights

What are the biggest barriers for people to subscribe wearable based insurance products?
"The biggest issue is that people feel trapped wearing these devices." … "If you are diabetic, for example, you're not supposed to eat potato chips. If your insurer knows that because it detected an increase in your blood pressure, it has the power to increase your premium because of that. Insurers need to find a very good answer to convince someone in this situation to subscribe the policy." … "A successful approach to wearable based insurance products needs to consider two challenges. One of them is not the hardware itself, but the hardware design.

People stop wearing the device after a couple of months and don't buy a second-generation device. If you ask someone: would you use this device even if its not linked to an incentive? The answer is no. Especially for women, which are far more health conscious then man. The problem with health devices is that it marks you as a sick person and this is where the design comes in.
The second thing is private policy, especially in Europe. Being completely complaint with GDPR can be a comparative advantage." … "In the case of workwear, you need to convince the unions. They are there to protect the workers. The employer and the insurer will want to see the data. The union and the employees won't." … "Increase the incentives is not going to fix the entire problem. People are getting more and more sensitive over privacy issues. Off course you can compensate that by increasing the incentive, but that is not how you orchestrate all of them and that will bite you back. The tendency is for privacy laws to increase."

Today fitness trackers and smart watches account for 90% of the wearable market. How do you see this evolving?
"It depends on the sector you look at. In the lifestyle sector it will blend more into the design. You will not need to wear anything because sensors will be all around you in your home. If you need to wear it, it will be far more implemented in the devices you already got. Shoes are a great example. In the health setting, wearables will exist in between solutions and will go under your skin and into your brain. People which cannot walk or see won't care about privacy issues, because the pay-out is far far bigger."

Wearable manufactures such as Apple sit in the middle of the relationship between customers and insurers. How should insurers react to this? Will they accept a back-end approach and focus on risk carrying or will they fight to maintain the relationship with their customers?
"When you pick up signs of change you always have 3 options. Either you ignore it and don't move, or you fight your enemy, or you partner with your enemy. Insurers position will depend on their management style and strategy. On one side this can be a huge opportunity for the insurer to invest in the customer experience because there is one thing they have that Apple doesn't, the trust of their customers as a reliable partner for many years. Early adopters might go for Apple, but you need to thing about the mass market, think about the normal people. They would rather go with the insurer their grandparents and their parents have."